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THE

CIVIL ENGINEER AND ARCHITECT'S

JOURNAL.

SHIP CANAL COMMUNICATION ACROSS THE ISTHMUS OF SUEZ.

Inquiry into the means of establishing Steam Navigation. By JAMES VETCH, CAPT. R.E., F.R.S. Pelham Richardson, Cornhill.

The Suez Navigable Canal for accelerated communication with India. By MR. CLARKSON. British and Foreign Agency Office, 57, Lincoln's Inn Fields.

Observations on the Red Sea and Mediterranean. By ARTHUR ANDERSON. Smith, Elder & Co., Cornhill.

THE attention of the scientific world has, for many years past, been directed to the design first sketched out by Napoleon Buonaparte, of connecting the Red Sea with the Mediterranean, by means of a navigable canal, and many endeavours have been used to influence the Pasha of Egypt to undertake the task single-handed: but engaged in protracted and expensive wars, which had the effect of desolating many of the most fertile provinces of his dominions, and the crippled state of his finances, have precluded the possibility of his engaging in this magnificent undertaking, however really desirous he may have been to compass this ambitious project. Since the cessation of war, with the loss of Syria, his sources of revenue have suffered a still further diminution, being now barely £4,000,000 sterling per annum; and we are therefore not surprised to hear, that within this few weeks past, he has wholly abandoned all ideas of carrying it out in person: but, at the same time, expresses his wish that the project should be taken up by European capitalists, who, provided his interests are duly considered, will receive from him all the necessary assistance and protection. Urged on by this consideration, the desire to shorten the distance between Great Britain and her immense territorial possessions in the East, and to facilitate commerce, several projects have from time to time been put forward with a view of engaging the attention of the British Government and of the monied classes, emulous to employ their capital in all important undertakings of acknowledged utility and likely to prove profitable. A very excellent article in the *Foreign and Quarterly Review*, has been followed by two able pamphlets just published, one of them by Mr. Anderson, the other by Captain James Vetch. It is not our intention, however, to follow either of these writers through their several statements, but merely to remove some erroneous impressions entertained by all of them, and to give a general idea of the question under consideration, with our own opinions thereon.

Pelusium, from whence it is proposed to conduct the canal, lays a little to the east of the Pelusiac branch, aod, according to Strabo, about two and a half miles from the sea; its circumference measured the same distance, and it was guarded not only by massive walls, but also by extensive morasses on every side; being situated in the midst of a naked level, between the sand desert passing into Syria, the sea, and the morasses, which now form a part of the lake Mansaleh. Its ruins may now be seen about two miles from the sea, the land having gained seven miles and a half upon the Mediterranean since that period. The Pelusian branch, which was of considerable magnitude in those days, is little more than a wide stream of mud as it crosses the arid plain from the lake Mansaleh to the sea. On its banks stands the fortress of Tineh, built by the Turks, and said to be a place of considerable strength. This branch of the Nile is now known as the Canal of Abu Manejji; it is the second branch issuing from the Damietta arm, which it leaves at about six miles below Cairo: it then passes by Bibers and Tell Bastah (Bubastes) and at length enters the sea, much contracted in width, and almost choked up with mud.

The lake El Mansaleh is formed in the low lands near the sea, which extend from the Pelusiac branch nearly to the Rosetta branch. It receives the Canal of Ashmin-erromman, which formerly passed through the territory of El Mansaleh, and then branched out into two divisions, one of which ran northward, and the other, making a bend, flowed into the lake of Tennis: this canal, from its uniform depth, is thought to be the Mendesian arm of the Nile; and the lake Boheïreto el-zar has been considered the Tanitic branch. "This lake," says Sicard, "begins half-league to the eastward of Damietta, and ends at the castle of Tineh, anciently Pelusium. It is twenty-two leagues in length from east to west, and five or broad from north to south. Its bottom is muddy and full of weeds. It is seldom more than five feet deep, and is separated from the sea by a strip of sand, at most a league in width; it communicates with the sea by three mouths, that of Tíneh the easternmost, Omm-ne-ferrej, and Díbeh. In summer, during the inundation, its waters are sweet, during the rest of the year they are salt. This lake contains many islands, most of them uncultivated, those of Matareyyeh near El Mansaleh are the most populous: two others are covered with the ruins of ancient cities. The bed of this lake is several feet below the level of both seas, the depth of mud and sand being very considerable; the original bed on which they rest being compact gravel, and calcareous matter, similar to the general formations of Egypt. The Pelusiac branch was considered the most important one, being denominated the *key* and *strength* of Egypt.

Nechos, the son of Psammetichus, and the Pharaoh Necho of Scripture, was the first who attempted to open a communication between the Nile and the Red Sea, which Darius, King of Persia, afterwards continued to the bitter lakes, from thence it is said to have been carried to the Red Sea by Ptolemy Philadelphus; it commenced from the Pelusiac branch, and extended as far as Arsinoe, now called Aggeroud, or Ajeroud: the length of this canal, says Herodotus, is equal to four days' voyage, and it is wide enough to admit four triremes abreast: the water enters it from the Nile, a little above the city Bubastes; it terminated in the Red Sea, not far from Patumos, an Arabian town. In the prosecution of this work under Nechos, it is said that one hundred thousand Egyptians perished, nor is this to be wondered at, when we consider the baneful and pestilential marshes through which it had to be carried, and the inevitable long exposure to the nightly dews, and burning heat by day, to which the workmen were alternately subjected: this writer says, "Darius carried on the undertaking (began by Nechos) but desisted from finishing it, on the false opinion that, as the Red Sea is higher than Egypt, the cutting of the isthmus between them would necessarily lay the country under water. The Ptolemies disproved this error, and by means of weirs or locks, rendered the canal navigable to the sea, without obstruction or inconvenience." Diodorus confirms this account. Pliny tells us that Ptolemy of Egypt, the second of that name, continued the canal to the bitter fountains; at this point the work was interrupted, for it was found that the Red Sea lay higher than the land of Egypt by three cubits (4½ ft. or 5ft.): he denies that the canal was ever completed to the Red Sea, but speaks of the river called Ptolemæus that passes by Arsinoe.

With all due deference to learned commentators on this subject, we are inclined to believe, with Pliny, that the canal was never carried beyond the bitter fountains, and that the river he mentions was the natural channel from this series of lakes to the Red Sea, through which the waters of the Red Sea flowed towards the Mediterranean: that in the days of Nechos the communication from sea to sea was continuous, that it continued so long after his days, and even to the time of the Ptolemy in question: that the waters of the Red Sea continuing to retire beyond their ancient limits, the channel from the bitter lakes to the sea dwindled down from a broad expanse of waters above the present head of the Red Sea, to a narrow channel or river, and were eventually cut off. In confirmation of this, we find throughout this depressed portion of the isthmus, a series of sea beaches, heaps and ridges of accumulated sea shells, and reefs of coral, of precisely the same species as now belong to the Red Sea, but not to the Mediterranean: these deposits are found in the bitter lakes at a very slight depression below the present level of the Red Sea, and from thence a series of depressions takes place throughout the whole chain of communication. It would appear, also, that as the communication was gradually cut off, the labours of man were called into requisition to remedy the mischief, artificial channels being made from the head of the sea, much above where it now is, to the bitter lakes; or, as Pliny terms it, the *Lacus Amari*, and thence from lake to lake. M. Linant's report tells us, that at the bottom of the two gulfs of Suez and Akaba the sea has advanced; this is positively ridiculous, and disproved by facts: the great salt plain at the head of the sea of Suez gives decisive evidence of its oceanic origin, and of having been in remote periods a part of the Red Sea, and Arsinoe, once a sea-port town, is now six or seven miles distant from the sea: even modern Suez is removed far from the ancient site. This head of the sea is not merely filling up by sands, but its formation is analagous to that of deeper waters, and common to the sea, and of such is the isthmus, showing throughout a gradual decrease in the volume of waters, and not merely a displacement of them. Granted that the remains of a town may be found under water, this merely proves that points of land, subject to the incessant motion of the waves, often give way, and become submerged: Yambo is built on a recent reef. Most of the large towns on the Arabian coast have become so barricadoed by the reefs and consolidated rocks as to be unapproachable for miles; and even Macullah, at the eastern mouth of the Red Sea, is built on a recent reef: the original boundaries of the Red Sea are on both sides of it, numerous and strongly defined, and in some places embrace desert plains many leagues in extent.

All the natural phenomena of the isthmus demonstrate that the communication of the two seas was kept up by a current always flowing from the Red Sea to the Mediterranean, through the valleys or depressions constituting the chain of lakes, that the hard gravel, marl and sand forming the desert is such as represents the bed of the sea at Suez, the whole of the extensive plain passing into Syria was at this remote period covered by the sea, and formed part of the Mediterranean. Hence it is evident that no danger is to be apprehended from again opening this line of communication, either of its overflowing the fertile valleys of Egypt, or causing a rise in the Mediterranean Sea. It is not on historical record that this line of communication was made available to the fleets of the ancients, nor does it appear to have been the desire of the Egyptians to maintain a passage for the ocean waters, the sea passage being prevented by a solid dyke or wall constructed across the channel near its entrance to the gulf; on the other hand, their chief aim appears to have been to make all the cultivatable portions of the land of Egypt available to its then dense population; thus the canal from Bubastis passed through the fertile Wadi, the Goshen of the Israelites, to Thaubastum, where it entered the Bitter lakes, which were the natural reservoirs of both the ocean and river waters, and lest the salt waters should flow over the cultivated tracks, or the channel between the two seas, should receive too great an impetus from the overflow of the Nile, large mounds were thrown across the Wadis.

Proceeding to the consideration of the several proposals for reopening the communication between the two seas by means of a ship canal or channel, we shall notice Mr. Anderson's pamphlet. This gentleman after a preliminary condemnation of all previous statements and speculations as superficial, crude, and erroneous, enters upon his subject by giving a somewhat lengthy extract from what he is pleased to term the report of M. Linant, a French civil engineer, in the employ of the Pasha of Egypt, which he obtained for a consideration: in this we suspect he has bought a bargain, for the report in question is copied almost literally from the one drawn up for the French engineers, and published in 1798, "*Description d' Egypt:*" in fact, in the extract in question, M. Linant observes "by many repeated observations made during my numerous journeys through the Isthmus of Suez, as well as from the levellings which were taken with great care during the occupation of Egypt by the French army. I assume that the level of the Red Sea is higher than that of the Mediterranean, and that it has once covered the Isthmus:" there is not the most remote reason to suppose that any triginometrical survey has been taken by him, or that he is acquainted with the country east of the chain of lakes. In the words of the French engineers M. Linant observes:—"The topographical position of the place shows, that from the Red Sea to a distance of 22,000 metres (nearly 14 miles), the spot where the ancient canal was re-dug by Amrou, or where the canal of the Prince of the Faithful still exists, it is only necessary to dig this canal to a depth of 290 metres (9 ft. 6 in.) when there would be at once established a current of water towards the Mediterranean; because, at the end of this distance, you enter the bed of the bitter lakes, now dry, which are there about 5 metres (16 ft. 4 in.) lower than the Red Sea. From thence the ground becomes lower and lower, as far as the point which separates the bitter lakes from the lake Themsah, where the ground for a distance of about 6,000 metres (6,560 yards) is at its greatest elevation 0·50 (19½ in.) above the level of the sea; the soil is here sandy. Next comes the basin of the lake Themsah, much lower than the Red Sea, and which is covered by the waters of the Nile during the inundations. The distance between this lake and the low marshy swamps of El Karish, is, at the most, only 3,000 metres (3,280 yards), and the land is not more than 1 metre (3 ft. 3 in.) higher than the Red Sea; this ground is also sandy. Leaving the basins of the lake Themsah, and passing behind the hill of Chek Amedek, near which the ancient canal must have passed, we find the ground is nearly everywhere on a level with the Red Sea as far as El-Karesh. From thence to Dus-el Cassah, and afterwards in a direction towards Bir-el-Divietor, we follow the traces of the ancient canal, in a direct line from the one sea to the other, the ground being all sandy, and much lower than the Red Sea. From thence to the ground which is inundated during the floods of the Nile, by the waters of the lake Mansaleh, there is again found a bed or sort of excavation, or sandy valley, which may probably have been the ancient canal. From thence to the entrance of Tineh, passing between Faramah and the ruins of Pelusium, the land is 9 metres lower than the Red Sea."

He proposes to begin at or near the remains of the ancient jetty, made at the entrance of the canal at Suez, making two embankments or piers, leaving between each an opening, which should form the section of a canal to be dug: the excavation to be carried on to the bitter lakes, a distance of 13½ miles, 130 ft. in breadth, and 9 ft. 9 in. in depth: to clear out the land between the lake Themsah and El-Karesh, a distance of 3¾ miles, leaving only a width of 32 ft. 6 in., a dyke being run across westward of the lake to prevent the waters spreading over the cultivated portions of Egypt: at the Das-el-Ballah, and also the inundated lands about Pelusium, similar dykes are to be constructed. He assumes that from the difference of level, the water being once let in this superficial bed, and flowing with the velocity of about four miles per hour, that the stream would soon scoop itself a channel to any required depth. He would supply the want of a port in the Pelusiac coast by a breakwater or pier, to be placed on the bar, which would be naturally formed at the embouchure of the canal, and concludes with estimating the expenses of excavation, embankments, masonry, and pier, or breakwater, at £150,000.

It is true that the estimate made about 50 years ago was much less, but both are equally absurd, when we come to consider the magnitude of the works required, independent of the canal. To commence the canal at the head of the sea would have been all very well in the days of Nechos, but no engineer practically acquainted with the nature of the sea above Suez, would ever recommend a plan which would entail the necessity either of the deepening the whole upper portion of the gulf, a work of vast magnitude and expense, or otherwise of carrying the canal through the very midst of it to deep water, a mode almost equally expensive. The whole head of the sea is extremely shallow, its bottom consisting not only of mud and sand, as we are generally led to believe, but also the same kind of clay, marl, and limestone formation which distinguishes this portion of the coast. Again, we very much doubt his obtaining a current of four miles per hour by the small depth of excavation he proposes: and granting that it is to be obtained, we doubt its efficacy in scooping out a channel to the requisite depth, believing, as we do, that the Red Sea, once flowing through these narrow valleys with a fall as great as in the present day, was unable, in its own strength, to preserve a passage, so that art was obliged to come to the aid of nature in order to preserve this passage for a more extended period of time than otherwise would have been the case. The estimate of the French engineers, embracing both branches, was £691,000.

Captain James Vetch, R.E., proposes to open the communication between the two seas by the shortest possible line: observing "that the shortest line would give the greatest velocity and scouring property to the stream; and, under equal circumstances, would cost least money. A straight line would also be most controllable, and with the least expense; for as soon as bends and angles are introduced to the channel of a large body of running water, an action immediately and inevitably commences on the banks, which would have to be provided against by a heavy expenditure in strengthening them to resist the erosion of the water; but with no reasonable expense could the banks be rendered secure, if the bends were considerable and numerous; for if they gave way in one place, the whole current might be changed and numerous breaches ensue, requiring equal expenditure of time and money to repair." These objections cannot, however, apply to the communication *via* the chain of lakes, which are the natural boundaries of the sea communication: the only points vulnerable to erosion are the communications between the lakes and the lower plains towards the Mediterranean.

An important point appears not to have had due consideration, and which must have weight in all plans put forward for connecting the two seas. For about 300 days in the year the winds and breezes set in towards the Red Sea; but during the period of the *Kamseen* they blow towards the Mediterranean: thus vessels will be enabled to sail one way and come down by the current on the other. This peculiarity of the atmospheric currents favours the passage by the chain of lakes, rather than by a straight narrow channel; these fine expanses of water enabling the mariner, in the passage to and fro, to avail himself of every capful of wind: again, by the circuitous route, the pressure of the waters of the Mediterannean upon the waters of the canal would, in some measure, regulate their height and velocity. The velocity of the current should be so apportioned as to enable sailing vessels to bear up against it; steam tugs might also, if necessary, be employed; tracking or warping would be of no service whatever.

Pursuing the circuitous route by way of the lakes, the only artificial excavations required are those which exist between them and also between them and the respective seas: in additional to the westward embankments proposed by M. Linant, we are of opinion that through the levels towards the Mediterranean the channel ought to be embanked on both sides, thus permitting the waters to be above the plains, preserving uniformity in the currents and height of waters, and protecting them on the one side from drifting sands, which, passing from the desert situate on the Eastern side, may otherwise in a few hours fill up local portions of the bed; and, on the other side, from the inundations of the Nile. In some places this precaution will be absolutely necessary, inasmuch as the morasses are below the level of either sea. Captain Vetch, in proposing a new line directly across the desert, candidly states that he has no knowledge of the nature of the soil over which he proposes the canal to pass, and even to those who have traversed those plains, it is very problematical whether the possibility exists of forming a canal by a direct route: he errs in supposing that the land above the head of Suez is wholly composed of drift sand. Again the greatest velocity is not wanting, for not only must this canal, if direct, be lined throughout, but it must also be protected by high and strong enbankments, otherwise it would be in continual danger of filling up in localities by sudden drifts: he proposes to construct a basin at its issue from the Red Sea, which he, with great propriety, proposes to be between three and four miles below Suez, where there is already four fathom water, regulating the issue of water by means of several parallel channels, constructed of masonry, and each capable of taking the largest class of ships navigating the canal, and capable of being closed on occasions of necessity, the several channels uniting at a little distance north of the basin; he would obtain a current of 2·15 miles per hour as the most likely to be effective for scourage, and yet not difficult to navigate against, and in these latter points we fully concur: his estimate of the expence of excavation, masonry, piers, basin, &c., for the direct line proposed by him, is £2,102,000, reckoning the total length of the canal at 75 miles, or 132,000 yards: the total quantity of excavation being 42,504,000 yards; presuming the canal to be 21 ft. deep, 96 ft. wide at bottom, and 180 ft. wide at top at water line. The actual cost for excavating and embankment must depend upon the people employed, for if Egyptians supplied by the Pasha of Egypt, wages are not more than 2*d.* per diem, if the labourers are to be brought from other places, greater expences would necessarily be incurred.

Further particulars of plans laid down by the French engineers have been so long before the public, that it is needless to notice them more than by saying that they proposed to preserve the level of the water in their canal at Ras el Moyeh equal to the low water level at Suez, and to throw all the remainder of the fall 26·64 English feet on the remaining distance of 30 English miles; and by so doing they conceived that energy would be given to the current of the canal to clear its bed from drift sand, and to hollow out and maintain a chanel in the shallow muddy bottom of the bay, so as to afford the requisite depth of water at Tineh.

The plan of Mr. Clarkson, who gives an extended review of the history of the ancient canal, embraces the same idea as Captain Vetch, in carrying the canal in a direct line from Suez to the Mediterranean near Tineh; he also considers that the descent of about five inches per mile is amply sufficient to secure the communication: he would carry the two lateral walls of the canal into the Mediterranean sea for six or seven miles into deep water; this eight miles he conceives would be no large addition to the extended labour and expence; we differ widely from him in this; the watery base is much deeper than he imagines, and embankments to run this length into the open sea, must of necessity be attended with very great expense, and require great engineering skill to execute; the Mediterranean is no fishpond in stormy weather.

REFERENCES.—T. Tineh; P. Pelusium; S. B. Lake Subaket-Bardoil; P. B. Pelusiac branch; T. B. Tumetic branch; Bu. Bubates; B. Belbeis.

The several routes proposed are marked on the accompanying map.

1. The line called by Captain Vetch the Bir Makdal line.
2. The Thanbastum line.
3. The Ras el Moych line as proposed by himself.
4. The French line as marked out by M. Linant.
5. The lines proposed by us.
6. The interior French line.
7. Ancient canal.
8. Waghorn's present route.

The time consumed by the present route through Egypt is four days, the distance travelled over being 346 miles: the time required by the canal route would not exceed 3 or 4 hours—this is important in a political, commercial, and pecuniary view: but even this is as nothing compared to the vast advantage of having a route independent of any power, and so long as British greatness exists, of being able to secure it, whatever events and fluctuations take place in Egypt, or whatever disagreements take place among European states. The way of Egypt is at present by courtesy alone, and might be put a stop to to-morrow, and very probably will be jeopardized on the death of the Pasha.

Besides the plans already laid before the public, there is another route we have marked out in the accompanying map, the possibility of which is based on the authority of an experienced and scientific man. Starting from the Red Sea below Suez, the canal passes into the beds of the bitter lakes, and from the head of these lakes to Cateih, passing by which, and entering the Mediterranean Sea through the great lake Subaket Bardoil, or King Baldwin's lake; this route is by the way Hebrash, Assebbie, Hassivon, Masinak and Bucaria, a distance of about eighty-three miles from the lakes. Should this route be thought too circuitous, let the line be direct from the head of the Red Sea below Suez, to Subaket Bardoil, following the base of the elevated plains of the desert towards the east. The advantages of this route we conceive will more than compensate for the increased distance: we avoid all the possibly cultivatable soil of Egypt, and form a natural boundary to that country: we avoid all the land periodically overflowed by the waters of the Nile from lake Mansaleh: we secure a much better outlet to the Mediterranean, and a fine capacious basin in the lake itself: we pass eastward of the sand hills through a firm soil of gravel and marl, which, from its elevated position is seldom incommoded with shifting sands at any time. The lake communicates with the sea by a wide mouth, from whence a salt water river passes into Arabia.

With all due deference to the opinions of Mr. Anderson, we believe that previous to any measures being taken by English or other European capitalists for carrying any one of these plans into effect, full security must be obtained from the Pasha of Egypt, guaranteed by the great European powers, that those who speculate in it shall have the fullest protection, enjoying, unmolested by any power, the fruits of their labours. A canal suited to the spirit, wealth, and enterprise of the present day, should be a magnificent one, open to all nations, and under the influence of none: it should be large enough to admit ships of the largest burthen: its tolls should be settled by the cabinets of Europe; wholly independent of the Pasha, who should have no power of interference beyond that of a member of the associated proprietary: nor should the joint body have the power of shutting their gates against any country or community. To accomplish this object the first important movement is, to obtain by grant or purchase a certain width of land across the Isthmus, which should embrace the proposed line of route: the western side of the canal throughout being considered the boundary towards Egypt, the eastern-side advancing, say, 10 miles in breadth from sea to sea: this tract of land should be erected into an inferior Pashalisk, tributary to a small amount to the ruling powers of Egypt or Turkey, but otherwise wholly independent of them. The corporative body should have power to erect forts at each entrance, sufficiently strong to defend their rights and enforce their tolls: they should also have on payment for the same, all the facilities of labourers and material which Egypt can furnish, food, pay, and accommodation being provided for the Pasha's subjects employed by the company. Is this, we ask, to be obtained? for otherwise capitalists will hardly be found to carry out this truly universal project, and incur enormous expenses, that the Pasha may reap the benefit by receiving the tolls, the only mode for re-payment for the outlay: the avarice of the Pasha is well known, against this no security can be given; and even, during his life, secured from imposition and consequent loss, who can foretell the issue of events under his successor? This, therefore, is the first preliminary step to any company being formed, to any capital being expended. It does not appear that Mahommed Ali would be averse to it, and even if so, whether, from pecuniary considerations, he might not be induced to consent to it: £150,000 or £200,000 would be well disposed of this way, and ultimately saved to the speculators in the hire of Egyptian labourers. It is impossible that the right of tolls, as Mr. Anderson assumes to be necessary, should be vested in his family: the Pasha loses nothing but a strip of desert, he gains a means of communication to various parts of Egypt, exemption from toll, if he desires it, for himself and his Egyptian subjects, a passage to his dominions on the borders of the Red Sea, and an annual sum of money. The Pacha's and the Sultan's consent being obtained, then, and then only, are we called upon to consider the most eligible route or a canal, for, of the physical practicability of making one, not the least shadow of a doubt exists. If the Pasha undertakes it himself, there is no more to be said on the subject: other than this, that his tolls be regulated according to the wishes of those who would avail themselves of it. It is barely reasonable to calculate on a union of European powers to effect an object in which England has so preponderating an interest, as consolidating our power in the East: it is true that all the nations bordering the Mediterranean will benefit largely by it, but in a vastly inferior degree. Austria might not be altogether averse to it, but Russia would be decidedly hostile, and France would look with jealousy upon a plan which, after all that can be said, is to increase the commercial greatness of this country. The question, therefore, should be confined to a company in which the Pacha will be a shareholder, such company having powers like that of the Honourable East India Company, and to be amenable only to appointed trustees and regulators of the tolls. "Political considerations," says Mr. Clarkson, "are foreign to this inquiry;" but the question resolves itself into a political one: the British flag must then float in perpetuity upon the plains of Egypt, who shall tell the result of it. The expense of cuttings, embankments, piers, &c., must of necessity depend upon the extent of operations carried on: the canal in size must be suited to the object, and great outlay consequently be incurred in forming harbours in the respective seas; the estimates laid before us vary from £175,000 to £2,500,000: our opinion is, that to be judiciously completed, the minimum of expense will be £1,500,000, which, to pay 5*l.* per cent. per annum requires an annual revenue of £75,000 per annum, indepeodent of incidental charges. We therefore say, with the *Foreign Quarterly Review*, that, "The expense, compared with the magnificent result, is so trifling, that the wonder is that it has not been carried into effect before now, either by a company having the support of Mahommed Pacha, or by the Pacha on his own account." The advantages to a body of shareholders are undoubtedly great, for independant of the great trade which would be carried through it, independent of its opening Abyssina, and the whole of the interior of Africa to the arts, civilization and religion of European nations, the Red Sea abounds with natural riches, and the fishermen of the Mediterranean would resort there in numbers, for its pearl and pearl shell, tortoise-shell, sponge the finest in the world, coral of commerce, and for domestic ornament, oils from black fish, besides sharks, dolphins, bonatas, and other numerous varieties, subservient to the wants and purposes of man. For other numerous and important particulars, we must refer our readers to the pamphlets in question, as well as to other statements which have been already laid before the public. We cannot, however, conclude this notice without calling the attention of our readers to another pamphlet from the indefatigable Mr. Waghorn, in which he strenuously urges the propriety of forwarding mails fortnightly instead of monthly, in which desirable object we most heartily concur.

CANDIDUS'S NOTE-BOOK.

FASCICULUS LV.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. It is a thousand pities that Buckingham Palace, and not that alone, but several other buildings, cannot be sent to keep company with the model of the British Museum, and like that, be discreetly secluded from the impertinence of public gaze. Instead of being further exposed to view, the south side of the Palace ought to be completely shut out from view; for it will now look more pitiful than ever—a mere higgledy-piggledy collection of architectural scraps and patches, more especially since the accession of—the little knick-knackeries lately added. Royal taste is, of course—royal taste, and, perhaps, ought to be exempt from vulgar criticism; but I suspect that the new chapel would be too much for even the loyalty of Camdenists to stomach. Not much of symbolism there!—on the contrary, it is most unutterably heterodox in that respect. Well! symbolism is not at all in favour in court: that's pretty evident; so neither is precedent, though the lynx-eyed in such matters cannot detect heterodoxy there. What a comfort it is to be occasionally purblind!

II. Although some of them are a degree or two better than those in the Regent's Park, the "Pimlico Palaces," as Professor Donaldson wickedly styles them, are very much akin to them, and partake of a similar littleness of manner. Intended to be imposing, they nevertheless do not impose, but, on the contrary, they generally tell their own tale very indiscreetly. Instead of being made, as they might be, to look like distinct mansions upon a noble scale, by only two or three houses being comprised within one design, the same general elevation is frequently continued along the entire side of a street or square, consequently, while uniformity is pushed to monotony, the impression of greatness aimed at is lost, it being evident at the very first glance, that such a façade consists merely of a row of houses put into uniform, therefore, of "speculation" houses—not such as are erected for their own residences by wealthy proprietors. As far as the builder is concerned, such system is convenient enough: a single elevation will serve for the whole job. Its pattern once set, a Pecksniff "terrace" or "place" may be stretched out as long as—a Chancery suit, and be the external design ever so bad in point of taste, that gives the occupiers of the houses no concern, because they are comparatively but birds of passage.

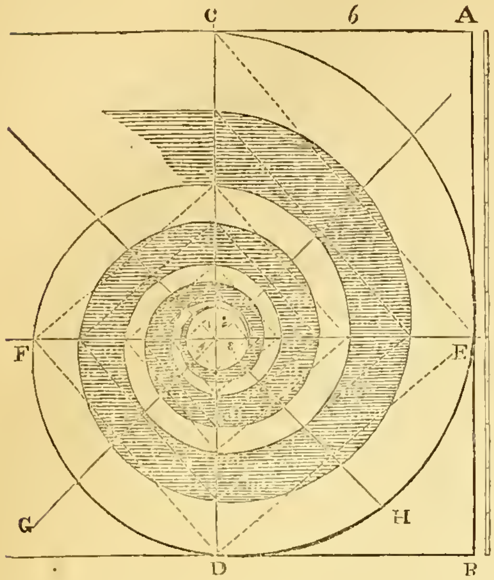
III. It is to be regretted that a little more public spirit and liberality of feeling in the cause of architecture is not shown by those among the noble and opulent, who possess magnificent mansions, worthy of being made known to all, yet are kept, in a manner, almost under lock and key. It is to be presumed that Chatsworth, for instance, and more especially that portion of it which was added by Sir Jeffry Wyatville, must contain a very great deal not only worth seeing but worth studying—and between the two the difference is considerable; nevertheless, there is nothing to inform us what it really is, neither are we likely to have anything, although it would be a mere bagatelle to such a man as the Duke of Devonshire—perhaps not the cost of a single fête—were he to employ the best artists of the day to make drawings and engravings that should completely illustrate the whole of the edifice. Very probably his Grace would not refuse the privilege of making drawings for such purpose to any one who might apply for it, and might even promise him subscribers, yet that kind of liberality does not go far—certainly not far enough for the purpose. It is almost in vain to look to the enterprize of trading speculation, whether on the part of publishers or artists, for works of that class, requiring a very great outlay, and promising but a very limited and a very slow sale. They ought not to be left for others to take up—or rather to the mere chance of its being done, but should be engaged in *con amore*, and with no more idea of profit than a man has when he gives a sumptuous banquet. As little would it matter though the world should set it down to vanity and ostentation: where there are so many other vanities besides, one more or less makes little difference in the sum total of them: neither would such kind of vanity be the emptiest of all.

IV. As this is the age of surprising discoveries of all kinds, we need not be particularly astonished at some one's having just discovered a "*bright halo*" irradiating the character of Sir Robert Smirke as a man and an architect, and claiming distinction for him on account of his "noble and generous nature!" With his private character the public have nothing to do, more especially as he is not one of those who are perpetually thrusting themselves forward into notice, and who advertise themselves and their doings in newspaper puffs; on the contrary, Sir Robert invariably "keeps himself quite to himself," as the saying is, and is no doubt fully entitled to the praise of being in his private station a very gentlemanly and highly respectable individual. Yet there are many others such—at least, so it is to be hoped, many truly excellent and worthy persons, who nevertheless are not on that account paraded before the public. It is in his professional capacity alone that Sir Robert stands exposed to notice, and his personal character belongs not to criticism but to biography. However justly such character may be claimed for him, his "noble and generous nature" does not discover itself by any overt acts: on the contrary, he shows himself to be of a very reserved and cold—not to call it a churlish disposition—not that he is on that account to be singled out for reproach, since even that is merely a negative defect, and one which does not at all concern the public. When, however, a man is officiously extolled for qualities which he does not appear to possess, it is but fair that the world should make some inquiry. To call upon us to admire the high character, and the noble, and generous nature of Sir Robert, is, however intended, not a little indiscreet: most assuredly his professional character for talent does not stand very high, among those at all capable of appreciating it, since, considering the numerous and ample opportunities which have been afforded him, no one in the profession has done less, or has manifested less of artist-like ability and feeling. So far from displaying any sort of invention or fertility of mind, his buildings present merely a few obvious and common-place ideas, hashed up over and over again; and are one and all must tame and insipid—even to poverty, in their detail. To talk of fancy and Smirke in the same breath would be preposterous; his Grecian designs and composition are purely mechanical, such as any one may attain to, merely by literally copying the Ilissus Ionic on all occasions, and sticking its columns against fronts which belong not to a columnar but a *fenestrated* style. Therefore even his so much cried up purity, is, after all, only impurity—mongrelism of the very worst kind, exhibiting in marked contrast to each other, two opposite styles, without any attempt to reconcile them, and thereby bring them in some degree into æsthetic harmony. All that Smirke has done has been quite as well done—in some instances, better, by others of the same school. Foulstone was quite equal to Smirke, and the buildings of the one might very well be mistaken for those of the other; therefore, it is hard for poor Foulstone—the late "Plymouth Vitruvius," and rather puzzling that he should be so little thought of by those who admire his *duplicate*. Possibly it is because he lacked the talismanic prefix of *Sir* to his name. Putting Foulstone, however, out of the question, it does not say much for the superior talent of Smirke, or for the heartiness of his admirers, that none of the latter—even those who consider him to have been unfairly treated, should have attempted to vindicate him, by directly pointing out in his works some of those excellences for which they so largely give him credit. Instead of so doing, they adopt the more cautious yet far less satisfactory mode of speaking of them in the lump, without particularizing any one of his buildings or its peculiar merits. Alas; for his classical taste shown by such a maudlin affair—such a jumble of Grecian and anti-Grecian, as the hall of the Post Office; or such another specimen of his, as is the church in Wyndham Place, or in the Mint on Tower Hill, or the Long-room of the Custom House, or his buildings in the Temple, or those of Serjeants' Inn, or King's College, or the College of Physicians and Union Club House, or the Conservative in Pall Mall. Is it for all—for every one, or for any one of these that our admiration is demanded? If so, and justly so, then has Sir Robert Smirke been, notwithstanding all his success, one of the most unfortunate gentlemen in his profession, for they are all sent to Coventry—are never referred to, spoken of, or mentioned in any way—most certainly not for admiration. As to his "noble and generous nature," the proofs of that are not more striking than are the beauties of his architecture. Is it his generous feeling which withholds him from ever joining the exhibitors in the architectural room of the Royal Academy? Are his ideas too precious to be there submitted to vulgar gaze, or would his designs so entirely absorb attention that everything else would be passed by unheeded, and they are therefore kept away out of compassion to others? His enthusiasm for art—supposing it to exist at all, must be of a particularly quiet kind, for never does it burst out on any occasion. Externally he wears much more that looks like indifference for art, and haughty contempt for public opinion. Most assuredly it is a very strange sort of generosity which determines him not to allow the public to view the Museum model, notwithstanding clamours and remonstrances. In that matter we may give him credit for discretion, but hardly for generosity of any kind, or for the warm feeling of a genuine artist who looks to public approval as his most prized reward. Very rarely, if, indeed, ever, has Sir Robert Smirke's name appeared in connexion with any scheme or plan for furthering the interests of art generally, or those of his own profession. He encourages no one, nor any thing: of course he is at perfect liberty so to act, without being responsible to any one for his conduct; but then let him not be held up as a pattern character; let us not be told of his noble and generous nature. If Sir Robert chooses to let the world misunderstand him—to veil the feelings of a warm-hearted and enthusiastic mind beneath the garb of a frigid and repulsive indifference, he must take his account accordingly, nor will *he* at least be surprised or disappointed at finding himself judged of from appearance. However, his hypocrisy, if such it be, is not of a very dangerous kind, for very few will be tempted by his example, to dissemble their virtues, and completely disguise all signs of "a noble and generous nature."

V. Singular paucity of invention is displayed by the surveyors of private fêtes—a greater disregard of money on the part of those who order, than of ingenuity and contrivance on that of those who have the management of them. One stock conceit—and one that would seem to be a piece of etiquette on such occasions—is to lumber up vestibule and staircase with such a profusion of evergreens and plants, that one might fancy Covent Garden market had been invited to the party, and was making its way up stairs before him; or else that he has mistaken the house, and has got into that of some horticultural and florist society. If there be ample space for them, and they are introduced sparingly, and just where an artist would place them for effect, plants and flowers—N. B. artificial ones would answer the purpose just as well and even better, besides being cheaper in the end—are admissible as embellishments on such occasions: but to have a mere crowd and mob of such things does not argue the most elegant taste. What is squandered away by some persons in a season or two, in temporary and trumpery decorations, would enable them to decorate their staircases and rooms in a style of superior and permanent beauty.

SYSTEM OF DRAWING VOLUTES.

By Mr. Maddox.



The size of the volute being first determined, the depth A B is divided into 12 equal parts; from the seventh part draw the right line E F, as shown in diagram; then number 6 parts at the top of the volute from A, and draw a line at right angles with E F, which will give the eye of the Volute. Lines are to be drawn (dotted in the figure) from C to E, E to D, and from D to F, and so throughout the volute, each square diminishing to the centre, as shown above, taking care to have them exactly parallel to the opposite ones. Quadrants of circles are struck from the diagonal lines G H (45°), which quadrants of circles all terminate where the dotted lines cut the lines C D E F. The first centre will be on the diagonal line H at 1, the second centre on the line G at 2; in going through the second time for the inside line the centres will be a trifle nearer the eye of the volute. The diagonal lines *only* are to be used for the centres. When the volute is on a larger scale, a small thin piece of transparent horn or ivory is generally used to avoid the unsightly punctures in the paper.

CONTROVERSIES ON CHURCH ARCHITECTURE.

Sir—It is not long since there appeared in the *Times* newspaper two interesting letters, signed "C. S.," on the state of the church, describing "the discrepancies of condition, feeling, and opinion amongst the clergy," and dwelling on the "depressing and perplexing effects on the young clergyman." Take pity, Sir, on another class who hardly suffer less from these "discrepancies," and with your valuable advice enlighten the path of the ecclesiastical architect. In the last number but one of the *Cambridge Ecclesiologist*, there are the following sentences on the proprieties of church architecture:—"A stone altar may be provided in two ways; either make it plain, a solid mass of masonry; the slab of block granite or marble projecting beyond the masonry, and *marked with five crosses*, or let the slab be supported on plain massy brackets fixed in the eastern wall." "*We assume the absence of altar rails and chairs.*" It is as easy to "*assume*," as Liston argued it was to *say* "read:" and very easy for critics of the Pugin school, who know nothing, and allow nothing, for all the difficulties engendered by this "discrepancy of feeling and opinion," to hurl their thunder at the unhappy architect employed by clergymen opposed to their "controversial arrangements," or who are so far "heretics" as to disallow the "dicta" of the Camden Society. Suppose the architect employed alternately by members of the "go-a-head," and by those of the "things as they are" school. In the former case he finds the clergyman originating the building or restoration, anxious to have "a stone altar," sedilia, lettern, faldstool, and perhaps, in painted glass, the representation of the saint or saints to whom the Church may be dedicated. On such instructions he prepares his plans: the work commences, and is perhaps completed, before the bishop of the diocese (an alarmist) becomes aware of the full extent of these "innovations," and objects to their introduction. The work is suspended; the plans and arrangement have to be altered, and the original spirit and feeling of the design become lost. This is no imaginary difficulty! In two cases within my own knowledge the churches were finished; in one, an Archbishop refuses to consecrate because the "solid stone altar" is introduced; in the other, a bishop threatens the same course if figures of saints (already painted) are introduced in the east window.

Suppose the architect employed by one of the latter class, the advocate of "things as they are." He is *cautioned* against these "modern innovations," these "shadows of coming Popery," and is required to embody in *these plans* the box pew, the twin preaching and praying pulpit, ground glass, and arm chairs! and if the employer in this case be a utilitarian, an advocate of the *least accommodation* for the *greatest number* principle, you have the monstrosities of galleries round the church (the east end perhaps excepted). This preaching house is finished and ready for consecration; the bishop of *this* diocese (not an alarmist) condemns its coldness and poverty; and in the next number of the *Ecclesiologist*, the production is criticised, its arrangements held to be "totally indefensible," "very objectionable," in fact, "one of the worst things they ever saw," "a perfect disgrace to the parties *responsible* for it." Now, Sir, it is this very *responsibility* I want to have defined. How, in the absence of all uniformity as to church proprieties, or church arrangement, is the unhappy architect to act? The question of surplice or academic gown is not more perplexing to the young clergyman, than the form and *aspect* of the reading desk, the pew or open seat to the architect (young or old). *His* province it cannot be to determine whether these novelties or "trifles" (as the Bishop of Rochester calls them) have "positive danger in them," whether "they indicate more than appears on the surface, or whether, considering the temper of the times, and the present unsettled state of the Church, they are calculated to irritate and vex the minds of congregations, and to become the badges of party distinction." Nor should he be called upon to justify and perpetuate what he believes to be inconsistency and slovenliness in worship. To refuse employment in those cases where the character of these arrangements is not in accordance with his own "private judgment," will not facilitate his children's support; and

> "There is no end to eating! legs of mutton
> Are vanquished daily by this little host."

To accept it when he knows that the result will *inevitably* draw down on his devoted head, the flagellations of these ready-made critics ("for a man must serve his time to every trade save censure"), is an act of heroism and self-devotion worthy so good a cause.

Forgive this long story from a constant reader of your journal, and

An Unhappy Church Architect.

December, 1843.

ROYAL ACADEMY.

Sir—Not finding in the last number of the *Journal* any remarks upon the architectural drawings, beyond the mere notice of the successful competitors for the prize medals offered by the Royal Academy to the students, I beg leave to submit a few remarks which occurred to me in the course of a rapid glance of these drawings, taken after the distribution of the medals.

There were six sets of designs sent in for the gold medal, amounting to thirty-two drawings, consisting of plans, geometrical and perspective elevations and sections. This, I understand, is the largest number which has been sent in for some years. For the silver medal there was but one set of drawings, this is the smallest number received for some years. The subject for the gold medal was a Metropolitan Music Hall, and Royal Academy of Music. I was struck with the general appearance of inattention to the purposes of the building exhibited in the plans and other drawings, excepting in those of Mr. Garling, to whom the medal was awarded. I say, excepting Mr. Garling's, because he, unlike the rest (from each room being assigned to some purpose described, and from a short sketch and description sent with the drawings), appeared to have studied well the arrangement of his building. As in almost all designs where outlay is not thought of, columns, pediments, statues, &c., were in great abundance; indeed it appears to be the idea of many young architects, as well as some old ones, that the more of these, they can crowd together, the greater the grandeur and beauty of the edifice. In some of the designs the Music Academy appeared to be lost sight of; a large central hall, surrounded by a suite of galleries, nearly a fourth part of which were appropriated as royal entrances, &c. In others they introduced court-yards, but still having no rooms, properly so called, for the academical department. One of the perspective views looked like a large temple on the top of a hill, the base of which was hidden by a crowd of small low buildings with domes, pediments, &c. In another, from the number of columns introduced, and from the point of view chosen, not a single window or door was to be seen, and it therefore looked like a tomb or some such building. Although having spoken so much in dispraise, I must acknowledge that all the drawings exhibited great care in the drawing, and, I might almost say, beauty of colouring; but the most of them departed from the printed directions of the Academy, namely, that no colour but sepia should be used, for in some I noticed red, blue, yellow, brown, &c. And, again, in the introduction in the perspective drawings of figures, such as soldiers, horses, stalls, with their attendant old women, boys, &c., which, in my opinion, instead of adding to the beauty of the design, turned it into a pretty picture, and no more. I fear from some little pieces of bad perspective, also introduced, that some one had been employed to put in that which certainly did not add to the beauty of the architectural design.

The drawings for the silver medal, sent in by Mr. G. Perry, of the West Wing of Greenwich Hospital, from actual admeasurement, exhibited great care, both in the drawing and colouring. The Academy reserving the power of withholding the medal, in a case like the present where only one competitor sent in, have signified that they considered the drawings of Mr. Perry worthy of the prize. Although these drawings did not exhibit the artistic handling shown in the gold medal drawings, they give promise of superior abilities. A student informed me that the probable cause of there being no other drawings in this class was owing to the council's description of the part required to be drawn, being very unintelligible, and that he had no doubt the students were afraid of commencing any drawings, as they might turn out after all to be of a wrong part. But why did not they make inquiries? I apprehend that either the Keeper of the Academy, or some other member, would have set the student right.

Yours, truly,

January 3, 1844. Q.

A MARINE SALINOMETER.

For the purpose of indicating the Density of Brine in the Boilers of Marine Steam-Engines. Invented by J. Scott Russell, M.A., F.R.S.E., F.R.S.S.A., Civil Engineer.

Read before the Royal Scottish Society of Arts, 28th February 1842, the Honorary Silver Medal of the Society awarded, and reported in their Transactions.

It was very early in the history of steam navigation that the inconvenience of raising steam from salt water was experienced. When the *Comet* descended below Port Glasgow in 1812, the boiler was found to boil over, or prime, as it is technically called by engineers, when part of the water of forced up so violently, along with the steam, as to pass over into the cylinder of the engine—a circumstance always detrimental, and sometimes destructive to the engines. This arises from the thickening of the water, its density being increased by the retention of the solid substances which compose sea water, and which remain and accumulate in the boiler, while the fresh portion of the water is passing off in the shape of steam. This process of accumulation of solid matter in the marine boiler is by no means slow. The whole of the water which a marine boiler usually contains is evaporated in three or four hours, leaving the solid substances in the cubic content of boiler behind it, and being replaced by salt water, with an equal quantity of depositary matter, accumulating as rapidly as before; and since it is known the solid matter amounts to as much as $\frac{1}{30}$ of the whole mass of water, it would follow, if the process of ebullition could continue so long as 150 hours, there would be deposited in the boiler a quantity of solid matter equal to the number of tons of water in the whole content of the boiler.

Long, however, before this degree of solidification can take place, evils of a different description intervene to impair and put an end to the functions of the boiler. The solid constituents of salt water which are left behind do not diffuse themselves uniformly over the whole liquid mass, so as to constitute a homogeneous brine; on the contrary, the new supplies of sea water, as they enter the boiler, remain secluded from the former more saturated brine, rise by their less specific gravity into an upper stratum, while the denser brine forms a bed in the lower part of the boiler, and surrounds the fire box and heater flues occupying the water spaces and legs, which are usually at a high temperature, and which, in double tiered boilers, are generally the most intensely heated. The intense heat of the metal expels the water from the brine in contact with it most rapidly in the hottest places, and salt is deposited on the hottest parts of the furnaces and flues, extending rapidly to those less heated, and so not only diminishing the evaporative power of the boiler, but injuring its substance, and endangering its existence.

The remedy for these evils was very early invented. But I have not been able to discover the inventor of the cleansing process commonly called "blowing down," or "blowing off." It is almost universal, and is performed in the following way:—There is forced into the boiler, at each stroke, rather more water than is required for the supply of steam, so that the boiler becomes too full. Openings are then suddenly made at the bottom of the boiler, and the brine at the bottom being violently ejected, carries with it any solid substances that may have accumulated near the bottom—the boiler is thus cleansed; and before the water has got too low, the openings are again closed, and the boiler continues to be fed as formerly. Another remedy, pretty generally adopted, is the brine pump, by which, for every portion of water supplied to the boiler, about one-fourth part of that quantity of brine is withdrawn from it. This process does not so thoroughly carry off all the impurities as the former; but it is attended with a saving of fuel by a contrivance for giving to the feed-water entering the boiler a portion of the heat of the discharged brine. The recent introduction of this process is due to Messrs. Maudslay & Field of London.

In whatever way the saturation of the water with solid matter may be remedied, it is essential to the accomplishment of this object, that some simple apparatus should be contrived for the purpose of showing when the cleansing process is required, and whether it is successfully applied. If this be not obtained, the usual consequence of acting on wrong data are sure to follow. A contrivance was patented, which was thought promising, but was found liable to be mechanically out of order when most wanted:—a ball of greater specific gravity than salt water was connected with an external index, by which there was indicated on the outside, the fact of the brine becoming sufficiently saturated to float this ball. Another was to place in the glass gauge of the boiler a glass hydrometer bead, which would float when the brine became saturated to a given point, and fall to the bottom in the ordinary state of the boiler. But this fails entirely of accuracy, although very elegant; for the brine of which we wish to indicate the density is in the lower stratum, not the upper one, where the usual glass gauge is placed, and irretrievable mischief might be done before the indication would show any change.

I have lately employed, in some large ships destined for transatlantic voyages, a species of brine gauge, or index of saturation, which is found to possess every advantage, and which I therefore desire to communicate to the public through this society. The drawings sent are such as may enable any engineer to construct them for himself. The details of the arrangement of the apparatus were made under the direction of Mr. James Laurie, formerly one of my assistants; and he also has obliged me by writing out the annexed description of the operation of using the index.

The principle I have used is the well-known law, "that the heights of equiponderant columns of liquids vary inversely as the densities of those liquids."

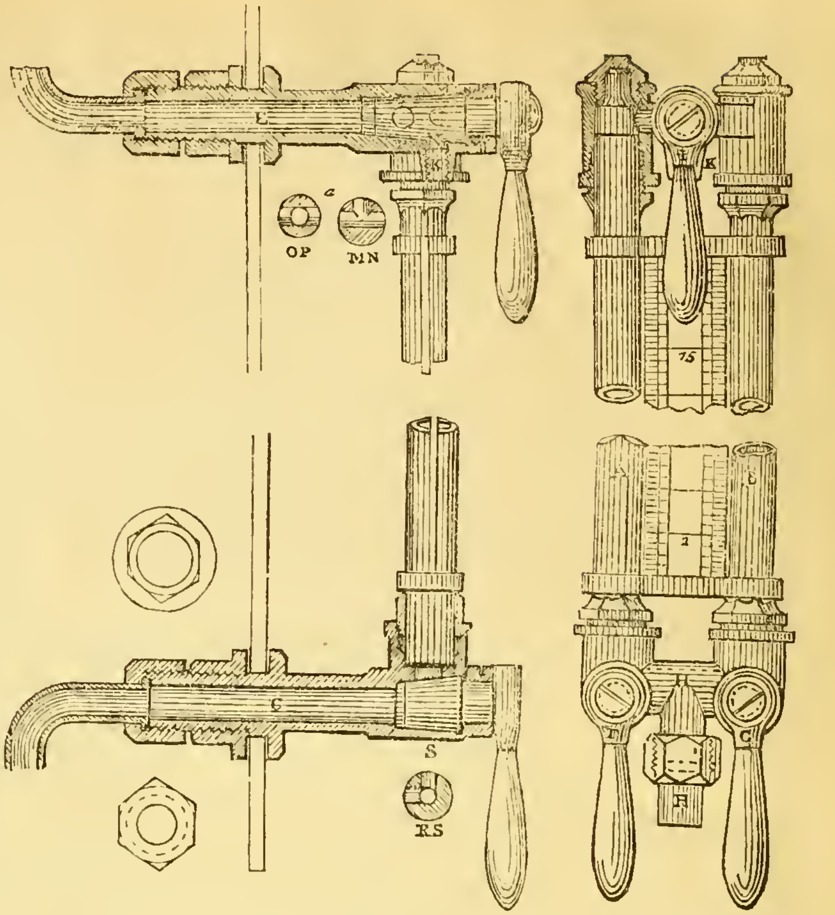
If I take open glass tubes bent in the form of the letter U, and pour one fluid into one of the sides, and another fluid into the opposite side (taking care to use the heavier liquid *before* the other); the one being mercury, and the other water, they will stand at the height of 1 in. and 13 in. respectively. If I use alcohol and water, they will stand at the height of 10 in. and 8 in. respectively, the height of the one fluid being always greater than that of the other, in the proportion in which its weight, density, or specific gravity is less. In like manner fresh water and salt water will stand at heights of 40 in. and 41 in., showing a difference of 1 in.

The use which I make of this principle is as follows:—I reckon the best scale of saltness of a boiler to be that which takes the common sea water as a standard. Sea water contains $\frac{1}{30}$ of saline matter. When the water has been evaporated, so as to leave only half the quantity of distilled water to the same quantity of saline matter, I call that two degrees of salt, or brine of the strength of two, and such brine would show, in fig. 3. the columns 40 and 42, or double the saltness of sea water, indicated by a difference of 2 in. A farther saturation would be indicated by a difference of 3, 4, 5, and 6 in. between the columns, and so indicate 3, 4, 5, 6, and any further degrees of saltness—a range which may be made to any degree of minuteness by the subdivision of the scale of inches. This scale is that which appears to me most simply applicable here—and it is that which I adopt for marine boilers.

The mechanical apparatus which I have employed to give this indication is perfectly simple, and has the advantage of being such as the engineer already perfectly understands. To the marine boiler I apply two water gauges of glass, instead of one as at present used; they both serve the purpose of the present glass gauges, and the pair would be valuable for this, if for no other reason, that there would always be a duplicate when one is broken, an accident not unfrequent. To these gauges I simply attach small copper pipes, so that one of them may be placed in communication only with the salt brine in the lower part of the boiler, and the other with the feed-water which is entering the boiler; the one then holds a column of brine, and the other of pure sea water, and each inch of difference shows the degree of saturation.

Without the use of any attached scale, the engineer, by a little practice, comes to know in his particular vessel, what difference in inches can be admitted without danger, and at what difference of height it is imperative to blow off. But it is convenient to have an attached scale. It may be satisfactory to state, that the practical range of scale in an ordinary boiler in the ordinary working, is 6 in. to 10 in., a difference sufficiently great to be easily observed. The rule of working them is nearly this:—Continue the operation of blowing off until, if possible, the difference of the columns is less than an inch; it will be unnecessary to blow off again until the difference is at least 6 in. As a practical rule, I find that it is necessary to blow off when the brine at the bottom has about three degrees of saltness. But this will vary exceedingly, according as the construction of the boilers is more or less judicious. When the heat is greatest in the lowest portion of the boiler, and the flues return above, they will be most liable to salt, and require the most frequent cleansing.

The following is Mr. Laurie's description of the instrument. The drawings give the details of the apparatus.—J. S. R.



The fact that the specific gravity of salt water is greater than that of fresh, and that it increases with the degree of saturation, is what the operation of this instrument depends on; by its means two columns of water, the one feed and the other brine, are poised against each other, so as that any difference of weight betwixt these columns immediately becomes apparent by the lighter of the two requiring an accession in quantity to resist the upward pressure to which both columns are subjected. This is accomplished by having two common glass gauge-tubes close together, each of which is connected with a separate tube; that inside the boiler descends to the level of the water, the specific gravity of which is to be measured, and having either or both of these tubes so connected with the feed-pipe of the boiler, that by opening a cock one of the pipes will be filled with feed-water, while the other remains filled with brine, which cock being shut, the tubes remain so filled; but inasmuch as feed-water is of less specific gravity than brine, it will be forced up and stand in the glass tube at a higher level than the brine, which difference of levels increases with the saturation—and hence the index to judge of the saltness.

Fig. 1 and 2, A, B, are the two glass gauge tubes; C, one of the tubes forming the connexion betwixt one of these glass gauge tubes and its tube D, that descends inside of the boiler to near the bottom; E, the tube forming the connexion betwixt the upper ends of these tubes and the inside or the boiler and ascends to near the top; F, G, two cocks so made, as shown in the drawing, that by their means each of the tubes inside of the boiler may be shut off from the glass tubes, and also may be connected with the tube H, leading from the feed-pipe of the boiler; I, a cock affording the means of shutting off the tube E from the glass tubes, and also of connecting either of these glass tubes with the tube K, leading to the bilge of the vessel; each of these cocks has a handle, and when the instrument is indicating, the three handles hang perpendicularly downwards. To bring the instrument into operation, the three handles must first be put in the position ¡ ¦ which has the effect of allowing the brine to flow right up the glass tube A, and out through the tube K, into the bilge of the vessel; this having been done for so long a time as that A and its tube inside the boiler be thoroughly cleansed and filled with brine, the handles are then to be put in the position ¦ ¡, which, in like manner, cleanses and fills B and its tube inside of the boiler with brine; finally, bring the handle of the top cock into its original position, and put either of the lower handles horizontal, which forming a connexion of the feed-pipe with one of the tubes inside of the boiler, fills that tube with feed-water; thus there are in the two tubes inside of the boiler two columns of water of different specific gravities, the one being brine, the specific gravity of which is to be measured, and the other feed-water, the specific gravity of which is pretty nearly constant, so long as the temperature of condensation is the same, and does not vary much, let the temperature of condensation be what it may; but, inasmuch as these columns of water are of different specific gravities, the pressure on the bottoms of them will force the lighter up the glass tube, until such a quantity of brine has followed it as makes it of equal weight with the other; and hence, in the two glass tubes, the water stands at different heights, the magnitude of which difference becomes known by means of the scale fixed betwixt the glass tubes, and therefore also the degree of saturation of the brine.

The use of this instrument, which might be called a Salinometer, is not confined to this one subject, for it answers thoroughly all the purposes of the common glass gauge, the position of the surface of water in the boiler being midway betwixt the surfaces of water in the tubes.

When either or both of the glass tubes is broken, put the handles in the position ! ¦, and nothing can escape from the boiler. T. W. L.

CHURCH BUILDING IN IRELAND.

It at all times affords us much pleasure to notice the works that are in progress in Ireland, particularly when we have to record buildings of a public character, such as the one we are about to describe; for the description, together with the preceding remarks, which are slightly abridged, we are indebted to the *Newry Examiner*. The architect is Mr. Duff, whose ecclesiastical works we have before noticed in this *Journal*.

We hear of continual comparisons between England and Ireland, in which the relative prosperity and poverty, civilization and crime, learning and ignorance of these two countries, are descanted upon with no small share of skill. There is, however, one prominent part which these balances of national characteristics have, either through inattention, or incompetence to do justice to the subject, left almost unalluded to. This is the more to be regretted, as nothing more tends to introduce good feeling between countries, and a sense of emulation, than judiciously pointing out to the less improved country the causes and consequences whereby the more cultivated has arisen in eminence.

England has been remarkable for the richness of its churches since immediately after the conquest, when William, the Conqueror, with arms, introduced arts, and when the simple strength of Saxon edifices was supplanted by the more stately splendour of Norman towers. The temperament of these hardy Normans must have been more than tinctured with piety. They must have been essentially devout, for, whilst we find the castles of their nobles of comparative plainness, in no instance does aught beneath grandeur suffice them when they erected temples of religious worship. This may be accounted for by the prevalence then in repute of joining the priestly functions and architectural duties in the one person. The churches of England are almost all constructed after the designs of bishops and priests, and, perhaps, never again may the world expect to behold Gothic architecture carried to such perfection as when such men as William of Wykeham, though wearing the sacred purple, deemed them sanctified duties to resign, with compass and square, inspect stone-hewers, learn the relative bearing of timbers, and, in a word, all but became artisans, by spreading out the protecting span of roofs, and by sheltering civilised society.

Unfortunately for Ireland, its distracted state of society, ever in a turmoil between the invader and the invaded, afforded no shelter for arts to thrive. Hence its almost total want of magnificent churches; and Christ's and St. Patrick's in Dublin, and Armagh Cathedral, may be said to constitute the only pious preserves of ancient days. Better times are upon us now, and church building, within these last twenty-five years, durably marks the vast spread of civilization, learning and religion, which have come, as it were, in well regulated abundance upon the people. More Catholic churches have been built in Ireland within that period than were for the preceding two centuries; yet few of them are in the Ecclesiastical or Gothic style of architecture. Dublin has been especially blameable in this respect, and out of the hundreds of thousands sterling, its citizens dedicated to erect houses of worship these last ten or fifteen years, we look in vain for a Gothic building.

The Metropolitan Cathedral is Grecian, and, though grand, is less striking in appearance than a Gothic pile of equal magnitude. The church of Saint Xavier is the paragon of prettiness, and its panelled ceiling and vestibule are extraordinarily beautiful in their way, nor is its portico deficient in symmetry and justness of proportion. Much of the beauty of Saint Paul's church is lost from its propinquity to the river, its portico, tower, and dome, are worthy of a better situation, but the interior greatly disappoints the eye that looks even for a small portion of effect. The churches of Saints Michan, Michael, and John, though externally Gothic, retain little of the style in the interior except the altars. St. Andeon's is still too far removed from completion to form any competent judgment upon its probable effect; yet if we might hazard an idea, we opine meagreness shall be its characteristic. The Church of Saint Nicholas is also unfinished, but the magnificence of its ceiling and altar is unparalleled in this kingdom. The altar is a noble arrangement of columns and pilasters worthy the best designs of Claude Perault. The Church of Saint Francis is a spacious building, but in nothing remarkable for either elegance or judicious arrangement. The Church of Saint Andrew is the largest and least to be praised of any; its vastness is unrelieved by one solitary attempt at grandeur, or even taste in detail. Throughout all these religious edifices we seek in vain for the dim religious light found in Gothic buildings; and, whether to blame the architects or building committees, it is not here to determine.

Ulster, however, has to boast that it did not follow the example of the metropolis, and the new Cathedrals of Armagh and Newry, and the church of Dundalk, designed, erected, and erecting under the superintendence of Mr. Duff, of this town, are enduring monuments of the Gothic style. Newry first set the example, and its Catholic Church is a splendid edifice. Dundalk followed, and, with that independent tone of rivalry or emulation for which the people of Louth are celebrated in secular, as well as political affairs, the building committee of the town appointed Mr. Duff their architect, who succeeded in adding another triumph to the resuscitation of Gothic architecture. He was the only professional gentleman in the kingdom who had attempted to overcome the difficulties that lay in the way of arousing the hierarchy and the clergy to a just appreciation of the glories of the old, neglected, ecclesiastical style. Nor was he unsuccessful; and it must be confessed the people of Dundalk actively co operated to carry out his extensive designs.

ROMAN CATHOLIC CHURCH, DUNDALK.

This church is built entirely of fine hewn granite stone, and in the pointed style of architecture which prevailed during the early part of the fourteenth century. It contains a nave and side aisles, the north-west constituting the principal front, which apparently consists of three divisions, the central being separated from the lateral aisles by graceful turrets, octagonal in form, appropriately buttressed, panelled, and crowned by crocketted pinnacles. The upper stage of these turrets is composed of perforated panel-work, possessing peculiar lightness and beauty. The centre division, which projects considerably beyond the aisles, has a majestic doorway, leading to the interior porch and body of the church. This doorway is of ample dimensions, deeply recessed; and enriched with small pillars and hollow mouldings, with a lofty pointed arch, with rich tracery panel-work, and a bold label, enclosing carved spandrils, of a tasteful and elaborate design. On either side of the doorway are handsome tabernacle niches, for the reception of statues. Over the grand entrance rises a magnificent window, of lofty proportions, of six lights, and subdivided by a transom. The heads of these lights, with the pointed arch above, are filled in with varied tracery, of a beautiful description, the jambs are recessed and moulded, with a large hood moulding sustained at the springing, by beautifully carved corbelled heads. In the upper part of the pointed gable appears a circular opening, for ventilation of the roof, *octofoil*, moulded, and cusped; above which, an enriched cornice laterally sustains an open parapet of panel-work, capped and embattled. On the apex rises an appropriate pedestal, supporting a large ornamental cross. The angles of the side aisles are bounded by graduated buttresses, terminated by lofty pinnacles and finials. The principal entrance to the aisles are on the front, with moulded jambs, painted arches and carved spandrils, and hood mouldings. On a large cornice over the doorways, are windows of three lights, the heads filled with tracery of perpendicular arrangement, and corresponding in dimensions with those of the aisles—the inclined gables of the roof being finished with panelled parapets, capped and embrazured. The next portion of the church claiming attention is the south-east end, which, like the front, projects considerably beyond the termination of aisles, and flanked with turrets containing circular stairs which lead to the leads of the roofs. These turrets are of plainer character than the principal front; but the upper stages, when finished, will correspond, in every respect, with those already completed. The great window which lights the choir is fifteen feet wide by thirty-eight feet high, divided and subdivided by moulded transoms, into fifteen lights, which are designed to contain appropriate subjects in stained glass. The tracery of the pointed arch is beautifully varied. The aisles are embrazured, and sustained by buttresses and pinnacles, and lighted by eight lofty windows of three divisions, divided by a transom, the heads of each window having perpendicular tracery work. The nave, or clerestory, which rises high above the aisles, displays a similar arrangement, having windows, buttresses, pinnacles, and embattled parapets.

The dimensions of the building are as follow:—

Length of the nave, taken on the walls	179 feet.
Breadth between the pillars	33 do.
Length of the aisles, including porches	140 do.
Breadth of the nave and aisles, including walls ..	78 do.
Height of the nave from base of pillars to apex of roof	62 do.
Altitude of front to top of cross	78 do.
Height of the octagon towers	86 do.

The interior is not yet entirely completed, but much is executed to arrest and gratify the attention. It is divided by two ranges of granite stone pillars, having moulded bases and capitals, sustaining pointed arches of various appropriate mouldings, over which, upon a horizontal cornice, rests the clerestory windows that light the body of the house. Between the windows, slender shafts rise from the pillars below that support angel brackets; from these spring the ribs of groins forming the roofs, having bosses and exquisite foliage at the points of intersection. The ceiling is truly grand, and reminds us of those beautiful remains of olden time. The sanctuary is very spacious, in which are the three splendid altars, composed of elegant tabernacle-work, and executed in white marble.

The altar screen is to be of a most elaborate design, which is to separate the sacristy from this portion of the church.

ROYAL SCOTTISH SOCIETY OF ARTS—SESSION 1843-4.

This Society held its Annual General Meeting on *Monday*, 13*th November*, 1843.—James L'Amy, Esq., F.R.S.E., in the Chair.

1. The meetings for this session were opened by an interesting exposition of the construction and management of light-houses, given at the special request of the Council of the Society, by David Stevenson, civil-engineer. After alluding to the great importance of the subject, and giving a brief outline of the early history of light-houses, from which it appeared that the open coal fires, formerly employed in lighting our coasts, were superseded by a more perfect system only towards the close of last century, Mr. Stevenson proceeded to explain—*First*, The systems at present in use for producing signal-lights, by means of the *catoptric*, or reflecting, and the *dioptric*, or refracting apparatus, and also by the combination of these two, to which the term of *catadioptric* is applied; *Second*, The means employed for varying the characteristic appearances of the lights, describing the seven methods at present in use on the coast of Scotland; *Third*, The construction of the erections from which those lights are exhibited, *viz.*, the ordinary lighthouse stations which occur on the coast, those erected on sunken or isolated rocks —such as the Eddystone, Bell-rock, and Skerryvore—the floating light, screw-pile light, &c. &c.; and, *Fourth*, The construction of beacons and buoys, adopted in situations where light-houses cannot be erected. Mr. Stevenson concluded by offering a few remarks on the management of light-houses generally. The exposition was illustrated by a variety of models and drawings, together with specimens of the different kinds of apparatus employed, the use of which was granted by the Commissioners of the Northern Lighthouses. Thanks were voted to the Hon. the Commissioners of the Northern Lighthouses for the use of the models, and to Mr. David Stevenson for the exposition, which were given to him from the Chair.

The report of the committee appointed to award prizes for communications read and exhibited during the last session was read, by which it appears that not less than 21 prizes were awarded.

The office bearers for the current year were elected; when Prof. Thomas Traill, M.D., F.R.S.E., was announced the President for the year ensuing.

November 27.—Prof. Trail in the chair.

The President, on taking the chair, addressed the Society, thanking the Fellows for the honour they had done him in placing him by the chair. He stated that he took a great interest in the proceedings of the Society, and that it should be his earnest endeavour to promote the prosperity of the Society, and to forward its laudable object, the encouragement of the useful arts.

Several communications were made and referred to committee for consideration.

Sir Geo S. Mackenzie, Bart., exhibited a beautiful specimen in ivory, copied by Cheverton, by machinery, from the "Clytie," or (according to Flaxman) the "Isis," one of the finest antique busts in the British Museum.

A motion by James Thompson, Esq., F.R.S.E., civil engineer, "That the Society shall memorialize Government or petition both Houses of Parliament on the present neglected state of the Ordnance Survey of Scotland, and urging that it be resumed and prosecuted with vigour," was unanimously adopted, and a remit made to a Committee to prepare a draft and to report.

December 11.—George Buchanan, Esq., F.R.S.E., in the Chair.

The following communications were made:—

"1. *Description of the new Dock Gates at Grangemouth, on the Forth.*' By James Thomson, Esq. C.E. Glasgow.

Mr. Thomson exhibited a model and drawings of the dock gates recently constructed at Grangemouth, where the entrance lock, upon which are four pair of gates, is 250 ft. long, 55 ft. wide, with a depth of 25 ft. water over the sill into the new wet docks. The gates, which are wholly built of timber consist of a double framework, the front framing, or that next the sill, being straight, and the back curved, both, of course, uniting together in the heel and meter posts. The back or curved framing is formed with arched ribs, composed of plank in three thicknesses of four inches, firmly bolted together, and to the corresponding front ribs; this double framework, being braced together with horizontal and diagonal tension rods of iron, is planked on both sides, and made perfectly water-tight. The gates constructed in this manner are extremely light and buoyant; and by the admission of more or less water, with additional balance weights, the buoyancy of the gate is so adjusted that its whole weight is borne by the water, and, consequently, very little power required for opening and shutting, besides the great saving in tear and wear thus reduced to a minimum; in proof of which it was stated, that instead of from ten to twelve minutes, with four men, the time and power usually required for opening or shutting gates of similar dimensions, these gates, by means of improved crab gearing, are opened or shut in three and a half minutes, with only two men; and with a longer allowance of time, even one man is able to work them. Thanks voted, and given from the chair.

2. "*Observations upon Iron Lattice Bridges.*" By the same.

Mr. Thomson illustrated his observations with numerous drawings and models of several lattice bridges already completed, or at present carrying into execution, by Mr. Macneill and himself. The principle of lattice bridges, applied in timber, has for some time back been in use in America; but the adaptation of the principle to iron bridges, as now so successfully applied by Mr. Macneil and Mr. Thomson, is likely to supersede, in a great degree, the use of timber, and will supply a desideratum hitherto felt in establishing internal lines of communication, &c., where the expense of stone bridges not unfrequently precludes their being carried into effect, while the objection to wooden structures on the score of durability is obviated by the substitution of iron. The first bridge of this kind, recently completed by Mr. Macneil on the line of the Dublin and Drogheda Railway, and of which drawings were exhibited, is 85 ft. in span, consisting of two lattice-work frames or beams, one on each side, resting upon stone abutments; the lattice-work beams are composed of small bars of malleable iron, about 12 ft. long, and only a quarter of an inch thick, placed so as to cross each other at right angles, and forming a net or lattice-work, rivetted at every intersection; the lattice frames, so constructed, and stiffened with angle iron, support the roadway by means of light transverse beams, also of malleable iron, secured to the lattice-work at each end. This bridge, which altogether weighs only fourteen tons, sustained a load across its centre of twenty-four tons, under which the deflection amounted only to 3-10ths of an inch. A viaduct 230 ft. in length, with a central span of 140 ft., is now being constructed by Mr. Macneil, over the Royal Canal in Ireland, for heavy locomotive traffic. This viaduct, of which Mr. Thomson exhibited drawings, has a third lattice-frame in the centre, and is composed of malleable iron bars half an inch thick. Mr. Thomson described a very useful application of this principle to the widening of the roadways of existing bridges: and exhibited a pretty constructed model of one of the arches of a stone bridge, about 400 ft. long, with the addition of footpaths on each side, as at present executing under his direction, the old width of roadway being only seventeen feet, while, with the new footpaths, supported by iron lattice-work, the width will be increased to thirty feet. The appearance of these bridges, which may be either perfectly straight or slightly curved, as circumstances require, is light and graceful, combining as they do great strength with the least possible quantity of materials, and seem to be admirably adapted for crossing wide and deep valleys, rivers, &c. at a small expense, as also for ornamental bridges in parks, or approaches to gentlemen's seats, &c. The expense of construction, Mr. Thomson estimates at less than half the cost of stone; but he stated that he was at present making an investigation into their principle, with experiments upon a different arrangement of the lattice-bars, which he hoped would lead to a considerable saving both in the quantity of material and workmanship.

NOTES OF THE WEEK.

The sculptural decoration of the metropolis seems to be a great attraction just now. The statue of Nelson has been elevated to the top of the pole in Trafalgar Square, where it has produced such an effect, although a meritorious work of art, that we question whether any more monostylar monuments, supporting nothing, will be erected for some time. We must say that the present is a luckless specimen; we have heard of midshipmen being mastheaded, but we never saw an admiral mastheaded before. It seems that discontent and disgust have even afflicted the committee; they are going to have the cable at the feet of the Admiral altered, so as to give greater solidity to the statue. We wish while the statue is up, that they would knock off the cocked hat, which is too great an attraction, catching the eye from every point. The statue of George IV., by Chantrey, is also mounted on the pedestal near St. Martin's Church. It seems, on a cursory view, to be a good likeness of the King, and the horse, which is a powerful charger, planted on his four feet, with his head slightly turned, is a fine one. We must, however, see more of it. George III. is, it seems, to come from Pall Mall to the North West pedestal opposite the College of Musicians. We hope the pigtail of this statue will also be cut off. The statue of William IV., by Nixon, is nearly ready. It is to be placed at the junctions of King William-street and Gracechurch-street. We hope the artist has not, agreeably to the practice of modern art, represented the Sailor-King with a doodeen in his mouth, or some other attribute of the ruling habit of the living man; the statue, of Devon granite, is fourteen feet high, and cost £2,200, voted by the Corporation of London. What inconvenience would it be to the Corporation of London to vote a similar sum every year, for a statue of some man of genius born in London, and who has a right to such honours at the hands of its municipal authorities. We can give some names to keep them going for a few years, and tell them where to put them. Milton, Bread-street, Cheapside; Pope, Lombard-street; De Foe, Cripplegate, (or Finsbury Pavement).

Mr. Nixon has finished the series of the Four Seasons for Goldsmiths' Hall. The last statue is that of Autumn. He has in hand a statue of Mr. Carpenter, the founder of the City of London school, to be placed in the vestibule of the school; and also of Sir John Crosby, for Crosby Hall. It has been noticed, as in some degree singular, that statues are now being erected to two contemporaries and near neighbours—Whittington and John Carpenter. Mr. Bailey, R.A., has in hand a marble statue of that excellent statesman, Sir Charles Metcalfe, to be 9 ft high, and cost £3,000, to be placed opposite the Senate House, Kingston, Jamaica. A bust is also to be sent to Calcutta. He is also occupied with the statue of Sir Astley Cooper, for St. Paul's, which will soon be placed on its pedestal.

Some noise is being made about cheap imitations of bronzes in zinc, but we have not seen any of them.

As an example of the increased attention paid to decorations, we are glad to instance the three new doors just completed for York Minster, from the designs of Sydney Smirke. The three doors are alike of the decorated style, 16 ft. high, and 6½ ft. broad. The tracery in the upper part is very rich, supported by slender Gothic columns. The hood mouldings spring from the tops of the capitals, and terminate in rich finials and crocketting. Three trefoils, bearing shields, occupy the centre of the arches, and the lower part of the door is divided into six decorated compartments. The work is executed by Mr. Wallace and Mr. Scott, of Newcastle.

Mr. Rigby has taken the contract for the erection of the new Marine Barracks at Woolwich, for £70,000. The works have been commenced. The barracks are to accommodate a thousand men.

The Woods and Forests have begun pulling down the Rookery and neighbourhood, to make way for the new road from Buckingham Palace to the Vauxhall Road. The embankment of the Thames is also to be proceeded with.

The Glasgow and Ship Bank, at Glasgow, has been completed. Six emblematical statues, by Mr. Mossman, jun., occupy the pedestal. They are, Britannia, the City of Glasgow, Wealth, Justice, Peace and Industry; each seven feet high.

Hess, of Munich, the painter, has finished his grand painting of the Battle of the Borodino, or the Moskowa, for the Emperor Nicholas. It is looked upon as something grand in the great way.

The splendid gallery of Cardinal Hesch is at last to be sold, at Rome, and is the object of much attraction, from the value and intrinsic merit of the collection. It contains good specimens of nearly every school.

St. Stephen's, Coleman-street, has got a new altar window, of painted glass. It is well executed, but the subject is ill chosen, being Ruben's Descent from the Cross. All imitations of historical pictures are bad.

Barbarism is not, as some have surmised, a pure English quality. Even German artists go the length of destroying rival works, by stillettoing frescos in public places.

A triumphal arch is to be erected in the Ludwig Strasse, at Munich, by Von Gärtoer, the sculpture to be by Wagner.

The Commune of Hornu, near Brussels, intends to erect a church, the interior of which, it is said, will be entirely of iron.

It is announced that the British and Foreign Institute has now reached to nearly 1000 members. The Institute will, therefore, be opened on the 15th instant; the lectures and the *soirées* on the assembling of parliament. The literary department is to be under the direction of Mr. Buckingham; and besides the attractions of the reading-room and library, with the public journals of various countries, there will be engravings, pictures, and works of art and *vertu*, to be collected for the inspection of visitors, it is also intended to introduce occasional music, vocal and instrumental. It is determined also to divest these entertainments, as much as possible, of the formality of a public occasion, and make them resemble, in every particular, an evening party, conducted with all the ease of a private assemblage in the best circles. The hotel department, for which a separate mansion has been taken, will be under the direction of Mr. Whitmarsh.

Patent Bearings for Locomotives.—At the Liverpool Polytechnic Society, Mr. Dewrance (superintendent of the engine building department of the Liverpool and Manchester Railway) exhibited some very perfectly cast and beautiful specimens of the "*Patent Metallic Bearings, or Steps, for Locomotives,*" which had been found to be superior in practice to those previously used, and which, the metal being soft, considerably diminished the friction, by working more smoothly, while, at the same time, they lasted much longer than was anticipated. One engine had run with them a distance of 4,480 miles without requiring renewal or repair, and another (the identical bearings of which were produced) had run 1,000 miles, without additional giving or vibration. The substances for the part in which the axles worked, which he had combined in one instance, and found to be effective, were, six parts of tin, eight of antimony, and four of copper, forming (as we understood him) a solder. Mr. Dewrance also pointed out various plans of giving an equal supply of oil.

GLASS, WATER AND GAS MAINS.

(Translated for the Civil Engineer and Architect's Journal from the Bulletin du Musée de l'Industrie.)

The subject of glass mains is attracting some attention in France. Earthenware pipes have also been used on a small scale; they must not, however, be subjected to a pressure of two or three atmospheres, as the joints being difficult to lute, give way, whatever cement may be used. For luting, some gas companies have used Roman cement, but the gas escapes by imperceptible fissures at the joints, and they have been found so objectionable, on account of the frequent escapes and disturbance of the pavements for repairs, that the local authorities have objected to the use of earthenware mains in such situations. The glass mains, manufactured by Messrs. Bergeron of Rive de Gier, are luted with bitumen, and may be screwed together. The weight is about a third of that of cast iron, and the cost laid down about 7*s.* 6*d.* per yard run for a 4¼ in. bore. The process at present will not produce pipes of more than 8 in. bore. Of course, in England, with the low price of cast iron and the duty on glass, glass pipes are out of the question on economical grounds.

AGRICULTURAL CHEMISTRY.

Report of two Lectures delivered by Professor Brande, F.R.S., *to the members of the Royal Agricultural Association of England, at the Royal Institution, Albemarle-street, on Wednesday and Thursday the 6th and 7th December, 1843. (Specially reported for this Journal.)*

Lecture I.

In compliance with the request of your noble President, I have the honour to deliver to you two lectures upon subjects connected with agricultural history. The subjects which I have chosen are those of lime and clay; and I have fixed upon these for reasons which I shall presently describe to you more at length. I think you will agree with me that under existing circumstances, the union of practice with theory in the subject that is engaging our attention is more than ever desirable; and that the important bearings of chemical science upon agriculture become daily more and more evident. Why *chemical* science? Because experience teaches us that that sort of superficial knowledge which may enable a man to make rough analyses of soils, to discover their leading constituents, and to ascertain their relative proportions, is far from being sufficient to satisfy the demands which the scientific agriculturist thinks it right to make upon the practical chemist; much more than this must be expected from the chemist—information, indeed, which can only be furnished by the experienced analyst.

It was long ago shown by Sir Humphrey Davy, and the celebrated Liebig has proved more recently, that the fertility of a soil, as relates to the production of particular crops, may depend upon the presence, or absence, of very minute and almost imperceptible portions of inorganic substances—alkalis, for instance, and the salts of metals—substances which, a few years ago, were either entirely overlooked, or thought not worth looking after or mentioning if discovered; the necessity, for example, of sulphate of lime to clovers, silica to grasses, phosphorus to wheat, and so on, was quite disregarded. But now these matters are beginning to attract notice, and to open up new fields of chemical inquiry, which can only be successfully cultivated by the joint labour of the farmer and the chemist; hence every one interested in the welfare of chemistry—and what rightly constituted person is not so?—must see with unlimited satisfaction, and with a happy anticipation of the future, the good feeling that is beginning to dawn between practice and theory—between the agriculturist and the chemist. We are beginning to "scent the morning air," as it were, of a better order of things, and it is with great satisfaction that I myself see, that you, gentlemen, impressed with the importance of this union, have associated an eminent chemist with your body, and that many valuable papers are beginning to appear in your useful *Journal.*

Soils are made up of organic and inorganic constituents. We are now to confine ourselves to the latter, and these we class under two heads; first, those which constitute the bulk of the soil, and on the mechanical texture of which the growing crops depend, such as clay, sand, and lime; and secondly, those particular substances involving the fitness of a soil for particular crops, such as sulphate and phosphate of lime, soda, ammonia, magnesia, &c.

Lime is an article no doubt of great importance to agriculture, and some of its salts perform such important, though often obscure, functions, that I propose first to consider it, and then to call your attention to silicious and aluminous substances as existing in soils, which constitute clays.

First, I may ask, what is lime? The chemist will tell you it is a compound of a metal and oxygen, being what he calls a metallic oxide, consisting of 20 parts by weight of calcium and 8 of oxygen. I cannot show you this metal, calcium; but I can show you the counterpart of it. It has hitherto been obtained in very minute quantities. It is one of those extraordinary metals discovered by Sir Humphrey Davy which is most difficult to procure, in consequence of its high affinity for oxygen. The moment it is obtained and exposed to the air, it passes into lime. At the instant when deprived of oxygen, we see it as a brilliant metal, but the moment the air is admitted it passes into lime.

I will now show you, as its counterpart, the metal potassium, which is a white brilliant metal, resembling silver or lead in appearance, and distinguished by its strong affinity for oxygen, and by burning when put into water. If it is thrown into water, it will take fire, dissolve, and produce a solution of metallic oxide—so also with the metal calcium, the base of lime. There is another character belonging to this solution, which likewise belongs to lime, and that is, that it is what chemists call an alkali; and the test of an alkali is that it reddens blue litmus paper, and browns paper tinged with yellow.

Lime does not exist in a native state—small quantities have been found in some of the lakes of Tuscany, but it may be said not generally to exist in a native state. What then are its sources? The best known is carbonate of lime, which is very abundant, and which recommends itself especially as a source of lime, in consequence of the facility with which it admits of decomposition. Carbonic acid has a weak affinity for other bodies, and can therefore be easily got rid of. But I must stop here, to tell you that carbonic acid is a substance which combines with lime, and exists with lime in all its natural spars. It is composed of charcoal and oxygen. Lime, as was just told you, is composed of a metal and oxygen, and on the one hand we have a compound of oxygen and a metal producing an alkali, and on the other hand carbon and oxygen producing carbonic acid. (The learned Professor then proceeded to illustrate by experiment the formation of carbonic acid from carbon and oxygen, and for this purpose he inserted a piece of burning charcoal into a glass jar containing oxygen gas;) he then observed, there is charcoal introduced into oxygen gas burning vehemently—doing, in fact, what it does in the common air, where it burns by virtue of the oxygen which the air contains. If the charcoal be allowed to continue burning as long as it will, we shall find that a large quantity of it has disappeared; the oxygen has lost all its original qualities, has combined with the carbon, and become carbonic acid, and that acid combining with lime, produces, as before said, carbonate of lime. We here employed first, combustible metal, then charcoal, and then oxygen, and these are the ultimate elements of carbonate of lime; the proximate elements are carbonic acid and lime.

Now you must not forget that all we do here, and in fact all the bases of chemical combination, are bound down by the strictest laws of weight and measure; and though charcoal is burnt in oxygen without any reference to weight, it can only *combine* in certain weights. So also when the metal of lime is thrown into water, it burns, but requires a particular quantity to be combined with a particular quantity of oxygen to produce lime. Six parts of carbon added to 16 parts of oxygen produce 22 parts of carbonic acid; 20 parts of calcium added to 8 parts of oxygen produce 28 parts of lime; and thus 28 parts of lime added to 22 parts of carbonic acid will produce 50 parts of carbonate of lime.

Carbonate of lime constitutes in various forms mountains and hills and strata, covering immense distances; and it is common to speak of it as primary, secondary, and tertiary limestone, meaning that it occurs in those series of rocks considered generally under those terms, which may be explained as signifying the older, intermediate, and newer strata of our globe. There are a number of specimens of limestone upon the table, but I will only select a few to show you the distinct characters of each.

The primary or primative limestone, illustrated in marble of different kinds, more especially in the crystallized white marble of Carrara and the Alps, in statuary marble, and other varieties of limestone, has no organic remains, because it has been subjected to great fires and heat, in which it has been fused, and thus lost all traces of organic remains. In the secondary limestone we discover more or less of organic remains, and we may trace in some of them the aggregates of corals and other bodies. The Derbyshire spar is a specimen of this limestone. We now come to lime of the newest or tertiary strata, and here we can trace the remains forming at the present time. Shells are ground up and cemented in various ways, producing a variety of limestones.

In regard to chalk, it is right I should remind you that there are strata distinguished as chalk with, and chalk without, flints. One particular property of the latter is that mortar made of it hardens under water, and it is hence valuable as a hydraulic lime.

There are a number of varieties of carbonate of lime producing calcareous spars. Coral and shells, for instance, are made up of carbonate of lime. And I will now remind you, that to whatever source you go for carbonate of lime, it is composed of carbonic acid and lime. You may easily recognize calcareous stone by the test of its effervescing in acid; and if you take any kind of limestone, and pour upon it a weak acid, effervescence ensues arising from the escape of carbonic acid, and this may be taken as a test of the presence of carbonate of lime. In all cases, where we take common soil and see effervescence, it may be attributed to carbonate of lime.

The chemist goes from this to ascertain what quantity of carbonate of lime there may be in any soil which he may think it right to examine, and this is a simple operation. The following is the process:—Put into the pan of a balance, two flasks, one containing a previously weighed quantity of the soil, the other some muriatic acid, and counterpoise them. Then pour some of the acid on to the soil, so long as effervescence takes place from the escape of carbonic acid, which will, of course, leave that pan so much lighter. The weights which are requisite to be added to the pan containing the flasks to restore the equilibrium, will give the weight of carbonic acid that has escaped; and then, by adding 28 parts (for the lime) to every 22 parts of loss, you will ascertain the weight of the carbonate of lime originally present. (Or, what will do equally well, multiply the loss by 2·2727.)

There are a number of foreign matters occasionally associated with carbonate of lime, which were once entirely overlooked. These foreign matters are now frequently considered of great importance; whether they are of that immense importance which some seem to attach to them, is a matter for future experience to determine. True it is, however, that there are in limestones certain bituminous substances, as well as potassa, soda, magnesia, phosphate of lime, &c. Upon this latter, very great stress has been laid, and it has been considered a very important ingredient of the soil, especially in limestones. It is found in limestones certainly in very minute quantities, forming less than one per cent., but it must be remembered that if the soil contain only one grain in a pound of foreign matter, that when you multiply it by the quantity of soil in an acre of ground, it soon mounts up amazingly, so that the smallest quantity may be a matter of the utmost importance. The chalk about Brighton, upon being examined by Ehrenberg with a microscope, was found to consist of a multitude of animalculæ. This led us to look at phosphate of lime, which is always found associated with corals and relics of that kind as important. No doubt such chalk would form a very valuable manure, if we may allow the term, to chalk which does *not* contain phosphate of lime. We now now come to an important subject—the converting of limestone into lime—that is, how to get rid of the carbonic acid. And first, as to the characteristics of carbonic acid. If you collect it in the form of gas, as I have done, you will find it a very heavy gas, and it extinguishes flame. An instance of its weight may be seen by decanting a vessel of it into one containing atmospheric air, when you will find that it will displace the atmospheric air at the bottom of the jar. For this reason it collects in pits and wells, where it is known under the name of the choke damp. It is extraordinary, that if a person descends into a well containing it, he will be immediately suffocated; but if it is diluted to a certain extent he can then breathe it, and it acts as a narcotic poison—drowsiness comes on rapidly and he dies. But there are a number of gases which extinguish flame; we must not rest satisfied therefore that carbonic acid is the gas, unless you have this other test by lime water, which it will convert into carbonate of lime.

I have said, that carbonic acid and lime have but little affinity for each other; and now to get rid of the carbonic acid. You have seen that the acid drives it off by effervescence. But the common mode of getting rid of it consists in burning the limestone. If you take a quantity of chalk, suppose 50 cwt., and expose it in a proper kiln to the action of a proper heat, you will find that 22 cwt. goes off in the shape of carbonic acid, and that 28 cwt. remains, and this which remains is lime, known under the name of caustic or quick lime.

I will not go into the question of burning lime, but it is a very important one. It should be burnt in a current of air, and if damp, so much the better. You may take a piece of chalk, and put it into a close vessel and keep it hot for days, and yet not get rid of the carbonic acid; so that you see the affinity between carbonic acid and lime is not so feeble after all: but when you expose it to a current of air and moisture, their joint operation carries away the carbonic acid, and thus you may in a short time entirely divest the carbonate of lime of its acid. Now I nearly remember the time when it was thought that when you burnt lime the limestone absorbed the fire, and that that was the reason why lime was so hot. Now, we know, in consequence of Dr. Black's discoveries, that the mildness of chalk is owing to the presence of carbonic acid, and that the heat of lime is the consequence of its expulsion.

Lime is possessed of many important properties which fit it for agricultural purposes. One of which is, the changes it undergoes upon being exposed to the air. If you expose quicklime to the action of the air, it gradually crumbles down into a powder. In doing this it absorbs water from the atmosphere, and it also absorbs carbonic acid, so that lime, after being exposed to the air for a week is no longer quick lime, but part of it has become chalk, and part hydrate of lime, *i.e.* lime in connexion with water. The strong affinity which lime has for water makes chemists sometimes use it as a means of drying air. This strong affinity is best illustrated in the operation of slaking lime—that is, throwing water upon it. Here we have two kinds of lime, one contains a quantity of aluminous earth, the other is pure lime. If we pour water upon these, we shall find that the temperature begins to rise enormously, and that is a proof that chemical combination is taking place; and this occurs much more rapidly in what is termed "fat lime," than in "meagre lime." A great deal of heat is evolved in the operation—often enough to set fire to sulphur or matches. The lime then crumbles into a fine white powder, and this powder is slaked lime. Every 28 parts of lime combine with 9 of water; so that 37 parts of slaked lime are equivalent to 28 of quick or caustic lime.

Now having slaked the lime, if you expose it to the air it gradually absorbs carbonic acid, it parts with water, and ultimately passes back to the state of chalk. If to slaked lime you add excess of water, you will obtain a solution of lime called "lime water." About 700 parts of water are required to dissolve 1 part of lime; and from this you may obtain a notion of the strong alkaline power of lime, for this solution, though it contains only 1 part of lime in 700 of water, has a nauseous bitter taste, and by applying the common tests, it will be found to be a powerful alkali. Now if you expose this to the air it will become turbid, as lime water does if added to carbonic acid.

Carbonic acid is derived from various sources, amongst others from our lungs, and if I blow into lime water, you will see that the air from my lungs precipitates the carbonate of lime. Or if you take some air from a candle, you will find that that is pure carbonic acid. So if we go to a brewer's vat and collect the gas escaping in fermentation, that is carbonic acid. If you burn charcoal and oxygen you obtain carbonic acid. If you burn dung in oxygen you obtain carbonic acid. If you burn plumbago, or black lead, you get carbonic acid—that, therefore, is another carbon. If I take some spring water, and test it by lime water, I shall find carbonic acid there—it becomes turbid. In Thames water there is an immense quantity of carbonic acid. I do not point these out as so many isolated facts, having no particular bearing, for they have all their agricultural uses. Waters, in many instances, are important as containing carbonic acid, for water readily permeates the soil, and finds it way to the routs of plants. Air also contains a little carbonic acid, in the proportion of about 1 in 1000.

As regards the uses of lime, it may be stated, first, that its alkaline property makes it a powerful destroyer of worms. If mixed with dead leaves or turf it tends gradually to decompose them, and converts them into mould. Another property is, that it neutralizes acids. Another and most important property is, that it decomposes the salts of iron. Water containing a salt of iron does a vast deal of mischief to the soil it permeates. This will be corrected by lime. If to ferruginous water slaked lime be added, you will see it decompose, the iron is precipitated, and has become oxide of iron. Lime also decomposes aluminous compounds. It has also an important action upon animal matter. If a little quick lime be mixed with almost any animal matter, ammonia will be the result. If bone dust be added to quick lime, ammonia will be produced: there is, however, no ammonia in bone, and none in lime, but there are the elements of ammonia in bone. Another effect is that after ammonia has been formed, if there be certain substances in the soil the ammonia passes into nitric acid; and if it contains potass or soda, nitrate of potass or nitrate of soda is formed. It is probable that the lighter soils of India and America derive their fertility from ammonia. Here the elements of ammonia, mixed with air, produce nitrate of ammonia.

Felspar mixed with lime, and exposed to the action of water and air, reacts, and potass becomes evolved with a certain portion of silica. In this state it is thought particularly favourable to the growth of grasses and wheat, which require silica in connexion with potass. With regard to the general tests for lime, the one most commonly used by chemists is oxalic acid. There are other tests, but this is the best. If you take a precipitate of oxalate of lime and heat it, you can convert it into carbonate of lime; and thus you can come at the quantity of lime in any soil.

When lime has passed again into a state of chalk, it becomes a valuable ingredient in the soil. It is the same as broken limestone of another kind, but it has this advantage, that it crumbles down into an impalpable powder; and though you may mix ground limestone with the soil, it is never so effective as when it has been reduced from the state of quick lime to carbonate of lime by slaking, when it comes much more readily into contact with the roots of vegetables.

I will not go into this subject now, but I may say that roots of plants appear to be capable of secreting certain acids.

There are peculiarities derived from the presence of magnesia in certain limestones. When it exists in limestone, which is burnt into lime; such lime will remain caustic, and resist the action of the air and water for a long time. If mixed, therefore, with the soil, it will be found to retain its causticity long after the common lime has become inert. The presence of magnesia may be ascertained by applying nitric acid, which will not dissolve the magnesia. Some limestones contain argil, or clay; others, oxide of iron, and they derive certain peculiar properties from the presence of those substances.

The other salts of lime which claim the agriculturists attention, are the sulphate and phosphate of lime, of which I shall speak in the next lecture.

AGRICULTURAL CHEMISTRY.

Lecture II. By Professor Brande, F.R.S.

(Specially reported for this Journal.)

The history of lime and its salts, which we commenced in the preceding lecture, necessarily leads us to speak upon that important article, sulphate of lime, or gypsum, which is a compound of sulphuric acid and lime; and as I have called your attention to the ultimate elements of lime, so must I do with regard to sulphate of lime, which is to be regarded as containing the metallic base of lime, united with sulphur and oxygen. Sulphuric acid is a compound of sulphur and oxygen. Lime is a compound of calcium and oxygen; therefore, the ultimate components of sulphate of lime are sulphur, calcium, and oxygen.

Now I will proceed to build up this substance; and for this purpose I will first make sulphuric acid, which I do by burning sulphur in oxygen, as I previously made carbonic acid by burning carbon in oxygen. To burn the sulphur in this way it must be mixed with a small portion of nitre. In the atmosphere sulphur burns with a thin pale light, but when introduced into oxygen, it burns with a beautiful purple light, and produces sulphuric acid. If I take this substance, then, and add it to lime, I have sulphate of lime. The same substance may be obtained by using the sulphuric acid at once and lime, then you may see the immense affinity that exists between sulphuric acid and lime, and how much heat is evolved during the combination. In all cases their proportions are quite definite, and we have 40 parts of sulphuric acid always combining with 28 parts of lime.

Sulphate of lime is met with in a variety of forms, and is known under a variety of names. There is a variety met with in this country called anhydrous sulphate of lime, which is sulphate of lime minus a certain quantity of water. This substance is very difficult of solution in water, requiring about 350 parts of water to 1 for that purpose. It is often met with in the form of crystals, and is frequently found in digging wells about London in the blue clay; it is also pretty abundant in the clay at Shotover Hill, near Oxford, and elsewhere. It contains 68 parts of dry sulphate of lime, with about 18 parts of water. If a gentle heat be applied to this, the water goes off, and the substance crumbles down to what is well known as Plaster of Paris. If it is mixed with water it regains the water it had lost by the heat, and reproduces a crystallized or solid compound. It deserves notice, however, that if you overheat sulphate of lime it loses this property of re-combining with water, and you thus may destroy its property as a plastic stone.

Now you will find sulphate of lime diffused pretty generally through common spring water in the neighbourhood of London, and some of the shallow wells of London are almost concentrated solutions of gypsum. Its presence may be readily tested by oxalate of ammonia, which immediately renders water turbid which contains it. It is this which renders water hard, and unfit for mixing with soap. When organic matter of any kind comes into contact with sulphate of lime and water, there is a tendency to mutual decomposition, whereby the sulphuric acid loses its oxygen and becomes converted into sulphur, and then we have sulphuretted hydrogen very often evolved. It is not uncommon to find rivers of Africa and Asia which contain great quantities of sulphuretted hydrogen.

I have called your attention to the existence of sulphur in sulphate of lime, putting aside its secondary combination, sulphuric acid, because there are certain crops which contain not only sulphate of lime, but sulphur, in its peculiar and, comparatively speaking, free state, such as mustard, horse-radish, and other plants having their flavour.

The principal sources of sulphate of lime in this country are, first, the red marl and salt deposits. It is found in great quantities in the salt-pits of Cheshire; it abounds also in the Alps and other primitive rocks; and it is also met with in abundance in the tertiary strata in the neighbourhood of Paris, from which circumstance it derives the name of plaster of Paris.

With regard to the uses of sulphate of lime in agriculture, there can be little doubt that owing to its action it may be called the life of plants; for if we examine a plant, we shall find that it constitutes a considerable part of its texture. The notion of its attracting and retaining moisture is incorrect, as it does neither one nor the other, nor does it promote decomposition. It does, however, assist the growth of certain crops, and if we examine the ashes of them when burnt, we shall find sulphate of lime. It is found in the ashes of clover and trefoil; but not in any considerable quantity in those of wheat, barley, oats, beans, or peas. And it is found that to these crops sulphate of lime is of no use whatever, whereas it is a fertilizing manure to others. The fact is, that plants which do contain it never grow well on soils that are destitute of it, and this is found to be the case with other inorganic substances. Plants which contain carbonate of lime will not grow in a soil that does not contain it. There are many plants which contain salt, and they will not grow where it is not. Wheat must have phosphate of lime, because wheat possesses it, and so on.

It is stated upon good authority that an ordinary crop of clover requires from about 1½ to 2 cwt. of sulphate of lime per acre. And this proportion is recommended for use by those best versed in the subject. Of course it is of no use where the soil already contains it; and it is of importance in practical agriculture to ascertain what the soil does contain. If fields which once gave luxuriant crops of red clover no longer do so; if the young plants spring up soon, but die as the summer advances, it may be concluded, without any chemical analysis, that gypsum is wanted. There are other sources of gypsum amongst manures which are known. Peat ashes contain 12 or 14 per cent. of sulphate of lime, and it is also found in coal.

There is another statement with regard to gypsum, which we do not find borne out by experience—that is, its capability of fixing ammonia. We know that it is highly essential to vegetation. Anything, therefore, which would tend to fix it, and collect it, would be very valuable. Carbonate of ammonia is produced in stables and other places where animal matter is undergoing particular stages of decomposition, and though very injurious both to man and beast, it is a substance of great value as a manure. It has been said that sulphate of lime will fix this substance, and that if a stable be strewed with it, that purpose will be effected. But it does so very imperfectly. If I take sulphate of lime and add to it a solution of carbonate of ammonia, I shall find, after a time, that sulphate of ammonia will be formed, and that carbonate of lime will be thrown down; and it is stated that this change will take place when stable manure is mixed with sulphate of lime. We can do it in the laboratory, but it is a very doubtful process in the stable; and we should always take care that we do not apply particular experiments of the laboratory to practical general cases—the reasoning may be good, but the practice is bad.

Another salt of lime on which we must say a few words is, phosphate of lime. This substance occurs in considerable quantities in the bones of all animals, and it is quite clear that all the phosphate of lime in our bones must come from the soil. Plants contain it; so do animals, and we are constantly taking it in, in wheat, bread, &c. It consists of phosphoric acid and lime—and now we come to the production of phosphoric acid. That extraordinary substance phosphorus, which is a part of our bones and blood, and which is an essential part of that most important organ, the brain, exists in the vegetable world in the state of phosphoric acid. If we burn phosphorus in oxygen we have a brilliant combustion, and phosphoric acid is the result, and to this we have only to add lime to produce phosphate of lime, or what has been called bone earth. 28 parts of lime, 36 parts of phosphoric acid, and 18 of water, are the components of 78 parts of crystallized phosphate of lime.

How is the soil supplied with phosphate of lime? This is a question which has lately very much engaged the attention of agricultural chemists. In the first place, it derives it from artificial manures, from bones, and in bones you have an extraordinary compound. Bone is composed of an earthy part and an animal part. If we digest bone in acid we dissolve the earthy part and have the animal part remaining; and if we burn bone we destroy the animal part and leave the earthy part. We find that this earthy part of bone is indestructible, but the animal part undergoes decay; and if we examine bones that have been long exposed to the air, we find that they are comparatively light, and that a great deal of the animal part is gone. The animal part of bones may, however, be preserved for a long time, which is proved, by taking bones that have been long immured in caverns, where we find the animal part quite perfect. Dr. Buckland, indeed, out of some antediluvian bones made very good gravy and soup.

There is another very curious source of phosphate of lime, although it is one which has been over-rated as regards its quantity. This is a substance called the *coprolite*, which is the excrement of certain antediluvian animals who were so voracious that they fed on each other. They consequently ate a great quantity of bones, and their excrement is little more or less than phosphate of lime. This excrement does exist in some soils, but when Liebig tells us that here we have stores of phosphate of lime that are to suffice for all agricultural purposes, I think he goes on at rather too rapid a rate. The subject is, however, an important one, and any source of phosphate of lime that can be discovered is of great importance. Another source is *guano*, which is the excrement chiefly of birds, and it contains, amongst other things, a large quantity of phosphate of lime.

Phosphate of lime, as a mineral product, has been discovered in various places in this country. Some beautiful crystal specimens of it from Devonshire are on the table. It has been found also in Bohemia; and at Estramadura, in Spain, where Dr. Daubeny discovered considerable quantities of it almost in a pure state. How far it is available as a manure, is a question which I cannot go into now. It is also found in some marls, and in chalk, in oyster shells, corals, the crust of metals, and in clay-slate; or when I say phosphate of lime is found, it is in reality phosphate of alumina, which afterwards appears occasionally to form phosphate of lime.

Such is the importance attached to phosphate of lime by Liebig, that he considered it the most essential ingredient in the soil with reference to particular crops, and more especially wheat. There can be no doubt that, to a certain extent, this is the case, and a number of important questions arise as to the best mode of obtaining and applying it. The finer the state of division in which it can be applied the better, and, as bone dust is a fine substance, it is often used with advantage. When bone was first employed, it was imagined that it was only the animal part that was worth anything; the bones were therefore broken up, and as long as they emitted a disagreeable effluvium it was thought they were doing their duty. It was afterwards found that the earthy portion also did its part, which is by no means an unimportant one.

Phosphate of lime, instead of being applied as ground bone, should be dissolved and mixed with sulphuric acid, when it may be applied with considerable advantage. It may, perhaps, be said, that the acid might be fatal to the crop, but this is not the case, the soil, in all probability, contains lime, and the sulphuric acid acting on this, produces sulphate of lime, and you would thus procure sulphate of lime, and phosphate of lime, both of which are valuable substances. Some notion of the immense quantity of phosphate of lime contained in certain vegetables, may be gained by referring to the quantity contained in the bones of animals. In the intestines of horses, especially, we occasionally find large masses of phosphate of lime derived from the hay and oats which they consume.

I must now pass on to what should have been the exclusive subject of our meeting this evening, namely, the consideration of clays. This is a very important subject, but one which we can only attend to, on the present occasion, as regards the leading points connected with them. In the first place, we know that a great part of the surface of all countries consists of what is called clay. We also know that very different substances pass under this name; all, however, agree in containing one element which is peculiar to clays. This element used to be called argil or argillaceous earth, but it has lately been called alumina because one of the elements of alum. To obtain it you may take a common solution of alum, and then add an alkali, which will decompose the alum and produce a white flocculent precipitate, which is alumina. It is this which gives to clay its elasticity, and its retentiveness with regard to water. It is a substance which has a strong affinity for water, and if, therefore, we take the pains to collect this precipitate, and dry it, we shall find that it takes up a considerable quantity of water. This is one important property belonging to this part of clay.

Another important property is, that it has a strong affinity for vegetable matter; and now, when we talk of fixing elements in agriculture, we may say that aluminous earth fixes organic matter. Here is an experiment. You see a quantity of clear water with a brown precipitate at the bottom: this is merely an infusion of vegetable extract which has been mixed with aluminous earth. The aluminous earth has taken all the vegetable matter out of the water. Thus I fix organic matter; and if this would happen in the soil it would be very useful, as it would keep the organic matter in that position in which it would be most useful to the crops.

There are some chemical peculiarities belonging to this substance by which aluminous may be distinguished from other earths. If to the above precipitate I add soda or potass, or an acid, the precipitate will be re-dissolved; and I must tell you that alumina is soluble both in alkali and acid. Alumina is on the whole a very extraordinary substance.

Another component part of clay is silica. You are all acquainted with this substance in its pure form, as a beautiful mineral, rock crystal; it is also known as common flint, and is sometimes beautifully coloured, as in the amethyst. There are a great variety of rock crystals exhibiting themselves in different form. Chalcedony is another form of silica which must have been in solution; and we may infer that silica has been dissolved in water and has not been fused. Another form of silica is common sand, a substance which we frequently do not regard in all the important bearings which belong to it. But it is beautifully applied, as the boundary of the ocean, being insoluble in water, and well adapted to resist the influx of the waves; it is the only substance indeed that would be applicable to that purpose save hard rocks, for we all know the effect of the ocean upon soft rocks and banks of shingle. Besides being insoluble in water, sand cannot be solved in any common acids; it can, indeed, only be solved in one acid, and that is a very rare one. Now we see the difference between silica and alumina, the latter being soluble in all.

If we fuse a mixture of silica, potass, and soda, we obtain glass; if we increase the quantity of silica, we have glass not easily fusible; if we increase the quantity of soda, we get glass very fusible, and ultimately we may obtain it soluble in water. Now here I have that extraordinary substance flint in a soluble state, and if I considerably dilute it I shall have what the old chemists called "liquor of flints;" and I find now, if I add acid to it, that I can throw down the silica first in a gelatinous state; then if I use a stronger solution, I find that it will become as hard as flint.

As you will find that silica constitutes an essential ingredient in grasses and a great variety of plants, you can understand that it gets to them by being brought into a soluble state, principally by the action of an alkali.

With regard to the term clay, it is sometimes thought to be applied to pure alumina, but this does not exist in a native state, except in the sapphire and other magnificent gems, which are composed of it. Common clay contains a greater quantity of silica than alumina, yet it derives its leading properties from alumina. We find, for instance, that when a soil contains a great quantity of alumina, it is known under the name of "strong clay" or "stiff clay," and so on through the different varieties of loam, sands, &c.; as, for instance—

When in 100 parts of soil there are 10 of clay, it is termed sandy.
When from 10 to 40, sandy loam.
" 40 to 70, loam.
" 70 to 85, clay loam.
" 85 to 95, strong clay.
" 95 to 100, agricultural clay.

Clays also contain potass, soda, and sometimes phosphate of lime, and it is in consequence of the soda and potass which they contain that they become such important ingredients in the soil. We know how much the texture of the soil depends upon clays—that is mechanical; but their great chemical properties depend upon their power of retaining water, and their containing a certain quantity of potass and soda.

If clay contains a large quantity of potass and soda it contains a great agricultural treasure, and if we can get out these alkalis they become very valuable. The question, therefore, occurs, "How are we to ascertain if the soil does contain much alkali?" This is done easily by a common chemical process, which, however, I cannot go through here, because I cannot bring a furnace before you. I will, however, make use of electricity, to show you that there is alkaline matter in this clay. And I do it so:—I take some of this powdered clay—it contains some oxide of iron—and I place it upon this plate of platina, I now moisten it with a drop of water; and the question I wish to determine is, whether there is alkali in this clay, which I have washed so as to take all the soluble salts out of it; now I will make this part of the electric circuit—now I am decomposing it, and doing what I might do in a furnace by means of lime and other agents—and now you may see the development of alkali: here I should remark to you that electricity is a great chemical analyser, and resolves things into their elements in a wonderful way.

Amongst other peculiar properties belonging to clays, are the absorption of air, ammonia and nitric acid. Strong clay is used for a variety of useful purposes, and we have here a subject of great importance on which much might be said—draining, in which the application of clay for tiles, &c., is most convenient.

I have now concluded the task which your Lordship did me the honour to impose upon me. On all future occasions I shall be happy to assist your excellent society with any information which I may possess—and I need hardly say that this is a branch of science in which much remains to be effected.

At the conclusion of this and the preceding lecture, His Grace the Duke of Richmond, K.G., in a speech highly eulogistic of the abilities and kindness of the learned lecturer, proposed a vote of thanks to Professor Brande for the able and interesting address with which he had favoured the society. Philip Pusey, Esq., M.P., on each occasion seconded the votes, which were carried with acclamation.

THE TEMPLE OF MINERVA, OR THE PARTHENON, ATHENS

THE fine arts attained their greatest perfection in Greece during the period extending from the 80th to the 111th Olympiad, (*i. e.*) from the year 460, to the year 336 before Christ, which comprises the age of Pericles and Alexander; and to this period the most admirable masterpieces now in existence must undoubtedly be referred. Political events had long been preparing the way for this glorious advance. The Persian war, by the agitation it produced throughout the whole of Greece, had given an impulse and activity to the mind of men, which were the principal causes of this stupendous progress. Athens had been the grand theatre of the struggle, and consequently the operation of these causes was felt there in all its force. The successful issue of the war, by inflaming the nation, awakening it to a keen perception of its greatness, and inspiring it with a noble patriotic pride, raised its intellectual faculties still higher, and led to those astonishing improvements in art, particularly in Attica, which, as we learn from Herodotus (lib. v. cap. 78), began to appear in the fourth year of the 67th Olympiad.

Athens had the honour of producing Cimon and Pericles, at an epoch when its glory, power, and revenues, had reached their utmost limit.

[1] We are indebted to the conductors of the illustrated work on *Ancient and Modern Architecture*, published by Messrs. Didot, for permission to insert the above interesting paper. It will afford a favourable specimen of the manner in which the work is got up, and will, we hope, justify the high terms of approbation which we have felt it our duty to express in relation to this valuable work.—ED. C. E. & A. JOUR.

An abuse of power and breach of trust, which may perhaps appear venial in the eyes of the artist and antiquarian, who contemplate the beautiful specimens of art produced thereby, farther facilitated the execution of almost numberless monuments, which started up, as if by magic, to make ancient Athens the most wonderful city in the world, and a school for architects and sculptors through all succeeding ages.

The various states, when freed from the Persian rule, had formed a league to carry on the war against the great king; the chiefs of Attica were empowered to fix the contingent of each state; and, as proposed by Aristides, this contingent φορος, was at first very moderate, the total amount not exceeding 460 talents, or 100,000*l*. Such was the first contribution under the superintendence, 'Ηγεμονια of Athens. This treasure was originally deposited in the isle of Delos, inhabited by priests only, and secured from all danger of spoliation by its sacred character. Subsequently, when the power and ambition of Athens had increased, and a disposition to abuse them had sprung up, the tributes were augmented, and Athens ultimately succeeded in obtaining posession of the treasure, which, under Pericles, was raised to 1200 talents, and was, as we shall show hereafter, deposited in the opisthodome of the Temple of Minerva. This treasure was gradually increased by usurpations, and its guardians devoted the greater part of it, first to works of public utility, and afterwards to objects of art, or merely of luxury; a fact which explains the possibility of the immense works executed under the administrations of Cimon and Pericles. But, by thus flattering the national vanity in devoting the war subsidies to the embellishment of Athens, Pericles aroused the enmity of nearly all the other Grecian states, and prepared a reaction, which ended in the ruin of his country. A profound philosopher, a skilful orator, endowed with a mind bold in conception and fertile in expedients, with a noble and majestic exterior which had procured him the surname of 'Ολυμπιος, Pericles joined to these brilliant qualities an enlightened taste for the arts, of which he gave good proof in selecting Phidias to superintend all the works he caused to be executed. Of these works the most remarkable in every respect is the monument to which the present notice is devoted.

In the middle of the Acropolis, or citadel of Athens, stood a temple dedicated to Minerva, and called the Parthenon, either in homage to the chastity of the goddess, or because it had been consecrated to her by the daughters of Erechtheus, frequently designated by the name of Παρθένοι virgins (Hesychius). It was also called 'Εκατόμπεδον, on account of its extent, which was 100 feet in front, and not on every side, as some authors have supposed. We know that after Xerxes had ravaged the country of the Phocians, and vainly endeavoured to pillage the Temple of Delphi, he entered Attica, razed Athens to the ground, and destroyed all the temples by fire, without even excepting that of Minerva, which was the oldest in the city, and the most revered by the Athenians. Some traces of this last have been discovered recently. Among the ruins burnt in the 75th Olympiad (450 before Christ), have been discovered a number of tiles, antefixes of burnt clay, small bronzes, an immense quantity of lead pencils, which were no doubt used by the architects to draw on marble, and several colour-pots containing blue and red, which were used to paint certain parts of the architectural ornaments.

The new temple built by Pericles was placed on the highest point of the Acropolis, and is the first object that strikes the eye from whatever side Athens is approached, and is visible from the very entrance of the Gulf of Ægina. Under the direction of Phidias, the two cleverest architects of the day, Ictynus and Callicrates, were employed to erect the Parthenon.

The Parthenon subsisted many centuries almost uninjured; the Christians converted it into a church, and when the Turks became masters of Athens, either from indifference or forgetfulness, they left it untouched, except that some of the inhabitants occasionally carried away a piece of marble to make lime. Spon and Wheeler, during their stay in Attica, had the pleasure of seeing it entire in 1676. Not long after, Athens was besieged by the proveditor, Morosini, who was subsequently Doge, and Field-Marshal Count de Kœnigsmarck, a Swede, who commanded the Venetians, then at war with Turkey. The Turks had converted the Parthenon into a powder-magazine, which was fired by a bomb on the 28th September 1687, and the broken pavement still shows where the destructive missile fell. The explosion cut the temple into two parts, as it were; the whole eastern side of the cella, five columns of the portico, all the internal constructions of the cella, eight columns of the northern row of the peristyle, six of the southern, and all the sculptures belonging to these several parts of the edifice, were either shattered to atoms or thrown down. The eastern pediment, too, must have suffered considerably in its sculptures, though its architecture was not injured; but, to judge from the state of the ruins, it would appear that it had been seriously damaged previous to the event of 1687, probably at the time when it was converted into a Greek church. Morosini's desire to enrich his country with the spoils of this superb structure, contributed still more to its ruin: he determined on removing the statue of Minerva, with her car and horses, from the pediment; but owing to some awkwardness or inattention on the part of the workmen, these *chefs d'œuvres* were thrown down and broken into a thousand pieces.

The Parthenon is built entirely of white marble, dug out of Mount Pentelicus, in the immediate neighbourhood. The temple is Doric, octostylar, peripterous, and uncovered. Its length, measured on the top of the steps that support it, is 114 ft.; its width, 51 ft. The respective proportion of the two principal dimensions is very remarkable. The sides have seventeen columns, and the ends eight only,—less than half, an arrangement which seems to have been generally observed by the Greeks; we find it again in the Temple of Theseus, which has six columns at the ends and thirteen at the sides; and also in the temples of Pæstum. The Temple of Jupiter Olympius was in the same proportion, being, according to Pausanius, 95 ft. by 230 ft. The Romans made their temples much shorter.

The length of the cella outside, not including the pilasters that project at each end, is 78 ft. 6 in.; the width 35 ft. 2 in. The interior is divided into two parts, of unequal side; the largest is the temple, or ναος; the other, which was entered from the back front, was the opisthodome. The position of this temple with respect to the points of the compass, gave rise to an error which is not yet entirely removed, notwithstanding all that architects and antiquarians have written for that purpose. It was long believed that the front of the Parthenon, as is the case with most other temples, was turned towards the west, and in fact it is the western front that faces the entrance to the Acropolis by the propylea; but here lies the difficulty. It is at this end that we find the smaller division of the cella, which the partizans of the common custom have been pleased to call a vestibule, or πρoναος. But if we admit this, where shall we find the opisthodome, which all ancient authors are unanimous in placing in the back part of the temple? It must therefore be acknowledged that, contrary to the usual practice, the front was turned to the east, and we shall give further proofs of this when we come to speak of the sculptures on the pediments. Round the temple, as we have already said, there runs a peristyle composed of forty-six columns, eight on each front, and seventeen along the sides. We are indebted to Mr. Travers for one important remark: all the columns lean towards the interior of the temple, so that those at the angles have a double inclination, in order to oppose a greater force to the pressure of the edifice. The jointing of the blocks that form them is so well executed, that it requires close examination to discover it, the interstice being scarcely so thick as the finest thread; and the same perfection is observable throughout. The columns have no base, but stand upon three very high steps, which form a stylobate for the whole edifice. The height of the columns, including the capital, is 34 ft. 2 in.; their diameter is 3 ft.; those at the angles being rather larger, their diameter is nearly 1½ in. more.

The capital is very plain, and has no astragal, its place being supplied by an indenture which crosses the fluting without stopping it. The capital is joined to the shaft by four listels; the plinth has no talon; as that moulding would have had a paltry appearance in such a severe style of architecture. The total height of the capital is 2 ft. 2½ in.; *i. e.* 13 inches for the echines and listels, and 13½ in. for the plinth.

The columns are fluted with sharp edges throughout their whole height; but to make the fluting appear still deeper by the effect of light and shade, it is not cut in segments of a circle, which would have permitted the light to fall equally on every part of the concavity; but it is made flat at bottom, so that the sides, rising abruptly, cause a deeper shadow. This fluting does not, as in most Greek temples, run up directly, and at right angles, to the listels of the capital; it is more in the Roman style, except that in the Parthenon, instead of terminating, as in Roman architecture, by a semicircle, they end in a kind of elliptical arc.

The columns support an entablature 10 ft. 10½ in. in height, no less admirable for the beauty of the marble with which it is ornamented, than for the masculine character that prevails in its profiles. The face of the tryglyph is exactly perpendicular to that of the architrave, a rule which Leroy thinks was followed at Athens till the reign of Augustus, when the Greeks, and the Romans after them, began to deviate from it, in making the face of the tryglyph slope to the architrave. The height of the tryglyphs of the Parthenon is 4 ft. 4½ in., and their width 2 ft. 9¼ in. It will be observed that here, as in all Greek Doric temples, the angle of the frieze is flanked by a tryglyph, whereas the Romans left the corner plain, and placed the tryglyph perpendicularly over the axis of the column.

There is one very singular peculiarity, which Messrs. Fuente and

Travers observed, first in the Parthenon, and afterwards found in all Greek temples, which is, that the stylobate does not present a line perfectly horizontal, but a curve slightly convex. The entablature follows the same curve, and its face forms a concave line on each side of the edifice; so that the angles are not absolutely right angles, but slightly acute. These dispositions were evidently intended to add to the solidity of the temple, by making its several parts tend to the pyramidal form, and by opposing a greater resistance about the centre of the great lines to the pressure from within.

Mr. Woods, though he acknowledges that the fronts are perfect, thinks that the sides are inferior to those of the Temple of Theseus. "Why," asks he, "should a continued colonnade, crowned by an upright entablature, require more slender proportions than one supporting a pediment? I cannot tell; but such seems to be the fact. Yet, as in the Parthenon, the height of the columns is very nearly $5\frac{1}{2}\frac{1}{4}$ diameters; and in the Theseum the height is only $5\frac{1}{2}\frac{5}{7}$ diameters: the difference seems too small to produce any sensible effect: but the intercolumniations in the Parthenon are only equal to about $1\frac{2}{3}$ diameters, whilst in the Theseum they are $1\frac{5}{8}$ diameters; and to this greater space is doubtless owing the lighter appearance of the latter."

The portico is double on each front of the Parthenon: and the reader will perhaps be surprised to hear that the columns of the second row, raised on two steps, are of less diameter than those of the portico, and do not all correspond exactly with their axis. These irregularities, which the theory of the art will not admit, are not perceptible in the execution, and contribute, on the contrary, to the general effect. These smaller columns, appearing to converge to a central point of view, give the peristyle the appearance of being deeper than it really is: whereas, had these columns been of the same diameter as those in the front, from their not being like them enveloped in a flood of light, they would have appeared heavy and massive. Their height, including the capital, is 35 ft.; diameter, 2 ft. 8 in. The entire height of the capital is 1 ft. 9½ in., of which the plinth occupies 11¼ in., leaving 10¼ in. for the echinus and listels, which are only three in number. The fluting of the shaft is here executed in segments of a circle. The internal arrangements of the temple were nearly the same as those of the basilicas built by the Romans at a later period. Spon and Wheeler found three sides standing of the gallery, and which was composed of two rows of orders, containing twenty-two columns. These columns have been all thrown down and destroyed; but their plan has been drawn, and sufficient elements of the lower order have been found to ascertain their dimensions. The shaft was 15 ft. 6 in. in length, and 2 ft. in diameter. The capital, composed of a plinth, an echinus, and three listels, was 12½ in. in height; the architrave 1 ft. 6 in.; and the tryglyph, 1 ft. 7½ in.: the width of the intercolumniation was, from axis to axis, 8 ft. 2⅝ in. It is worthy of remark that these columns, for about one-third of their height from the bottom (5 ft. 3 in.) have only a flat fluting, as at Pompeii; the rest of the shaft only is cleared out. These columns formed a portico of 7 ft. 6½ in. in width, round the hypæthron or open part of the temple; the hypæthron was 16 ft. wide, which gives 31 ft. 2 in. for the inside width of the temple; its length was 49 ft. 2½ in.

The temple was lighted by the door and the opening in the centre of the roof. When the Christians consecrated it to their worship, they made a window in the eastern end, and built a semicircular sanctuary. The Turks made scarcely any alteration. This apsis is now demolished to within three or four feet of the ground. In the part of the temple under the opening, and near the bottom, stood the pedestal of the famous Minerva, of which we shall soon have to speak. Part of the base of this pedestal is still visible; it was 10 ft. 10 in. square.

In the back part of the temple was the opisthodome, so long supposed to be a vestibule preceding the temple itself. Its width is the same as that of the temple, and its length 21 ft. 6 in., or nearly one-third of the cella.

By some inexplicable error, Stuart, Chandler, and others, have represented, both in their text and plans, that the opisthodome was supported by six columns, placed in two rows: there never were but four. M. Brönsted has so given them in his plan, and the fact has been recently proved by Messrs. Leake and Travers. One of the columns having been broken, the Turks erected in its place a square pillar of masonry, which, as well as the three columns, is now demolished. The latter, according to Stuart, were of the same dimensions as those of the smaller order in the peristyle.

In the opisthodome, besides the money proceeding from the public revenues, and the contributions of the Grecian cities, 1000 talents were always kept in reserve to meet unforeseen expenses of the state. At the beginning of the first Peloponnesian war (432 A. C.), when the power of Athens was at its height, 6000 talents (£1,296,000), according to the Abbé Barthelemy, and 9700 talents (above £2,120,000), according to M. R. Rochette, were deposited in the opisthodome. The names of all the debtors of the state were inscribed there; they were called Ἐγγεγραμμενοι εν τη Ἀκροπολει, and after the payment of their debts, Εξ Ἀκροπολεως εξαληλιμμενοι. Private individuals were accustomed to deposit sums of money there which they were afraid to keep at home; it was also the repository for offerings made to the goddess, Ἀναθηματα, or votive offerings, and valuable spoils taken from the Persians, part of which was the throne with silver feet, on which Xerxes sat to witness the battle of Salamis. Other trophies, shields taken from the enemy during the Median war, were suspended on the architrave outside the temple, and alternated with bronze inscriptions, if we may judge by the marks of the nails which held them. The two guardians of the treasure deposited in the opisthodome of the Parthenon, were Jupiter Σωτηρ, and Plutus, the god of riches, represented with wings, and, by an exception peculiar to this god, not deprived of sight.

At the present day it is impossible to doubt that the Greeks made use of painting in the decoration of their architecture; the labours of Hitturf, Raoul-Rochette, Letronne, and Brönsted, combined with recent researches representing the Doric temples of Greece and Sicily, have removed all uncertainty on the subject, and given positive confirmation to the assertion of Vitruvius (lib. iv. chap. ii. § 2) respecting the blue wax, *cera cærulea*, which he states to be the usual colour for tryglyphs; the metopes appear to have been generally red. We know, from the testimony of ancient authors, that all celebrated sculptors had a skilful painter at command, whom they employed to paint their works; the names of several of these artists have reached our own times. "There was not in all Greece," says M. Brösted, "a single temple of architectural pretensions which was not more or less coloured—that is to say, painted so as to contribute to the effect and rich aspect of the monument by the harmonious colour of the symmetrical parts, and especially the upper parts of the structure. There were three different kinds of painting: 1. The colour was applied like common paint, without any illusive effect, merely to set off the architecture—that is to say, to give relief to the dull and monotonous colour of the stone. 2. The colour was used to produce an illusion in certain parts of the construction—that is, to give an effect of light and shade, of projection and depression on a plane surface; in a word, to produce real paintings, and consequently to dispense with sculpture. 3. Lastly, the colour was used as a finish for the mouldings. In this case, the application of the colours being altogether subordinate to the laws of polychromatic sculpture, did not belong to architecture, only in so far as these works were connected with it from their being an indispensable decoration."

We will now proceed to examine the admirable works with which Phidias enriched the Parthenon. Five grand pieces of sculpture made this edifice the wonder of wonders; they were, the two pediments, the metopes, the frieze of the cella, and the statue of Minerva.

According to Pausanias, the pediment αετος of the front, represented the *Birth of Minerva*, and the pediment of the back the *Dispute between Minerva and Neptune*. Now those who had seen the western pediment uninjured, if not in its details at least in its principal parts, before the explosion of 1687, without pretending to examine the sculptures minutely, all agreed that it was the *Birth of Minerva*, or rather her *Presentation by Jupiter to the Gods of Olympus*. Ollier de Nointel, ambassador from France in 1674, was of the same opinion, but the sketches which he caused to be taken of the already mutilated figures of this pediment were quoted to support a misapprehension that they were intended to remove. Stuart first pointed out the mistake, and asserted that the west front was the back front, and represented the dispute of Neptune and Minerva, while the east front presented the birth of the goddess. M. Quatremère de Quincy adopted this opinion, and made it the text of a learned dissertation, in answer to the contrary opinion maintained by M. Barbié du Bocage, in his Atlas of Anacharsis; M. Brönsted coincides with M. Quatremère. The east front is composed of about 24 figures, detached and in full length, more or less colossal; four of them were horses. Of these groups, of which there still remained a dozen figures entire when Carrey executed his drawings, only 12 or 13 fragments are now left, and they are in the British Museum.

The western pediment, which represented the *Dispute of Minerva and Neptune*, was composed, according to appearances, of the same number of figures and horses. Carrey made drawings on the spot of 22 figures; nothing now remains of them but five fragments preserved in the British Museum. Two figures placed in a corner, which were easily recognised as intended for Adrian and his wife Sabina, appeared to Spon, Wheeler, and Leroy, sufficient to authorize the assertion that these pediments had been restored under that emperor. But the very style of the sculptures proves this to be a mistake, and it is much more probable that, by a kind of flattery, of which there are numerous known instances, these heads were substituted for others in the times of the Romans; however, if we may believe Plutarch, the monuments reared by Pericles did not need restoration when he wrote his histories.

The second series of the sculptures of the Parthenon was composed of the metopes which decorated the frieze outside. These metopes were 4 ft. 4½ in. high, and 4 ft. 2 in. broad, those near the angles being rather narrower. Their height being greater than the width, shows that the architect intended to make them appear square, notwithstanding the projection of the band of the architrave. The figures were in higher relief than those of the inner frieze of the portico, because they were intended to be viewed from a greater distance. The metopes were 92 in number. Many of them had escaped the ravages of time and men, when Lord Elgin, during his embassy at Constantinople in 1801, unfortunately obtained a firman of the Turkish government, which authorized him *to erect scaffolding round the old temple of the idols, to take plaster casts of the ornaments and figures*, and also *to remove the stones containing inscriptions, as well as the statues still existing.* It is said that it cost Lord Elgin £74,000 to obtain all the beautiful fragments that it was possible to carry to London. This barbarous speculation, however, was far from being profitable to his Lordship, as the whole collection was purchased by the British Museum in 1816 for £35,000; and one of his most illustrious fellow-countrymen, Lord Byron, seeing his name engraved on the Parthenon, wrote underneath, *Quod non fecerunt Gothi, Scotus fecit.* It is nevertheless true that Lord Elgin has acquired a celebrity that Erostrates might have envied.

Very different was the conduct of the French ambassador, M. Choiseul Gouffier, who caused all the plaster-casts, now in the Museum of the Louvre, to be taken, and only brought away a single metope, which had long been detached. This is the metope that was purchased for the Royal Museum for the sum of 25,000 f. (£1,000) in 1818, after the death of M. de Choiseul.

Fourteen metopes still remain in their places. Some fragments have been found in clearing away the rubbish round the Parthenon, which operation was superintended by M. Pittakis; 16 metopes have been taken away, 15 of which are in London and one in Paris: the others have been destroyed by time, or the explosion of 1687, and the only traces left of them are in Carrey's drawings. The metopes of London and Paris all belong to the southern side, which was the least injured, and they represent episodes in the battle of the Centaurs and Lapithæ; but other subjects were treated in those which remain or have disappeared. The metopes of the Parthenon have been published several times, especially by Stuart, Legrand, and Brönsted.

The most considerable fragment of sculpture now remaining is a part of the frieze placed under the soffit or ceiling of the peripteron, about 10 ft. from the ground. This frieze is 4 ft. 8 in. high, and was originally 524 ft. in length. M. Brönsted estimates the number of figures it contained to be 320, the varied groups of which represented the procession of the grand quinquennial festival of the Panathenea. These sculptures were in very low relief, which was admirably calculated to allow them to be seen from below, without drawing back, as their position under a rather narrow portico absolutely required. Stuart and Revett sketched a considerable part of what existed in their time (1751—53). A fragment, containing seven figures, was removed by M. de Choiseul, and is now in the Louvre. Lord Elgin, in his turn, took down a length of about 250 ft., and carried it to London. In this frieze the harness of the horse was of metal, and the holes in the stone, made by the cramps that fastened it on, are still perceptible. The frieze has been published several times, wholly or in part, by the same authors that we have already quoted for the metopes.

We must now return to the great masterpiece of Phidias—the famous statue of Minerva, which stood in the sanctuary, and of which unfortunately we know nothing but what we can learn from the descriptions given in Greek and Latin authors. This statue, which, according to Pliny's statement, was 26 cubits high (35 ft.), including the pedestal perhaps, was made of gold and ivory, and the gold ornaments were equal in weight to 44 talents (£120,000). This statue was raised in the temple in the first year of the 87th Olympiad (A.C. 430). After being pillaged of the gold by the tyrant Lychares, who stripped off its golden mantle, and put on a cloth one, saying that it would keep the goddess warmer, it appears to have been finally destroyed by the Goths under the command of Alaric. Such was the temple which has been justly reckoned the masterpiece of architecture by both ancients and moderns.

ONE OF THE CRAFT.

A singularly blustering address has been issued by the new Editor of a contemporary journal, wherein, not content with vaunting of what he himself intends to do—and he certainly has a very large field for improvement before him—he gives his readers to understand that until now, when he has taken it up, "the periodical literature of architecture" has been marked not only by deficiency of talent, but also by "lowness of style, coarseness of diction, and a kind of *anything-arian* conscience." What the last expression may be levelled at, it is not very easy to guess, because, whether they be upon matters of fact, or on matters of taste and critical opinion, architectural topics do not touch upon moral or religious questions. Some, indeed, have thought proper to mix up a good deal both of *sanctimoniousness* and of religious party spirit—that, too, of the most intolerant kind, when they have handled the subject of ecclesiastical architecture, or have denounced the Grecian, Roman and Italian styles as Pagan and anti-Christian; but then they have not so much addressed themselves to professional and architectural readers properly so called, as they have sought to ingratiate themselves with their own particular sect or coterie.

We certainly were not before aware that the periodical literature of architecture was at all more open to the charge of looseness of principle than periodical literature generally, or even by many degrees so much so. At the same time, it must be allowed that a change has of late years come over architectural discussion and criticism; but it is both a natural and an advantageous one. It is but natural that a greatly extended circle of readers should have caused this species of literature to assume a more popular tone, and this in turn has helped to extend that circle still more. If, therefore, this is what is meant by the reproachful term "lowness of style," we can only say that it is to the full as good as the serving up stale truisms and namby-pamby remarks in inflated pomposity of verbiage. At all events it would seem that the offensiveness complained of is confined to diction and style, for had the matter also of such writing been considered poor, puerile, and absurd, that defect would have been dwelt upon more forcibly than the other.

Our contemporary is pleased to talk somewhat mysteriously of "scandal in the literature of architecture;" and no doubt there has been something of the kind, and, strange to say, it has most shown itself where it was least of all to be expected—in the publications of some professional writers who have aspersed nearly all their architectural brethren as a body, accusing them now of want of even ordinary talent, and now again of want of principle and honesty. To no one are the profession less obliged for what has been said of them, than to Messrs. Pugin, Gwilt, and Bartholomew—and to the last, perhaps, the least. However, from henceforth, we presume such scandals are to be put a stop to.

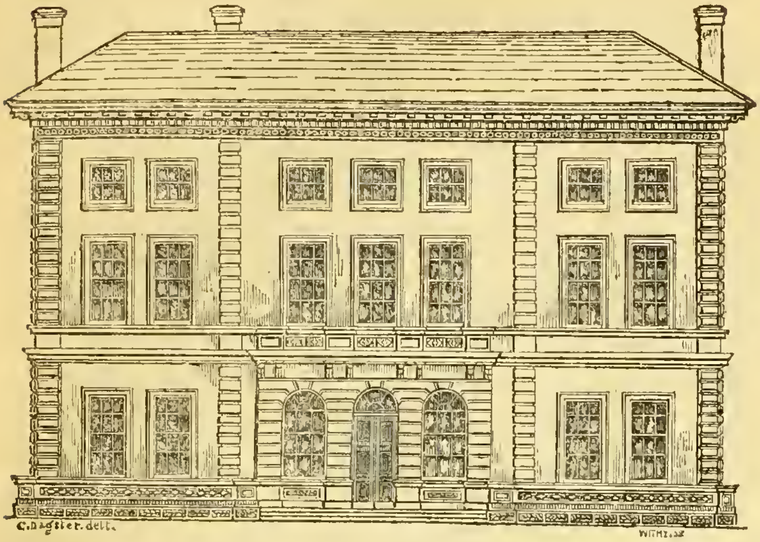
After no little bouncing, and some vapouring, too, about "the balance of justice hanging conspicuously over his columns," our contemporary takes up the submissive strain, imploring favours from authors and publishers, no doubt in order that they may be thrown into the said balance as "make-weight" on their side. It seems, therefore, after all, that his lofty independence may occasionally be jeoparded; and also that he trusts to the chapter of accidents, for being more fortunate than was his predecessor in obtaining the voluntary assistance of "high talent." However, he has shown himself discreet enough in one respect, since he has forborne complimenting that predecessor, or in any way referring to the past as satisfactory earnest for the future. His own style is by far more figurative than luminous; in fact, he sometimes wraps up his meaning in such very odd guise, that few will be able to make it out at all, for instance, where he talks of "baken-meats seasoned by a few gridirons!!" By "baken-meats," we suppose he means *pies;* but never before did we hear of "gridirons" being used as seasoning either for pies or anything else. Possibly this queer stuff may be intended as a specimen of "loftiness" of style; but then it soars so loftily that meaning is lost in the clouds. However, it is, at all events, funny and droll; and we therefore leave the "Swathed Horus"—as he chooses to call himself, "Infant of athletic promise," to do his doings as featly, and, above all, as "cleanly" as he can: only advising him to be more cautious for the future, and not to betray so much malevolence and arrogance towards all others who are engaged in the same cause as himself.

ROYAL ARSENAL, WOOLWICH.—Several powerful cranes are in progress of erection at this extensive department, made on the most approved principles, by Napier, the celebrated engineer. One capable of supporting 10 tons has been erected in the foundery, and the others on the wharf wall, for landing and embarking large guns shot and shells.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By Henry Fulton, M.D.

No. 5.



FEMALE TRAINING SCHOOL, TALBOT STREET, DUBLIN.
Scale 20 ft. to the inch.

The introduction of the Italian style is a novelty in the architecture of Ireland. It might be called the Farnese style, which as far as a bold unbroken cornice goes, is excellent. The edifice, of which a view is given, is newly finished; it is the design of Mr. Owen, the architect of the Board of Works, (the Woods and Forests of Ireland,) and does him considerable credit, and is intended for a model school. The unbroken cornice is very bold, perhaps a little too much so, as seen from immediately beneath; this is not the fault of the cornice, but of the site, as the building requires a larger space and wider street in front. I presume the architect was obliged to group the windows, and hence the necessity for the unmeaning tatooed pilasters which intervene. There is a kind of overlapping scale ornament, such as may be seen on the lately finished front of the London and Dublin Bank, in Dame Street, which would have had a better effect; and the tatooed quoins might also have been dispensed with.

Both on account of appearance and utility, it is desirable not to place chimneys at the ends of an edifice; any heat which is obtained from them might be serviceable in the centre, but here it is lost. The windows of the ground-floor might have had circular heads to make them correspond with the arches of the porch; still on the whole, we congratulate Mr. Owen on the production; and admire the omission of pediments and shoulders to the mouldings of the windows, an example of good taste which we hope to see followed.

II. In the last monthly number of this *Journal*, page 445, there is a very able article on the state of architecture; it goes at once to the root of the evil which impedes the progress of improvement. Were I a great potentate with plenary power, I would compel every architect in my dominions to read it; and if Mr. Gwilt were under my control, I would force him *nolens volens* to read it aloud in public: but alas, (for the nonce,) my authority is not so extensive, and I can only recommend its perusal.

The part of the paper I wish to call attention to, is that which treats of "the public and the profession," and the jealousy with which some, I am happy to say only *some*, of the latter (amongst whom Mr. Gwilt takes the lead) show in sneering at amateurs. I believe there is talent enough and taste enough, although it be latent in the profession to work out great things, and place the science where it ought to be, but where it is not, at the head of the fine arts; this will never be the case until such a pressure is applied from without as shall force the latent talent to show itself in practice; that is, until the public, who are the judges, shall be able to judge and require its development. If the public were well informed, I do not mean as to the mechanical part, but had their tastes and judgments improved and informed, would many of the edifices which have been erected in our day ever have had existence?

Sir William Chambers appears to have written his treatise in order to put down the "*gusto greco*" and give force in its stead to the *gusto Palladio*. Sir William was successful in his day, but his works shall not again be esteemed until the *gusto greco* shall again have been extinguished. I believe Mr. Hosking was the first to assert his want of faith in the infallibility of Palladio, and no disciple has come to the rescue. Even in Ireland, where Palladio reigned supreme, not a voice is now heard in his defence, although the Royal Institute of the architects of Ireland, in the inaugural address on the formation of the society, extolled the art as that which "Vitruvius taught and Palladio adorned," and we were even threatened with a course of lectures which were actually prepared, and were well known to be orations in praise of Palladio and his school, such as would have delighted Mr. Gwilt himself; but although these lectures and the drawings to illustrate them were all ready, they were not, and for aught I know, never will be delivered. The truth is, the star of Vincenza is on the wane.

III. Something must be done to raise up another and a better school. One naturally turns to the British Institute in expectation that they may be induced to do that *something*. Now, although I may come under the lash of Mr. Gwilt's pen, as "one of those idlers who had better mind their own business," yet I would wish in all humility, to give a few hints to the Institute on a subject of so much importance.

First, then, sue for a divorce from the Royal Academy, not indeed out of disrespect to the sister arts of painting and sculpture, or because you and I love them less, but because we love architecture more; and because the brilliant colouring of the one sister, and the poetic form of the other, quite throw the exhibition of architectural drawings into the shade, even if the hanging committee were disposed to give the best place in the rooms, and the consequence is, that few of the great body of the profession send drawings to the exhibition—few of those sent are exhibited—few of those exhibited are looked at—and still fewer are understood by the few who do see them. And, after all, although both Mr. Gwilt and myself might be able to see the beauty of an architectural drawing, and to realize in the mind's eye the effect which would be produced when constructed, yet many cannot, and others will not be at the trouble of giving it a thought at any time, and still less so when the eye is dazzled with the bright and varied hues of painting. I shall endeavour to point out a remedy for this in the third division.

Secondly, the Institute must get up an exhibition on their own account.

Thirdly, it is well known that the public in general are most profoundly ignorant of the nature of architectural drawings, and even of the subject itself, yet there is a method to teach them in spite of themselves, aye, and to instil into them a love of the art without their being aware of the why or the wherefore; it is by models, and when they fail the patient may be given up to the hopeless contemplation of such edifices as the palace at Whitehall, or the sentry box at the Horse-guards, or any other military post.

But of models, such as are to be desired, I have seen very few, and never a pleasing model of a modern edifice, nor indeed do I know any material out of which such a model can be formed, so as to give as good an idea of a perfect building as cork-wood does, of one which bears marks of the hand of time. I cannot speak of Sir John Soane's humbug collection, said to be given to the public, I mean humbug as far as the admission, or rather non-admission, of the public is concerned, for I never could get a peep at it. The models in cork which are in the Adelaide Gallery, in the Strand, are not well executed, nor do they appear to be on a scale. There is an artist at Rome, and another at Marseilles, who execute models of this description most beautifully, but they are worthless, except as toys, from being out of all due proportion, and as studies they would tend to corrupt, rather than improve, the taste. There is, or was some years ago, a collection of models in plaster to be seen in the Institute at Paris, but they are not worth the trouble of finding out the room in which they are kept. In the Museum at Naples there are some models in cork of part of the excavations at Pompeii, but as they are necessarily on a very small scale, they look more like toys than architectural works.

What I would propose is, that the British Institute of Architects should form a museum of models well executed, and all on the same scale, of all the buildings of antiquity of which we have accurate delineations, and also of all the modern ones of merit. As all the antiques are more or less dilapidated, cork-wood will answer admirably as a material: for the modern or restored works a premium should be offered for the discovery of a suitable material: or, perhaps, papier maché, to which the colour of Portland stone was given, might probably answer the purpose. The effect of wood painted is bad: the wood with which the Dutch, German, and Swiss toys are made would be much better, as it has something of the tone required. Such a collection, besides furnishing useful objects of study for the young architects, aye, and for the old ones too, would add to the interest of the annual exhibition of drawings, and tend with them to direct public taste into a proper channel.

By such means, and the aid of this independent *Journal, whose end is, to hold as 'twere the mirror up to art, to shew beauty her own feature, deformity her own image, and the very age and body of the time his form and pressure*, something may be done. The advantage of having an independent *Journal* as the reciprocal means of communication between the profession and the public is great, and I trust that the profession, so far from thinking themselves injured by contact with the public, may see that by having their own acquirements and the wants of the public reflected in such a mirror, they shall derive most benefit in proportion to the extent which the public may advance to in learning to form a correct judgment on the merits or demerits of an architectural design.

THOMSON'S TILTING APPARATUS FOR RAILWAY WAGONS.

For emptying Wagons at the termini of Railways, Shipping-places, &c., as used at the Magheramorne Lime-works, Ireland. By James Thomson, Esq., F.R.S.E., M.R.I.A., F.R.S.S.A., Civil Engineer, Glasgow. (Read before the Royal Scottish Society of Arts, the Honorary Silver Medal awarded, and reported in their Transactions.)

The apparatus may be generally described as consisting of three parts, viz.:—1st, The cast-iron brackets or quadrants for supporting the machine, *a a a*. 2d, The tilting-frame upon which the wagon is placed, *b b*. And, 3d, The malleable iron-swings for supporting the frame to the brackets, *c c*.

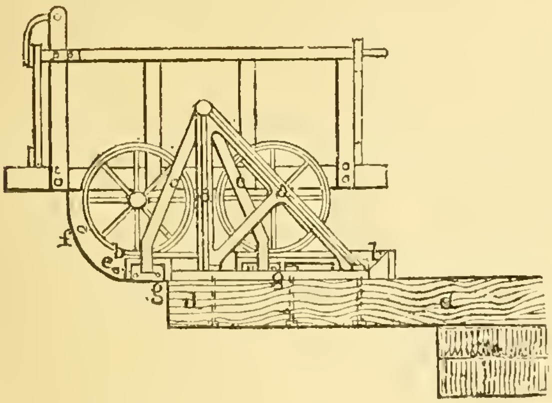


Fig. 1.

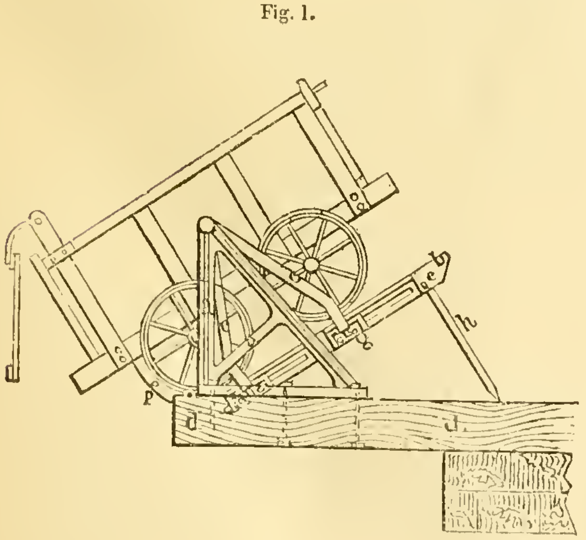


Fig. 2.

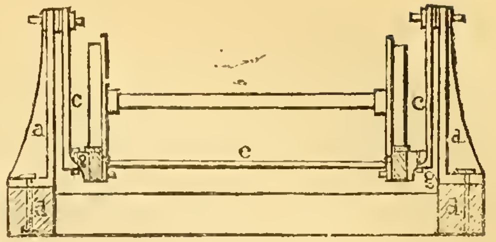
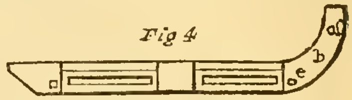


Fig. 3.

The supporting brackets *a a a*, are bolted to the wooden frame *d d*, of a moveable shipping platform, by means of which the apparatus is advanced at pleasure, and made to project beyond the wharf so as to discharge the wagon immediately over the hold of a vessel. The tilting-frame is formed of two cast-iron cheeks or sides, as shown in fig. 4, having in each two slots or grooves for attaching to the swings, and for adjustment of the apparatus. These sides of the



frame are connected together by two flat malleable iron-stays *e e*, as represented in fig. 3, with two bolts in each end, and a light round iron-stay *f*, at the curved ends. The swings are attached to the frame by means of snubs *g g*, which are bolted vertically to the lower ends of the swings, and horizontally to the sides of the frame, the bolts passing through the grooves or slots already mentioned, in which they are moveable—the upper ends of the swings work upon malleable iron journals fastened in the top of the cast-iron brackets. When the apparatus is properly adjusted (which is done by moving the tilting-frame forward or backward upon the swings by means of the adjusting slots), the wagon, on taking its position, should be so placed that its *centre of gravity may be slightly in advance of the point of suspension.*

The rails to the tilting-frame are laid with a gentle declivity, so that the wagon may be brought upon it with a slight impetus just sufficient to set the frame in motion—the wagon will then immediately fall into a position ready to discharge, as shown in fig. 2, when by a simple contrivance, which may be effected in various ways, the door of the wagon is opened from behind by a handle and connecting-rod communicating with the door latch, and the load discharged. While loaded, the position of the wagon will of itself remain the same, being in equilibrio; but immediately after it is discharged, and consequently the *centre of gravity thrown behind the point of suspension*, the tendency of the wagon is then to resume the horizontal position, which, however, it is prevented from doing, by means of the spur *h*, until completely emptied—the spur is then disengaged, and the wagon resumes its level position ready to be removed.

The whole operation of discharging a wagon (of whatever weight) is effected with perfect safety and facility in a few seconds, and one very important desideratum is supplied by this apparatus, viz.:—the practicability of *discharging wagons of different dimensions and different sized wheels upon the same tilting-frame.*

The advantages of the apparatus have been fully tested at the Magheramorne lime-works in Ireland, where they were first applied, and have since been in constant operation for the last three years, discharging wagons of three tons with 24-inch wheels, and wagons of only 20 cwt. and 20-inch wheels, with perfect facility and expedition —the cost of each apparatus not exceeding from 10*l.* to 11*l.* complete.

The Mersey and Irwell Navigation.—Late on Thursday, the 28th ult., or early on Friday morning, the lock on the river Irwell, at Barton, a little on this side of the place where the aqueduct on the Bridgewater canal is carried over the river, fell in. The lock is from 65 to 70 feet in length, and a great part of one side-wall near the top gate fell in, while about half the wall on the other side gave way. The top gate was entirely destroyed. The lock is an old one, and for the last two or three months has exhibited symptoms of giving way. The cause is said to be an unsafe foundation. The consequence of this accident, which fortunately was not attended with personal injury to any one, no vessel being in or near the lock at the time, will be the stoppage of the traffic on the navigation for a week or a fortnight. It is rather a curious circumstance that this should occur within three days of the time fixed for the transfer of the property in the entire navigation to Lord Francis Egerton, who, as we have already stated, is to take possession of the Mersey and Irwell Navigation on Monday the 1st of nuary.—*Manchester Guardian.*

AGRICULTURE AND ENGINEERING.

It has been well observed, that it is difficult to limit the range of professional studies, or the applications of professional knowledge. The ancients admitted this truth in all their pædagogic treatises. If Cicero and Quintilian laid down rules for the education of an orator, they urged the necessity for universal attainments, or a never ending pursuit of knowledge; if Vitruvius wished to produce a perfect architect, he laid down a category of studies and qualifications which men in these degenerate days would look at and fear to recognise. Without, however, requiring that a pleader should be a perfect mathematician, or an architect a good dancer and musician, we are not disinclined to recommend an ardent prosecution of study, and particularly of those sciences accessory to the practice of a profession, which widen the range of its application, and bring it in contact and harmony with other pursuits. We do not think the resident engineer of a railway the worse for being a good geologist, or the superintendent of an iron furnace for proficiency in chemisty; we believe, on the contrary, that they may find many useful occasions for the applications of such knowledge. It is with these views that we have looked with interest on the present position of agricultural science, the desire for a more efficient system of drainage, and the strong recommendations of a proper study of geology and chemistry; and here we pause and ask whether these are not circumstances which interest the engineer. Employed in the survey of an extensive estate, who so naturally would be the individual, not merely to ascertain its territorial limits but the nature and capabilities of its soils, subsoils, and mineral productions; to suggest the best system of drainage, of the supply of water, and of irrigation; to point out the best position for farm-steads, the most improved mode of construction, ventilation, and warming of the several buildings, the best means of preparing chemical manures, and the course to be adopted for the amelioration of the communications, means of conveyance, and implements; in fact, to make a report upon an estate and its capabilities.

When landowners come to consider what engineers have been already able to do for the improvement of estates, and of the country generally, we think there will be a natural disposition for their employment. All the great operations for the drainage of the country in the fens of Lincolnshire, Cambridgeshire, Bedfordshire, &c., have been executed under the direction of engineers, through whose means hundreds of thousands of acres have been rescued from the waste, and converted into corn-fields and pasture. Immense districts, moreover, have been reclaimed from the domains of the sea, or of rivers, by which the productive power of the country has been greatly increased. Such works as the embankment of the Nene, and others in the neighbourhood of the Wash, show what can be effected by well-conducted operations, and there are numbers and numbers of places on our coasts and on our river shores, where large additions might be made to the productive soil. Look at the estuaries on the Essex coast, the lagoons in the neighbourhood of Portsmouth, and on the Dorsetshire coast, the estuaries of the Dee, the Mersey, the Ribble, the Duddon, Morecambe Bay, and the Solway, not to speak of many equally favourable localities, but less known, and many of minor importance, but affording opportunities for profitable enterprise. All operations for the recovery of land, moreover must necessarily be attended with improvements of the drainage, of the water-courses, water communications, and places of shipment. The Lough Swilly and Lough Foyle embankments, now near complete, are very favourable examples of what may be done in the way of land recovery, and it is to be observed that in most cases land so recovered from the sea or from rivers is extremely productive, not being, as is vulgarly imagined, so much sand, but a fine alluvion. Partial engineering surveys of estates are common for mining purposes, but the greatest benefit would accrue from a general examination by well-informed engineers. The Dukes of Buccleuch and Sutherland, the Marquis of Bute, Earl of Burlington, and many other large proprietors avail themselves extensively of engineering science for the development of the capabilities of their estates, therein worthily following the example of the Great Duke of Bridgewater, for it is clear that the money spent under Brindley's direction in the improvement of the water communication, had of itself, at the same time, largely increased the mineral and agricultural value of the estates. The Duke of Buccleuch has laid out large sums on the improvement of the quarries and harbours on his estates, of which Granton pier is a splendid example. The Duke of Sutherland has for years been occupied in the systematic exploitation of his estates by the formation of adequate roads and harbours. The Marquis of Bute by his improvements at Cardiff, created a fine harbour, and immensely improved the value of his Welsh estates. In Inverness, the Earl of Burlington has for some years employed a gentleman of high scientific attainments, Mr. Jopling, the author of "Isometrical Perspective," as the superintendent of his slate and mineral works, who has greatly improved the roads and increased the produce of the property.

How many proprietors possess large estates, the resources of which are either unknown, or not adequately developed, where an improved road would bring a stone or slate quarry into work, where the finest brick or porcelain earth might be made available, where attention to the water courses would afford good mill sites, increase the produce of the estate by irrigation, improve its drainage, or perhaps, by very simple arrangements, convert a turbulent stream into a navigable river, enabling produce to be conveyed cheaply, and timber, materials, and manures to be introduced, and improving the access to markets. A simple bridge in a convenient place, may greatly facilitate communication between one farm and another, save time and labour of men and horses, and give better means for removing the produce. The deviation of roads, to avoid a hill or a vale, the most economical modes of constructing them all devolve on the engineer. In many cases the surface water is unfavourable to human or animal health, or insufficient for the uses of an establishment where the boring of an artesian-well may render the greatest benefit, and be the means of much pecuniary advantage. In fact, the opportunities are numerous in which a good engineering adviser can render important service to landed proprietors, and be the means of permanently improving his estates, and affording employment to the large numbers of the working classes dependent upon them, and for whom they may be unable to provide. In many cases where the means of improvement do not exist on the spot, the engineer will be able to find out in the neighbourhood, the course to be followed for adequate drainage, for improving the roads, or where the necessary mineral manures are to be found essential for the due development of an imperfect soil.

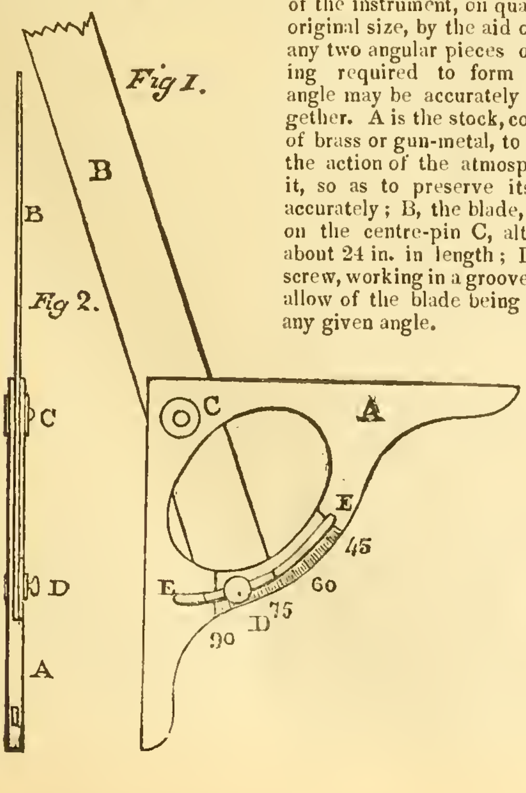
We believe, that in this respect, great scope exists, and it only wants the exertions of intelligent individuals to make this sphere of employment extensively available. While recommending this field of exertion, we must, at the same time observe, that a practical difficulty exists with regard to the uncertain nature of professional remuneration. It is too frequently the case that young members of the profession being called in, make charges after the rate of three, five, and seven guineas per day, being the charge of men in first-rate practice, a circumstance which has a material influence in deterring persons from calling in professional aid, or in inducing them, if they are to pay first rate fees, to make up their minds to have first-rate men, by which the junior practitioner is excluded. We would not in any way derogate from the dignity or adequate remuneration of the profession, but on every ground of propriety and policy we advocate moderate charges on the part of junior members. If experience be sought on the subject —what is the case with the bar and the medical profession?—the junior barrister gets a junior's fee, and works his way up to an independent practice. In the medical profession, however, there is a dignified scale of professional charges, on the guinea and half-guinea system, and every one who from professional standing cannot exact these charges, must submit to the derogatory and mischievous practice of sending in and charging medicines, or he must starve, or become an assistant for some years, which is much about the same thing; indeed, such is the mischievous system of remuneration in the medical profession, in consequence of young men not being allowed by etiquette to make moderate charges for visits, that a large part of the population are converted into medical paupers, as dispensary patients, &c., whereby we may fairly calculate that not less than a million a year is lost to the medical profession, being the sum which might be received from one million heads of families, small tradesmen, mechanics, and labourers. This sum would be adequate for the independent maintenance of five thousand junior medical men, and an efficient system would greatly raise the moral standard of the working classes, and get rid of the stain of medical pauperism, frequently the incipient stage of a demoralized career. Portrait painters have a wholesome system of political economy forced upon them, they know that it is of no use for John Scratchley to ask the terms of Sir Thomas Lawrence, but he must get up gradually as Sir Thomas Lawrence did. Lawrence, we believe, began at a shilling or half a crown; then his practice increased so much he was obliged to raise it to a crown, then half a guinea, a guinea, five guineas, till at last he did nothing under 250 guineas, and had more commissions than he could execute. People pay Sir William Follett a hundred guinea fee to induce him to give up a fifty guinea brief in their favour and such is the natural process, if a man be rising the public will raise his fees in the competition to ensure his assistance. We say again, then, let junior engineers, be moderate in their expectations, let them cultivate agricultural chemistry, geology of soils, and the practice of drainage, and there is a wide field open for their employment and exertion. At any rate we think we shall do good in directing attention this way, and we have, accordingly, not only made these few remarks, but in furtherance of the subject, published elsewhere the lectures by Professor Brande, on agricultural chemistry.

BEVELLING INSTRUMENT FOR JOINERS.

The Silver Isis Medal was presented to Mr. Thomas Quarm, 32, Wood Street, Princes Road, Lambeth, for *a Bevelling Instrument for Joiners.* (*Reported in the Transactions of the Society of Arts, London.*)

Mr. Quarm in his extensive practice in the finer parts of joinery, oft-times required a tool to answer the many purposes to which the one here explained may be applied. It will be found a valuable acquisition where any two angles when applied together are to form right angles. In a shop door the margins below the middle rail are at all times different from those above, which are required to form the sash. This causes the shoulder of the rail to be at a bevel, to meet the stile in the angle on the upper and lower edges of the rail, the angles on the reverse side of the door always varying to some extent; therefore, the angle of the shoulder would require to be different, as the case may require. By fixing the blade to the given angle, and by applying the reverse leg of the tool to the other piece, the line to cut to would be immediately given, so that, when applied together, they would be at right angles to each other as required, and, in the same way, the angles of the other side of the door would be given, therefore working with it with as much certainty as though the shoulders were square. Again, as all mitre squares hitherto constructed are subject to the change of atmosphere, and never correct, it would be a very unhandy tool if the blade were made of any length, answering only to one angle, if constructed with one leg only, however inaccurate the tool might be, the error would be increased two-fold when applied together. Both pieces would be fitted to the one leg in the present tool by moving the blade round to 45°, being so far as it will go; the fitting of one piece to one leg, and the other piece to the other leg, would, with certainty, form right angles when applied together; for, whatever might be the deficiency on the one side, would be made up on the other, if any. Again, by moving the blade in a straight line with the one leg, it will form right angles with the other, and may be used as a square in case of necessity. It will be found a very useful appendage to the drawing-board, to draw any given line to a certain angle required, without the assistance of a sector or scale; also as a bevel in isometrical and other perspective. The graduation beyond 45° is not continued, as any greater angle may be obtained on the reverse leg by going from right to left, instead of from left to right.

Description.—Fig. 1 shows a front view, and Fig. 2 a side view of the instrument, on quarter the original size, by the aid of which any two angular pieces of framing required to form a right angle may be accurately put together. A is the stock, composed of brass or gun-metal, to prevent the action of the atmosphere on it, so as to preserve its shape accurately; B, the blade, turning on the centre-pin C, altogether about 24 in. in length; D, a set screw, working in a groove E E, to allow of the blade being fixed at any given angle.



Fixed mitre-bevels, when made with one leg only, frequently vary from the angle of 45°, or half a right angle, so that when two pieces which have been set out by such a tool are applied together, their incorrectness is increased two-fold; whereas, in Mr. Quarm's tool, that difficulty is obviated by the use of the short end of the blade; for when the long end thereof is fixed at about 45°, whatever may be the variation in the angle set out by the longer portion of the blade, the two pieces when applied together will form a right angle. It will also be found accurate in setting out the shoulders of the diminished rail of sash-doors, and will likewise answer for a square, a common bevel, and a true mitre-bevel.

NEW ROMAN CATHOLIC CHURCH, "ST. GEORGE," AT LAMBETH.

This building, which is situated in Westminster bridge road, opposite the Blind Asylum and Bethlehem Hospital, is rapidly approaching completion. The foundation stone was laid in April, 1840, on which occasion the church was dedicated to St. George, the tutelar saint of England. It is the largest ecclesiastical edifice devoted to the Roman Catholic worship that has been constructed since the Reformation, when Henry VIII. destroyed and reduced the majority of the Catholic establishments. Its external dimensions are 250 ft. long by 84 ft. broad. The height of the tower at the west end at present is 60 ft., but when completed its extreme elevation will be 330 ft. above the ground level. The style of architecture throughout the building is the decorated Gothic. The tower is most substantially built with Caen stone dressings, its walls averaging nine feet in thickness. It contains a belfry with room for a peal of eight bells. On each side of the tower are double belfry windows, decorated with mitres, parapets, pinnacles, &c., and when funds shall admit, it is intended to ornament the walls with 100 statues of saints and martyrs. The tower will be surmounted by a steeple, built after the pattern of the magnificent spire of Salisbury Cathedral, and will be terminated by a large cross. The interior height of the church, from floor to ceiling, is 57 ft. The length of the nave in the clear is 160 ft., by 72 ft. broad; the chancel is 40 ft. long, by 26 ft broad. Over the entrance to the chancel is a richly carved oak screen, and a rood loft in the form of a cross, on each side of which will be placed statues of the blessed virgin and St. John. From either side of the rood loft ascends a spiral staircase, terminating externally in two turrets decorated with crockets, figures, and other ornamental work. Each turret is elevated 40 ft. above the ceiling. A carved stone pulpit will be placed at a short distance from the chancel screen. Adjoining the chancel, on each side, are two small chapels for altars, over which are to be placed stained glass windows. The chancel window is very large, measuring 30 ft. by 18 ft.; the mullions are of stone, with rich foliage; the interstices will be filled with stained glass of various colours, the subject is the root of Jesse, or genealogy of our Lord. It is the gift of the Earl of Shrewsbury, and will cost £500. Underneath will be placed the principal altar, which will be decorated with statues of saints and bishops. Another large window is placed in the tower opposite the chancel window, and is considered a fine specimen of the decorated style of architecture. The church contains in all 28 windows.

The roof is constructed of carved stained timber, which will be stencilled in various colours and devices. The mode in which the roof has been built is a modification of the manner anciently observed in the building of large edifices. Instead of covering the rafters of the ceiling with lath and plaster, to form a basis on which to construct the decorative work, as is usually done in modern buildings, the rafters themselves subserve ornamental purposes, by which means considerable expense is avoided, and beauty is combined with utility. The roof is supported by two rows of fluted stone pillars, consisting of eight in each row. The pillars are 18 ft. in height, and will be finished by capitals elaborately wrought in fine stone, carved in rich foliage, and connected one with another by small intercolumniations, in the form of arches, rising from the capitals to the rafters. The floor of the nave and aisles will be covered with red and blue Staffordshire tiles, each tile measuring six inches in the square. The chancel and side chapels are to be paved with encaustic tiles cast in different shapes and of various colours. At the south-west corner of the south aisle will be placed the large and richly ornamented baptismal font carved in Caen stone. The interior of the church is not obstructed by galleries; the only projections are the organ-loft and two small galleries for the choir over the two side doorways at the east end. No pews or closed seats will be allowed, but open benches will be placed down the aisles, constructed with low backs, so as to afford an unobstructed view of the interior. The seats will yield ample accommodation for 7,000 persons. The bare cost of erecting the building will be £20,000, but it is expected that a sum of £40,000 will be necessary to complete all the contemplated embellishments and improvements, including the tower and spire.

At the east end of the church is a large sacristy, and adjoining at the north east corner are cloisters, which connect the edifice with a presbytery, containing a spacious dining-room, and affording accommodation for several priests. Abutting on this is a convent for the Sisters of Mercy, and a school for 300 children. The convent is fitted up with kitchens, refectory, dormitories, a small chapel with a belfry, and will furnish an abode for 13 Sisters of Mercy; whose charity and kind offices will be distributed indiscriminately among the members of all religious denominations who may need assistance.

The convent, with its accompanying buildings, will cost £7,000. The architecture displayed in its construction is of a similar style to that used in the building of the church, only more subdued, and of a less expensive description. Several little turrets and spires are erected in various parts, which give it a very pleasing effect. The church and nunnery together stand upon an acre of ground, measuring 42,000 square feet. The entire edifice is built from the design of Mr. Pugin, and built by Mr. Myers, who, during the last ten years has been engaged in the construction of 37 churches.

The cathedral will be consecrated and opened for public worship in the autumn of the present year; but a considerable time must necessarily elapse before the great tower and spire shall be completed. The subscriptions towards this gigantic undertaking have, for the most part, been raised in the provinces through the exertions of the Rev. Mr. Doyle, who is the principal officiating priest. The Earl of Shrewsbury and the late Mr. Benjamin George Hodges have been the principal contributors. A considerable sum has also been subscribed by the poorer classes inhabiting the parish of St. George. The names of the King of Sardinia, the King of Bohemia, and other foreign potentates also figure largely in the list of contributors. A liberal donation is expected from Louis Philippe, who, during his stay in England, was a resident of St. George's parish. The Roman Catholic chapel in the London-road, as soon as the building is finished, will be converted into an hospital for the cure of cancer. The church is the largest structure in Great Britain that has been erected by voluntary subscriptions.

NOTES OF THE WEEK.

STRONG and urgent representations are being made to obtain a clear space at the east end of the Royal Exchange, efforts which we sincerely hope will succeed. If the houses on both sides of Finch-lane were removed, and those on the east side rebuilt as City offices, we believe no loss would be sustained by the corporation, while great public accommodation would be afforded. It would indeed be a shame that a public building of such importance should be spoiled for a trifle.

It is an item worth consideration in the progress of the age, that the lectures at the Royal Institution are to be considerably extended after Easter, so as to include a course on the Arts and Manufactures by Professor Cowper, and on Fresco and Decorative Painting, by Mr. Wilson, Director of the School of Design. It is by these compliances with the spirit of public improvement that the Royal Institution will maintain its high standing and achieve a position of permanent utility as a superior school of the useful and ornamental arts. The exertions to make it a school of scientific agriculture are equally commendable, but do not so properly come within the sphere of our observation.

The improvements at Eton College exhibit a commendable spirit of improvement, the attention to the sanatory arrangements is very laudable, inasmuch as it is very necessary. The drainage and ventilation are carefully looked to in all the arrangements, and a sanatorium for the sole use of the students has been established at Eton Wick, a mile off. Among the new buildings is a range of three large houses in the Elizabethan style, two of which are completed, opposite to the principal entrance of the college. A large hexagonal hall for a mathematical school and lectures is also nearly completed. The new lodge and gateway at the end of the Long Walk Wall is the subject of some criticism, but with its small octagon turret makes a handsome addition.

At Orleansville, in Algiers, a beautiful antique marble bust in fine preservation, has been discovered. Other excavations are going on there.

The bronze statue of Molière was this week placed on its marble pedestal on the fountain at the end of the Rue de Richelieu, at Paris.—The Council General of the Seine has determined on publishing the ancient works, manuscripts, accounts, &c., which it possesses relative to the customs of Paris, particularly the curious book of Trades of Boyleau.—M. Marochetti has just finished his equestrian statue of Napoleon. It is said that it will surpass all his former works.—The hotel Pontalba, next to the English Embassy, and one of the most magnificent private residences in Paris, has just been completed, it is by M. Visconti in the style of the interior court of the Louvre, constructed by Perrault.

A new hospital of 600 beds is to be erected at Paris, for the northern districts, in the Clos St. Lazare, the plans are by M. Gauthier.

The church of St. Severin, at Paris, one of the finest, is being completely restored, and in particular its curious tower. Some new sculpture is much admired, and particularly a Descent from the Cross. The new church of St. Vincent de Paul, at Paris, is making much progress, and will be completed by the 15th June. The whole of the external works are completed.

We are sorry to learn that the Hotel of the Minister of Foreign Affairs at Athens has been burned, and that an attempt was made to set fire to the Hall of the National Assembly, which fortunately did not succeed.

The postmasters on the Orleans, Rouen and Strasburg roads have sent in a complaint to the French ministry of the losses they have sustained from the railways, and the impossibility of carrying on their contracts. The ministry have promised them some relief in the ensuing session.

It is again reported that the Upper Silesian Railway is to be connected with the Austrian lines, and that the necessary arrangements have been made by the two governments.

In some excavations on the Augsburg and Donauwerth Railway works, a most interesting discovery has been made of tombs of the first four centuries of our era, belonging to the Celts, Romans and Germans.

A house has been built at Lyons in the Edinburgh style of twelve stories on the side of a hill. It is looked upon as a kind of giant.

A new church is to be built at Berlin, by voluntary contributions, in the Exercier Platz.

A new bath is to be erected at Bagneres de Luchon, by the town council, at a cost of £18,000. It is to be worthy of comparison with the buildings at the German Brunnen.

On the archæology of public monuments a course has been opened in the military school of St. Cyr. This might be well imitated in England, but we have nothing of the kind, not even in our Royal Academy of Arts.

INSTITUTION OF CIVIL ENGINEERS.—SESSION 1844.

January 9.—The PRESIDENT in the Chair.

THE first meeting of the season was held on Tuesday evening 9th instant. During the recess several alterations have been made in the rooms of the Society: along the sides of the gallery have been placed some handsome cast iron open work shelves, and brackets cast and presented by Messrs. Ransome and May of Ipswich, for supporting a series of busts of eminent engineers, and scientific men. The theatre which was formerly oppressively hot, and but dimly lighted, has now two gas lights placed near the ceiling which throw a powerful light into all parts of the room. The products of combustion are carried off by the open-jointed telescopic tubes which have been applied by Professor Faraday to lighthouse lanterns, and were described by him at a meeting of the Institution last year. This system of lighting and ventilation, which was, we understand designed by Mr. Manby, the secretary, appeared to be perfectly under control, and was very satisfactory in its effects.

The following papers were read.

1. By Mr. JOHN STOREY, descriptive of *a combination of Cast and Wrought Iron used in some Bridges on the line of the Bishop Auckland & Weardale Railway*. A general review of the usual construction and expense of occupation bridges of brick, stone, timber, and cast iron was given, showing their defects. In order to obviate these objections the author has introduced combined trussed beams of cast and wrought iron, which he contended might be advantageously adopted, and that bridges could be thus constructed at a less cost than those of stone, brick, or even of timber. The structure described consisted of longitudinal segmental girders of cast iron, resting on masonry abutments: a system of wrought iron tie trussing was applied, and struts were placed where requisite, to receive the pressure: when more than one principal truss was necessary, they were connected by transverse braces, and distance pieces of cast iron: sockets being cast upon the girders to receive the timber joists upon which Dantzic timber planking was spiked. The communication was accompanied by five drawings, illustrating in detail the various modes of construction treated of, with estimates of the expense as compared with ordinary bridges of similar spans, whence it appeared that the cost of the former was much less than that of the latter.

2. By CAPTAIN W. S. MOORSOM, Assoc. Inst. C.E., descriptive of *a Cast Iron Bridge over the Avon, near Tewkesbury, on the line of the Birmingham and Gloucester Railway*. The principal novelty of this work, which was proposed, and its execution superintended by Mr. Ward of Falmouth, is the mode of constructing the two piers, which were externally of cast iron in the form of caissons, each weighing about 28 tons; the plates composing each caisson were put together on a platform erected upon piles over the site of the pier, the bottom of the river being levelled by a scoop dredger, the caisson was lowered, and some clay being thrown around the exterior, a joint was formed so nearly water-tight, that two small pumps drained it in six hours. The foundation being thus excavated to the requisite depth, the caisson, which sank as the excavation proceeded, was filled with concrete and masonry; cap plates were then fixed for supporting eight pillars with an entablature, to which was attached one end of the segmental arches 57 ft. span, with a versed sine of 5 ft. 2 in. There were three of these arches, each formed of six ribs of cast iron, and two such piers as have been described, the land abutments being of stone-work joining the embankment of the railway. It was stated that this mode of construction was found to be more economical in that peculiar situation than the usual method of fixing timber coffer-dams, and building the piers within them; the total cost of the bridge being only £10,192, and the navigation of the river was not interrupted during the progress of the work. The paper was illustrated by eighteen remarkably well-executed drawings by Mr. Butterton.

3. A paper by Mr. G. W. HEMANS, Grad. Inst. C.E., descriptive of *a Wrought Iron Lattice Bridge erected across the line of the Dublin and Drogheda Railway* was then read. This bridge, which in construction is similar to the wooden lattice bridges of America,[1] only substituting wrought iron for timber, is situated about three miles from Dublin over an excavation of 36 feet in depth; its span is 84 feet in the clear, and the two lattice beams are set parallel to each other, resting at either end on plain stone

[1] [The original inventor of the lattice bridge, was the late Mr. Smart, of Westminster Bridge Wharf, Lambeth, who many years since took out letters patent for the principle.—EDITOR.]

abutments built in the slope. These beams are 10 ft. in depth, and are formed by a series of flat iron bars $2\frac{1}{2}$ in. wide by $\frac{3}{8}$ in. thick crossing one another at an angle of 45°; at 5 ft. 6 in. above the bottom edge, transverse bearers of angle iron are fixed similar to those now used for supporting the decks of iron steam vessels, and upon those the planking for the roadway is fastened. The account of the mode of construction, and of the raising and fixing the lattice beams, by Messrs. Perry of Dublin the contractors, was given in detail, and the author stated that, although it was expected that considerable deflection would occur, which was provided for by forming the beams with a curve of 12 in. in the centre, they did not sink at all even when heavy weights passed over them. The total cost of the structure, including the masonry of the abutments was £510. It was stated that this bridge had been erected by Mr. Macneill, M .Inst. C. E. in order to test the soundness of this kind of structure before he applied it in a bridge of 240 ft. span to carry the Dublin and Drogheda Railway over a canal.

The meeting adjourned to January 16th instant, when it was announced that the Annual Meeting would be held for the election of the council and officers.

ARCHITECTURE.

Report of a Course of Lectures delivered by Professor Cockerell, *at the Royal Academy.*

(Specially reported for this Journal.)

Lecture I.

Mr. President—The fine arts, whether they are regarded as an intellectual gratification intimately connected with mental advancement, or as the noblest recreation of which our nature is capable, should always be a subject of the highest importance amongst a polished and civilized community; and the Professor, however arduous and responsible his duties may be, will hail with satisfaction the returning season of his labours as a public and private benefit, so far as he may have it in his power, to illustrate his art by sound argument and profitable suggestions: and, as a true lover of his art, will rejoice in a candid discussion of its principles, regarding such discussion as a whetstone, whereby truth may be elicited and maintained. But the art especially which I so badly represent, demands, as a peculiarly learned art, the guidance of that experience which may point out the sources of its constitution, call into exercise the reasoning faculties, and engender a deep interest in its behalf.

Under the blessings of peace, architecture assumes peculiar interest. We may daily see the happy effects arising from the encouraging sentiment of emulation; expressions of regard for architecture have become almost universal; and we can scarcely look into the public prints without discovering some evidence of this fact; parliament for the first time has promoted such works, and has given a stimulus to them, which only patronage can give to the higher works of art.

The saying of the painter Barry, that he lived a century too soon, appears to be verified in the success which has crowned the exertions of his able successor in name; and the lambent flame which this academy has kept alive through good and evil report, seems now to shine forth with greater lustre. How great then should be our endeavours to qualify ourselves for this improved state of things!

The study of the fine arts is, as has been truly stated, the study of the "true and beautiful in nature." This science engaged the attention of Plato, Aristotle, Socrates, and the ancient philosophers; the fine arts have long been studied in the universities on the Continent; and it is now, I trust, becoming general in this country. The London University has already commenced; and Oxford and Cambridge will no doubt follow. An illustrious member of Oxford, (Mr. Gracewell,) in a remarkable paper published a few weeks ago, recommends a union between literature and the fine arts, and remarks that the fine arts being founded on the unchanging moral and intellectual nature of man, admit of being taught as dogmatically as the principles of any other science. In this respect they are unlike the useful arts; but when the useful arts have procured us the necessaries of life, the fine arts are found equally essential to enjoyment. Apollo and the Muses are only gifts to such a state of society, whilst they tend to check the progress of avarice, pride, and the other vices which follow in their train.

The arts will hail the proposition of Mr. Gracewell. Such a system, and in the hands of scholars, will go far to establish a respect for those branches of learning, and by thus uniting the elegancies of literature with those of art, each will illustrate the other; and by this means employment and amusement will be found for a large portion of society, who but for such a unity would regard the arts as toils.

The union of literature is obviously essential to the fine arts, and it has been ever so since the days of Socrates. The Grecian arts excelled through this circumstance. Many of Jocko's inventions were taken from the suggestions of the poet; so with Raphael and Reynolds and others, in whose works the suggestions of the poet may clearly be traced. Reynolds no doubt derived many ideas from conversation with Burke, Johnson, and other *literari* of the day. But whilst we leave to far more accomplished scholars the discussion of the fine arts, we have practical studies which we must endeavour to obtain and understand as the means of acquiring that greatest of all blessings, sound judgment.

We know, that like good taste and virtue, sound judgment depends not upon argument, syllogism, or sophistry, but must be cultivated by a beautiful and dispassionate revision of the best specimens of art. Philosophical discussions upon the sublime and beautiful will always be valuable as one of the means of instruction; but the subject is so subtle that it is not to be circumscribed by language, however logical. It is after all to genius we must look for the exact adjustment of those qualities on which the beautiful depend. The artist may lay down incontrovertibly his principles of art, but their adoption in particular proportions may not always succeed. To the practical student only belong the scruples and the grains of proportion, and it is in labour only combined with genius that the philosopher's stone is to be found by the artist. (The Professor here referred to some works of art by Palladio and Peruzzi, to show that where to apply the great principle of order was peculiarly the province of the man of genius, and was only to be decided by him.)

The speculative part of the fine arts, without the assistance of manual operation, can never attain perfection. Each department of art is of sufficient importance to occupy the whole attention of one man, but it is essential in an art where so many details are involved, that the student should occasionally be awakened to an enlarged view of the subject, and it is for this purpose that I have in former lectures taken extended views of the history of our art, and directed your attention to the magnitude of its extent; for to know what has been done, is to know what can be done. Charles V. said well that a man who possessed many languages, became, in fact, multiplied into many individuals, and enjoyed in an increased degree the privilege of existence. And the same remark might be applied to the architectural historian, whose experience teaches him the peculiarities of different nations, and points out to him the propriety or otherwise of peculiar applications to particular circumstances.

We are thus led to consider the practice of the fine arts, as but another language by which the moral and political subjects of the day are modelled and expressed: and as the literature and language of one period are not applicable to another age, so is it with the practice of the fine arts. For instance, imagine the republication of the *Nuremburg Chronicle* of 1492, as the journal of science of the present day; or of the works of Gore, Spenser or Chaucer, for the entertainment of the readers at the West-end of the present day. To follow the same principle in the fine arts would be equally preposterous.

When Edward III was engaged in his palace at Westminster, he granted a precept to—it might be the president of that day—compelling him to press all the painters throughout the country to go and assist at 1*d.* a day. Now let us suppose an officer despatched by Her Majesty on a similar expedition—to procure painters at 1*d.* a day; what an amusing exhibition should we not have! What complaints! What paragraphs in the newspapers! What petitions to the Commons House of Parliament! Thus we find the practice ever varying, though the principles remain the same. We admire the works of Chaucer, Gore, and Spenser, but it is the intrinsic beauty of their poetry that we admire, and not the language in which it is dressed: so we should be as glad to receive a commission now as in King Edward's time, but it is the compulsion at 1*d.* a day that we should not like.

I have also in preceding lectures recommended the study of those repertories of the experiments of past ages, which whilst they improved the understanding, proved the consistency of those great principles on which our art is built. Through the means of literature we may discuss the utility of popular conceits, and we thus arrive at those things that have received the praise of succeeding ages. When we consider, for instance, that Vitruvius composed his rules upon the science of the Greeks, good sense would seem to inculcate a respect to such rules; but such respect has not been awarded to them: for myself, however, I can only say, that my daily experience enforces upon me the greatest respect for his authority.

The Pantheon at Rome is a systyle; now M. Souplot has presumed to depart from the practice, and has made his portico merely diastyle, and the consequence of this startling diversion is, that the portico is meagre and unsatisfactory. I cite this instance only as proving my position, that respect should be paid to the theories and precepts of great masters if they are found to coincide with common sense and good practice.

Last year, when the Parthenon was cleared of the ruins, and some of the columns were exposed, it was found that there was a gradual rising of the columns of the central flank, so that the flank formed the arc of a large circle, and not a straight line from east to west. And this is in accordance with the principles laid down by Vitruvius, for, he says, if they be set out level they will appear to have sunk. This rule, however, has not been followed out at the important national work of the church of La Madeleine at Paris, and elsewhere. Let us inquire now of experienced builders, and we shall find 500 who know not so much as the name of Vitruvius, who will tell you when you build a barn, "be sure to make the roof hog-backed, for if you set it out level, it will look as if it had fallen." So says Mr. Harvey, a most respectable builder of Ipswich, and indeed I have heard it from my youth upwards; and thus we find that theory and experience agree. The professor in every art, is well justified in repeating to his students, the advice he has given to them to follow the principles and precepts of great masters without hesitation; if the practice appear strange, still, hesitate not; when you have tested the principles by practice, you will find their advantage, and will learn from time the reverence they deserve.

In enforcing this principle, Pope beautifully observes:—

"You then whose judgment the right course would steer,
Know well each ancients' proper character;
His fable, subjects, scope in ev'ry page,
Religion, country, genius of his age."
"Thence form your judgment, thence your maxims bring,
And trace the Muses upwards to their spring."
"When first young Maro in his boundless mind,
A work to outlast immortal Rome design'd,
Perhaps he seem'd above the city's law,
And but from nature's fountains seem'd to draw:
But when t' examine ev'ry part he came,
Nature and Homer, were, he found, the same;
Convinc'd, amaz'd, he checks the bold design,
And rules as strict his labour'd work confine,
As if the Stagirite o'er-look'd each line.
Learn hence for ancient rules a just esteem,
To copy Nature, is to copy them."

By literature then, the student will discover the consistency of great principles in art, and the conformity evinced by all the best authorities, whilst he will detect the fallacies of many pretenders, and the filchings and borrowings of ambitious authors.

In my last course, I invited you to consider this matter attentively, and, above all, I enjoined you to avail yourselves of every opportunity of seeking the best works, and of recording your opinion of them, always under the conviction that success must depend upon yourselves. I have referred to those preceding lectures: 1st. Because they apply only to the practice of the fine arts as they present themselves to the eye and the understanding, in which department these studies are essential. 2nd. Because the mathematical principles of an art form but a part of our consideration, and 3rd. Because the limitation of these lectures prevents our going over those grounds again, and requires that we should take a new line every year to fill up the measure of their utility. But I must remind you that though the lectures of this institution are unavoidably limited, that deficiency is greatly diminished by the liberality of other institutions. I refer more particularly to the London University and King's College, where the accomplished Professors give lectures almost weekly upon all the arts and sciences. You must be led to practice these arts before experience can be gained. Genius is a gift; and invention, nature only can bestow on us; but, be it remembered, that taste is the offspring of learning and a just education, and is always more or less within our power.

Let us now consider for a moment the present state of our art, and what is going on in this country. The actual state of architectural taste in Europe is remarkable. Since the revival of learning in the 15th century, the supremacy of Greece and Rome was readily admitted. Dryden and Pope had promulgated those laws which were regarded as the standard of good taste, all seemed settled, and no one ventured to doubt the prevailing sentiments, and the pursuit of taste in the best circles had acquired the utmost popularity. This was sustained by the writers of the middle and last century, but gradually lost its ascendancy before the great convulsions and political struggles which disturbed the empire at the end of the last century. Universal scepticism was raised upon all heretofore received doctrines; the test of reason was applied to every pursuit, and some artists whose critical works have had an effect upon our art, applied the doctrines of Bentham and the utilitarians. M. Duront, a respectable lecturer for many years at the Polytechnic Institution at Paris, refers all the problems of architecture to utility. He says there are no absurd rules of proportion that can be generally applied, because every building must differ in its wants; all features of which the use is not apparent, he proscribes. He abandons the base of a column as superfluous, when a column is built upon a column; for says he "has it not been proved that the base is not necessary for strength;" he proscribes all ornament in the structure, and recommends nothing that is not required to produce convenience, solidity, salubrity, regularity, and simplicity. Such were the doctrines that affected our art, as well as the political and social world during those years, which brought us to that startling simplicity from which we have now happily revolted. Heresies and latitudinarian views are as dangerous as the utilitarian doctrines. The student doubts if there be any fixed principles, and sighs for something which may satisfy that inborn desire of the mind for some standard of excellence to which he may refer.

It was extremely natural, on the recovery of Europe from the desolation of war in 1814, that we should deplore our sad departure from the rules of the fine arts, which were formerly in general acceptation. Long unused to that refined criticism, which experience can only arrive at, no wonder that we should fail to distinguish the good from the bad in former models, and should seize all that was presented to us. Like the youthful appetite, which swallows voraciously whatever has the semblance of nourishment, the artistic mind of Europe, during the last 30 years, has been wholly occupied in digesting those materials, and there is scarcely a school which has not been canvassed, criticised, and reproduced. This is on the wane, and Europe's mind is bent on asserting its own right to think and act for itself. To study departed excellence too intimately only extinguishes natural genius, and we become copyists, sinking under the errors of those we copy. We become mannerists instead of originalists. If there be no originality there can be no improvement; if no deviation from existing models, there can be no progression: whilst, to be original, is to escape from bondage, and at least to acquire the possibility of being superior. To these reflections may follow the inquiry, "But if we cease to follow existing models, how shall we find that exceeding skill which we do find?" This is a question I cannot pretend to answer, other than by saying that when you have a work to invent, you should put away all former notions; be animated only by the wants and requirements of the building, the materials to be procured, and the *genus loci*. Then let your invention proceed upon a natural view of these elements, without servility to any existing model.

Pedantry and ignorance are the two great enemies to the progress of our work. The pedantry of this age in architecture, arises from a small idea of the importance of the art itself. It has not been deemed of that essential importance to the character of the state, in which it was formerly held. Before the all-engrossing importance of war, or other vast operations affecting society, pedantry takes flight.

We must qualify ourselves for our profession by study and experience. These courses once gone through, we must exercise our own genius. The great captain of our day has no doubt studied every military tactic from Sesostris to Vaubau, but he never for a moment thought of resorting to any of those tactics in the achievement of his glorious victories; his only thought was how to suit his means to the necessity, his materials to the case, and the *genus loci*—and then his operations proceeded.

On his side, your Professor has felt all the importance of his duty, in the deep conviction that, however humble the seed he may sow in good soil, it may grow into a great tree, whose branches may extend to distant lands. He must bear in mind that he is acting amongst the richest and most powerful people in the world; that England's sons cover not only this land, but the continents of America and Asia, with their works, which do homage to the superior education and skill of Britain. Often we may see the most magnificent works in those countries raised from some office in this metropolis—some individual who may have derived his instruction from Sir John Soane or Peter Nicholson, and have carried his experience, and the superior learning of this country, into the presence of the autocrats and potentates of foreign countries; thus verifying the words of the prophet, "Seest thou a man who delighteth in business, he shall stand before kings." England, indeed, is like a great hive, from which the bees swarm, and carry honey into other lands. Two remarkable instances occur to me of this fact. Mr. Ladrone, a pupil of my father's, sent me, some years ago, the plans of the capitol of Washington, which was built by him. M. Montferron, at that time a young man of no repute in Paris, is now architect to the Emperor of Russia, and is engaged in building the church of St. Isaac. This is a magnificent structure; the section of the portico is like St. Paul's, but it is made of iron, and is contracted for by Mr. Baird.

Your Professor, then, considering the great importance of his duties in this respect, must omit nothing which his own, or the experience of others, has taught him. To interest you, therefore, he endeavours to acquaint himself with the movements in those nations which are before us in the fine arts. It is on this account that he visited our neighbours in Paris last year, and those on the Rhine this year, because, with the nature of their habits, they are more addicted to follow the fine arts than ourselves. With the blessing of peace greater public works have been accomplished there than here, and there the most liberal patronage is bestowed upon all the followers of the fine arts, whilst this country labours under the incubus of a national debt.

I purpose, in the present course, to direct your attention to the fashionable architecture of the day, and to refer to the much discussed subject of church building. These fashionable buildings in a country arise from many remote causes, which it is difficult to recognize—such as the moral condition of the people, their habits and government, the poetical vein of thought which prevails, politics, religion, &c. And the fashions change greatly with the age. When I first entered the profession, the Egyptian architecture was esteemed the most beautiful. We are not so susceptible of *mode* here, as our Gallic neighbours; but in France there was not a chimney of that day that was not covered with hieroglyphics, or shaped like a mummy. After that the Indian architecture prevailed, and George IV. adopted it in his pavilion at Brighton. And so on.

Such fashions will ever prevail, and certain deference must be paid to them, but in this fashion, as in dress, the weakest will take the extremes, whilst the prudent will only show a certain degree of conformity to it. I would suggest to the students that it is always necessary to refer to what may be called the tributary streams of art, for aid and assistance—especially to our Universities. The example of the accomplished Master of Trinity College, Cambridge, has been followed by a society not inferior in zeal, and it has taken the science of church building under its especial protection, on which subject it promulgates laws from head-quarters with the greatest confidence; and we can have no stronger proof of the favour in which our art is held, than the success which has marked the progress of the Camden Society. These gentlemen have limited their views to one style of architecture, and admit none other worthy to be used in a Christian church. They shut out all the rest of the world from their privileges, and adopt the architecture of the 13th century as the best adapted to this holy subject of church building. We admire the singleness of these gentlemen, so far as it goes, and shall endeavour to revive this subject in order to give a fair view of the matter, but not for the purpose of retaliating on those gentlemen terms which have already driven from the society the Bishop of London, the Bishop of Armagh, Professor Willis, Professor Sedgwick, the Master of Trinity, and others; and the students will find in this renunciation of the doctrines of the Camden Society, the danger of relying on such authority.

ARCHITECTURE.

Lecture II. By Professor Cockerell.

(Specially reported for this Journal.)

The Professor, who intimated in his last lecture that it was his intention to refer more particularly to church architecture commenced by remarking that the intimate connexion of religion with their art, threw, as it were, a veil of sanctity over all their proceedings. The most illustrious professors of the art were remarkable for their piety; they were wont to have solemn masses, and to offer up prayers upon the commencement of any great undertaking. "Unless the Lord build the house," said they, "we labour but in vain." That Sir Christopher Wren was fully conscious of the sanctity of the undertaking in which he was engaged when building St. Paul's Cathedral, was clearly evinced by an order which he had exhibited over the building, prohibiting the use of oaths amongst the workmen upon pain of instant dismissal. It was indeed a fact, that whilst an acquaintance with many branches of learning induced to scepticism, the study of the true and beautiful led to piety.

It had unfortunately happened that hitherto we had had no original style of architecture suited to the ritual and formularies of the Protestant church. In the 16th century our churches were made copies of the then existing Popish churches, and these forms had been perpetuated up to this very day. The time, however, would shortly come when Protestant churches should have a style of their own more suited to their worship, and more lovely than the mother whence they sprung. "*Mater pulchra, filia pulchrior.*"

The commissioners appointed in the reign of Queen Anne to inquire into the matter of church architecture had succeeded in leaving some beautiful specimens of their taste, but they spent upon eleven churches what was meant to serve fifty, and otherwise did not perform their duty as could have been wished. Such an enormous outlay and such a departure from duty thereby involved could not have occurred in France, where the government took such matters under their special cognizance and protection, for the Institute would at once have been consulted, who would have reported to the Ecclesiastical Commissioners the course most proper for them to pursue. In our country it was a most melancholy fact that whilst other subjects of far less importance constantly received the supervision of the state, such matters as these were entirely left to chance—to the accident of learned men, or otherwise, who might preside at the time. The consequence of such a system was the perpetuation of enormous heresies in art.

Since the 16th century then, the form of the papal temple had been retained, and the basilica of the western world had been retained with it; and how deeply rooted was the feeling in favour of the basilica, might be imagined from the fact that almost all the churches of the present day were in that form.

The Camden Society had decided upon the pointed style of architecture of the 13th and 15th centuries, as the best adapted to Christian churches. That that style exceeded many others in boldness of design, it was not to be denied, but that it excelled in suitableness to the ritual, was a very questionable point which it would be desirable to discuss; and, in doing so hereafter, he should direct the attention of the students to the plan and distribution rather than to the elevation; to the fundamental system of the structure appealing to the understanding, rather than to superficial forms appealing only to the eye. The Camden Society seemed to catch at that which was gratifying to the eye, whilst they passed over the more important details which recommended themselves to the understanding. The amateur generally, indeed, understood by architecture, the elevation only, but the intelligent architect regarded the disposition and the plan as the two bases of his work.

The forms of churches employed by Constantine were four. 1, The basilica; 2, The circular; 3, The octagonal; 4, The square or oblong. There were 18 basilicas in Rome, and St. Augustine introduced that form into this country in the year 596.

The second form was employed by St. Helena, the mother of Constantine, who was a native of York. That form was probably adopted from the tomb which she built at the holy sepulchre, and was in pretty general use until the dissolution, in 1312, of the Knights Templars' body, who employed that form in imitation of [the sepulchre of Christ, which they were appointed to guard. The octagonal form was also employed by Constantine, in Antioch, of which the church in Aix-la-Chapelle, by Charlemagne, was no doubt a copy; and this form was admirably adapted for the purpose of separating the male and female worshippers, as was then customary. Its adaptation to our ritual was well exemplified in the church of St. Dunstan, in Fleet Street, by Mr. Shaw.

The Fourth form, a square, like the basilica, was divided into three parts, having a nave and two aisles, and the centre of the nave was surmounted by a dome. This form was called *indronicâ formâ.* It was remarkably well suited to the protestant ritual. It was still employed in the Greek church, sometimes tetrastyle, and there were also a great many of that form in Germany. The four columns supporting the dome were, according to some writers, symbolical of the four evangelists. It was customary to run up these domes to a very great height; Eusebius says of Constantine, "*ad summam altitudinem, erexit, &c.*" Two principal types now contended for the pre-eminence, the Basilica, and the Byzantine, or vertical type. The Byzantine appeared best suited to us: as in the Byzantine style, we required galleries; but our ritual did not require the long nave and aisles through which the Roman Catholic was accustomed to view the Host. Pillars were an obstruction to the ritual of our church, and the fewer the pillars the better. With regard to the exterior, in his opinion, a large dome on the centre of the church, with smaller domes clustered around, afforded a very beautiful view. Our own church of St. Stephen, Walbrook, was a remarkable specimen of the beautiful grouping of domes, but it was unfortunately almost entirely hid from the gaze by the buildings with which it was surrounded.

The fact of the Russian churches being generally built after the Byzantine type furnished another reason in favour of that form, for the Russians were early converted to Christianity by missionaries from Constantinople, where the Byzantine form prevailed.

A glorious opportunity was offered by the Fire of London for suiting the temples of Christians to the uses and rubrics of our church. The matter was entrusted to the learned Archbishop Sancroft and Bishop Compton,—than whom, perhaps, no better qualified persons could have been found,—and aided by the immortal Wren, they left some beautiful models, as a living testimony of the genius with which they were inspired. One great reproach, which must adhere to Wren, was his modesty, which prevented his giving publicity to the principles by which he was guided in the execution of his works; had he left behind him any principles upon which he himself acted, they would most assuredly be regarded as canons by the students of the present day.

The learned Professor concluded his lecture by referring to church nomenclature. He thought that the cardinal virtues and graces might well be applied as the names of churches. The ecclesiologist appeared to be hard pushed for names, when he recommended such a one as St. John Pantiana, which, says the *Ecclesiologist*, "Though an uncommon, is a very beautiful name." If euphony were all that was cared for, it would be easy enough to find plenty of pretty names; but he thought something more should be aimed at than a mere pleasing sound.

[We had hoped to have afforded our readers much gratification by publishing the lectures of Professor Cockerell on this highly interesting subject at full length, as we did in our last number with his first lecture. Professor Cockerell has, however, intimated to our reporter that it is not his desire to have his lecture fully reported, and has given him to understand, that an attempt at a *verbatim* report in future would cause his exclusion altogether from the course. We are consequently enabled this week to do no more than present our readers with a very faint outline of the Professor's second lecture; and as that gentleman does not object to the publication of a brief abstract, we shall, with his kind permission, publish his remaining lectures in that form. We very much regret that we shall thus be precluded from presenting to the public his very admirable expositions of the art which he so ably represents.—Ed. C. E. & A. Jour.]

ILAM HALL.

Sir—There should be no occasion for making this inquiry, as the information should have been supplied by the account which induces me to seek further particulars relative to what appears to be a superior specimen of its kind. Ilam Hall, Derbyshire, the seat of Mr. Watts Russell, is said to have been erected "a few years ago," and to be remarkable for the "happy unison of both exterior and interior magnificence" displayed in it; the entrance hall and armoury being "finished off" in oriental magnificence. Nevertheless, there is nothing further said to bear out such character, nor are we told who was the architect of so superior a work, although his name might very well have been mentioned, notwithstanding the "want of space," which seems to be the never failing excuse for withholding matters of positive information, perhaps at the very same time that the writer is evidently ekeing out his paragraphs with more twaddle or fustian—as is the case when we are told that "what renders the charm still greater, is the perfect feeling of domestic comfort which remains unsullied by the grandeur which surrounds us." The idea of being "unsullied by grandeur," is certainly a new one. What description there is of the mansion is given only in a coarse and vilely drawn lithograph, which, however, serves to show that the structure is chiefly in the Elizabethan style, unusually picturesque in outline and in the grouping of its parts. Beyond this, nothing is to be made out, all besides being left to the imagination—to be shaped out for themselves by those who can perceive what beauties of detail and execution such a subject is capable of.

I would, therefore, fain elicit from some one of your readers, should any of them have visited the building—or from the architect himself, should this meet his eye, a more satisfactory and intelligible account of it. For anonymousness in architecture no reasonable motive of any kind can be assigned; certainly not, where a building would reflect credit upon the name of its author. Even the paltry lithograph view above-mentioned has the name of the *artist* boldly stuck at one corner of it; therefore, *he* is evidently neither ashamed of his handy-work, nor at all loth to receive whatever fame it may bring him.

I remain,

Yours, &c.,

Inquirer.

THE JOINT RAILWAY TERMINUS, LONDON BRIDGE.

Sir—Observing a paragraph in page 454 of the *Journal* for January, professing to correct the statement in the *Journal* for December last, describing the works of the new joint railway station at London Bridge, the object of which appears to be to produce the impression that the design for the façade building did not emanate from the writer, I rely on your high sense of justice and impartiality for the insertion of the following particulars, which will explain the circumstances under which the design was produced, and remove any misconception which might arise from the ambiguous wording of the paragraph I allude to.

Soon after the commencement of the proceedings, Mr. Roberts became seriously indisposed, and was laid up for several weeks, just at a time when it was extremely important that the plan and elevation of the façade building should be definitely settled, in order that the substructure works then executing by the Greenwich company should not be delayed, and should be adapted to receive that portion of the superstructure of the façade building, hereafter to be raised upon it; and on this account it was, as well as on account of the deficiency of accommodation in Mr. Robert's original plan, that I was directed in the preparation of an entirely new plan, laid out on the principle of providing distinct waiting rooms for first and second class passengers, which of course involved the necessity for a new elevation for the façade, which I was also directed to prepare, in composing which, however, I was left entirely free as to the choice of style and mode of treatment, being confined only as to the height of the building by an agreement previously existing with St. Thomas's Hospital. It was considered desirable that the design should also comprise the new booking offices of the Greenwich Railway company, so as to form when completed one uniform elevation, and on presenting it to Mr. George Smith, (the architect to that company,) it was readily adopted by him as to its distinctive features, and subsequently with the addition of the campanile, designed by me, and a slight increase in the height of the principal building, (which it was afterwards discovered could be obtained,) the design was finally approved by the boards of the joint station committee, and of the Greenwich Railway company; and it was not until some time after this that Mr. Roberts was sufficiently recovered to resume his official duties.

With respect to the details, which it is stated in page 454 "were left more immediately under the direction of Mr. Roberts," it is true that by his particular desire the fret in the lower frieze was introduced, square balusters used instead of round, the centre console under the balconies, and the vases upon them left out, and rustic quoin stones added to the south angle of the parcels office; with these exceptions every detail has been executed as originally designed by me. Under the circumstances it was to be expected that opportunities for alteration would be sought for; whether these alterations are also improvements may perhaps admit of question, and I have mentioned them that your readers may form a correct opinion as to their extent and value; but if the original conception of an architectural design, and of its details as actually executed, can confer a propriety in it, I think there can be but one opinion as to whom that propriety in the present instance rightfully belongs.

I am, Sir,
Your very obedient servant,
Thomas Turner.

13, *Judd Place East, New Road,*
January 11th, 1844.

SIR JOSHUA REYNOLDS.

Sir—On the 26th of December, it was asserted by the *Times*, in a review of Sir David Wilkie's life, "*That Edmund Burke touched up, if he did not write, the best of Sir Joshua's Academy discourses.*" I knew the folly of this exploded suspicion, and I wrote a temperate letter to the *Times* stating the origin of the injustice, and the reasons to conclude there was no foundation for it. The *Times* announced "*they saw no reason for publishing Mr. Haydon's letter.*" Now there was every reason for doing so, because it was an unjust accusation, and it was the duty of the editor to publish the reasons against it. Owing entirely to the ignorance of the nation as to the degree of intellect required to be a great painter at the time this calumny was first started, do I principally attribute that it was so innocently believed, for what was the foundation of it? The insinuation that Reynolds was imperfectly educated and could not have written so well.

It is well known there existed about 50 or 60 years ago, a writer, under the anonymous name of Antony Pasquin, who used to obtain money by threatening disclosures: he got hold of two or three letters of Reynolds', which he asserted Sir Joshua wrote to a lady from Minorca, during his voyage to Italy, and that the spelling was bad: on this discovery the suspicion is founded, not considering that if the letters were genuine, spelling badly was no evidence of not being able to think originally, for many of the greatest men of the last century were very bad spellers. Sir Joshua candidly alluded to the suspicion of being helped by his friends, but he denied it positively, yet acknowledging he had benefitted by their conversation, for says he in his papers published by Malone, "the observations they make on poetry and philosophy I applied to our art, with what success I leave you to conclude."

Reynolds' love of truth was proverbial, and if this had not been the real fact he would have scorned the affirmation. Malone says he was asked "if the discourses were not found in the hand-writing of other people after Sir Joshua's death;" he replies, "none whatever," and four he found warm from the brain in his own hand. Malone concludes, "I am as fully persuaded the discourses were wholly composed by Sir Joshua, as I am certain at this moment I am employing my pen in vindication of his fame." Reynolds affirms he wrote his own discourses. Pasquin insinuates he did not. The evidence then rests on the relative credibility of two men, and which ought the world to believe? Pasquin, who was hunted from society, as a literary assassin, and died from a beating he got from an exasperated man of honour, or Reynolds, whose whole life was devoted to integrity and a virtuous employment, whose word was his bond, who died regretted by society, and was followed to the grave by the most distinguished men of the day! The question must not be asked, it is an insult. "Few eminent artists have written well," says the critic; this is not justly stated—few artists have written at all: but those who have, have written well, viz., Apelles and Euphranor, Michael Angelo and Leonardo, Rubens and Reynolds, were all eminent, and have all written well.

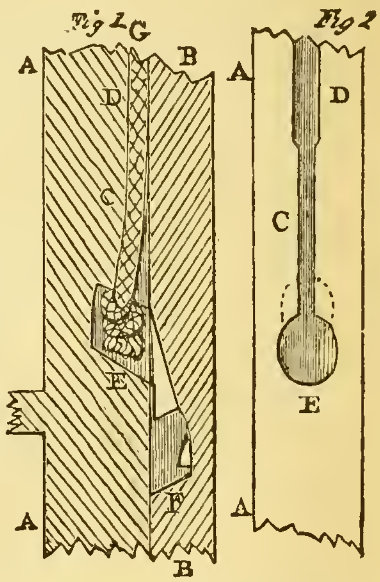
To conclude, it is not too much to say, Burke could not have written the discourse, the style is so pure, nor could Johnson. The style is an emblem of Reynolds' own nature, modest, calm, unaffected, and beautiful; they were the deductions of his own mind, and written by his own hand, and it was not just of the *Times* so to assault the illustrious dead and then refuse his justification.

B. R. Haydon.

London, Jan. 11th, 1844.

SASH-SUSPENDER.

For which the Silver Isis Medal of the Society of Arts, London, was presented to Mr. Jabez Osborn, and reported in their Transactions.



The ordinary mode of hanging window-sashes is by nailing the suspension ropes to the sides of the sash, which practice is very inconvenient when it becomes necessary to remove the sash from its frame, either for the purpose of repairing or cleaning it; both the woodwork of the sash and the line itself are destroyed by the nails, if the sash is frequently removed for either purpose. Mr. Osborn's plan entirely obviates these objections.

Fig. 1 is a section of part of a sash A A and frame B B, in which it slides as usual. Fig. 2 is a side view of the sash.

When the sash is in use, the line D C is attached to it by a knot in the end of the line being inserted in a hole sloping upwards, as at E, but when it is required to move the sash from its frame, the line D C is let into a groove in the frame, and the knob placed in an aperture F (fig. 1) similar to the aperture in the sash.

THE CONCILIATION HALL, DUBLIN.

Sir—Having read the "Observations on Architects and Architecture," by Dr. Fulton, in the *Journal* for the present month, I beg to correct an error relative to the above fabric into which he has fallen. Although I am quite ready to bear testimony to the justice of the *strictures* he has passed on the "offspring of a Martin," still I wonder how a person of such good taste as the Doctor, could commence without *nausea* to *operate* on so illegitimate *a subject for dissection:* or waste his time *analysing a mass* of incongruities such as every one was prepared for who had heard of the *undertaker* to whom the *laying out of the body*, and the construction and decoration of the *shell* were entrusted.

There was not any competition invited, and consequently no "committee of selection" appointed to decide on the merits of a design, or the fairness of an estimate, (the contractor in this case being the architect,) the Mecænases of the Corn Exchange deeming such things unimportant, when *neglected genius* was to be encouraged, and one of the fraternity advanced; such noble minded disinterestedness is worthy of the men who aspire to create a "national school of art," however the policy of insulting the whole profession may be questioned. For myself, I had every hope that the *contractor and architect* for the Conciliation Hall would prove worthy of his patrons, and fully realise the expectations they had formed of his abilities, and no doubt when the union is repealed, they will find in the *veteran undertaker* a person every way qualified to *undertake* the high office of "Surveyor-General of Public Works for the Kingdom of Ireland."

G. D.

Milford, Jan. 13*th*, 1844.

PACIFIC STEAM NAVIGATION.

Mr. Wheelwright's *Report on Steam Navigation in the Pacific, with an Account of the Coal Mines of Chile and Panama.*—1843.

If a proof were wanting of the extended nature of our steam navigation and commercial interests, it would readily be found in the prominent subjects of discussion at this moment, in connexion with transatlantic and West Indian steam navigation, and the communication with the Red Sea, India, the Brazilian coasts, and the Pacific. At the same time that our operations are thus extended, it is to be regretted that they are not equally profitable, from circumstances which we shall perhaps, ourselves, be called upon to discuss and consider on a subsequent occasion. It is further to be regretted, at the same time, that it presents a curious feature in the history of the subject, that a violent and injurious paper warfare is going on between the projectors and the companies. As if it were not sufficient to have a contest between Mr. MacQueen and the Royal Mail Steam Packet Company, Mr. Waghorn and the Peninsular and Oriental, Mr. Heathorn and the Bahia, we have a new element of discord in the controversy between Mr. Wheelwright and the Pacific Steam Navigation Company, of which the pamphlet now under consideration is the opening protocol. We need scarcely say that we view such a combination of disturbing circumstances with sincere pain for the result; on whichever side the victory may be, it is sure to be to the injury of both combatants. Wars of all kinds are active processes of destruction, whether fought on the reeking battle field, or with the less sanguinary but atrabilarious weapons of pen and ink, and, under present circumstances, property is depreciated to a fearful extent. Of the four companies named, the shares of all are miserably below their real value, and nearly unsaleable, while a general distrust as to investment in this class of property is being gradually diffused.

The *casus belli*, in the present instance, is a simple one, and requires but to be stated to be thoroughly understood, and, in succinctly stating it, we believe we shall be doing much more good than if we recapitulated the invectives and innendoes with which Mr. Wheelwright's book is charged. Mr. Wheelwright is a fine specimen of the merchant captain, of that class to whose energies, to whose industry, and to whose researches this country is largely indebted for the extension of its commerce and naval supremacy—employed for many years in the Pacific, the desire of introducing steam navigation on the coasts of the Spanish American countries, and of establishing an active communication with this country, took strong possession of him. For a long while he laboured assiduously in this cause, and by dint of great exertion, he succeeded in obtaining from the various governments extensive and valuable privileges conditional on his carrying his plan into effect. This preliminary step taken, of preparing the local interest, Mr. Wheelwright came to this country at a most unfavourable period for such a mission, every class of enterprise and industry suffering under the severest and apparently most hopeless depression. Ultimately, however, Mr. Wheelwright succeeded in inducing some of the influential merchants connected with the Royal Mail Steam Packet Company, and with South American commerce, to take up the plan, and, in 1838, a Board of Directors was formed. At the same time, among Mr. Wheelwright's own connexion in Liverpool and Glasgow, a large number of shares was taken. After various delays in October, 1839, a contract was entered into for two steamers to be built in London, and to be named the *Chile* and *Peru*. In 1840 a royal charter was obtained limiting the responsibility of the shareholders to the amount of the shares. By this time (the end of 1840) the period was approaching, at which the privileges granted by the local governments would have expired, and it became necessary to send Mr. Wheelwright to the Pacific to obtain their renewal, and prepare for the reception of the steamers. In this mission he succeeded, and before the end of 1840, the two steamers arrived at their destinations. Here two new difficulties arose, the Royal Mail Steam Company's vessel was removed from the Chagres station, so that the Panama traffic was virtually cut off, while from the hurried manner in which the *Peru* and *Chile* were sent out, adequate measures could not be taken for the supply of coals. One cargo of 600 tons of new Welsh coal, turned out a complete failure, and injured the machinery considerably. Captain Wheelwright was here again thrown upon his resources, and set about obtaining coal from the coast. After vainly trying the rivers Maule, Laraquita, and Valdiera, Mr. Wheelwright began working the mines of Talcahuano, which he had already explored in 1834. Of these mines he obtained a lease, and soon raised large supplies of serviceable coal, of which nearly 5000 tons have since been taken at an expense of about 15*s*. per ton, while "shafts have been sunk to the depth of more than 100 ft.; machinery for raising the coal has been made, workshops built, coal screens and coal carts provided; a mole 300 ft. long constructed; a railroad formed from the working shaft to the end of the mole; a breakwater erected for the protection of the mines; launches built to convey the coal on board; in fact, all the conveniences and material provided for the effectual keeping up and working the mines. And all these important advantages have been secured at an expense of only £2194, and under judicious arrangements a full and ample supply of coal may always be provided."

Having effected this, Mr. Wheelwright remained in superintendence of the affairs in the Pacific till the end of 1842, when, at the request of the Directors, he returned to England, in his way exploring the Isthmus of Panama, and the supply of coal there. Now, however, we come to the tragic part of the performance. Hitherto we have had to laud Mr. Wheelwright's energy, industry and enterprise, the skill with which he combated obstacles and provided resources for the conduct of the undertaking. No men, however, are faultless, still less projectors, and Mr. Wheelwright, like too many of his brethren, had early in the enterprise involved himself in disputation. The school in which his energy and enterprise had been best cultivated, the merchant navy, is but a poor school for discipline, things are carried out upon too small a scale, and the relations are too simple to suggest the artificial expedients requisite in large undertakings, and where many individuals are concerned. Captain Wheelwright, while acting as superintendent of the company's affairs in the Pacific, thought only of the services he had performed in the suggestion of the undertaking and the formation of the company, and of the large stake he and his friends held in it. He felt a deep interest in it both personal and pecuniary, and while he assumed a high degree of authority to himself, he freely expressed his sentiments on the acts of the executive at home. He forgot that as superintendent he ceased to be a partner, and that instead of having to deal with mercantile co-partners, he was under the official superiority, not of Messrs. George Brown, J. R. Templeman, J. N. Daniel, &c., but of an abstract body, the Directors of the Pacific Steam Navigation Company, and on several occasions he indulged himself not only in insubordinate strictures on the conduct of the Directors in his correspondence with them, but also in his communications with his co-officials and third parties at home, shareholders in the company. No board, whether they had acted rightly or wrongly, could either consistently with their own dignity or with the interests of the company which they represented, submit to this, and they firmly but courteously called Mr. Wheelwright's attention to the subject, at the same time that they showed every confidence in Mr. Wheelwright's proceedings, and every disposition to allow him the legitimate exercise of his own discretion and responsibility, (p. 43, 40, &c.) A course like that pursued by Mr. Wheelwright was bad enough when carried on at a distance, but still worse when he came into personal contact with those over whom he seemed to consider that he rather held the superiority, than that he was bound to recognise it in them. He seems to have been totally incapable to discriminate between A & B and C & D, as private individuals and as abstract personages engaged in the management of the affairs of the company. Being at the same time totally ignorant of the mode of conducting public business, he was ever led into fresh difficulties, and ready to give and to take umbrage on the most trivial occasions. Thus it is one of his grievances, as stated by a partizan, that he was always politely requested to leave the boardroom while the directors were engaged in discussion, a course of proceeding which is well known to every one who has had experience in committee business, and at which it could be supposed that few officers of a company could take umbrage, and still fewer expose themselves by making it a ground of public complaint. However, Mr. Wheelwright's grievances did not end here, he brought plenty of others about his ears, which forced on the directors his dismissal.

As to Mr. Wheelwright's charges against the directors, they have been fully considered by them, and are not worth going into, neither should we do good by engaging in a controversy of the kind. We think Mr. Wheelwright and everybody else may very quietly dismiss them. We have every respect for Mr. Wheelwright's public services, and we have every wish for the success of the enterprise, and we have only alluded to the subject of this pamphlet in the hopes that some attention may be paid to the earnest expression of our desire that this crimination and recrimination may cease on each side. Mr. Wheelwright's services are great and ought to be remunerated, at the same time by his own act he has precluded his re-instatement in the active superintendence of the company's affairs. He cannot hope that he can succeed in displacing the London directors, supported as they are by so many influential capitalists and large holders, neither can they expect that Mr. Wheelwright can remain in opposition without great detriment to the credit of the company, and without a serious depreciation of the value of its shares. Let Mr. Wheelwright have compensation, either in the shape of an annuity for a short term of years, or of a per centage on the profits, when a certain dividend has been paid: let the bye laws excluding proxies be rescinded and two Liverpool directors elected on the board, and we believe a permanent settlement of all differences will be made, of the most beneficial result to all parties.

Having got rid of the controversial portions, we will now proceed to other points of more interest to our readers. Mr. Wheelwright, with great judgment and foresight, urged on the directors at an early period that the steamers should be built of iron, and the boilers of copper, and he gives satisfactory reasons for his recommendations. These were not at that time acceded to, for the merits of iron steamers on a large scale were not so firmly established as they are now; neither was the alleged superiority of copper boilers admitted. The directors were not therefore to blame in rejecting what they considered an experiment, in favour of the ordinary and established modes of construction; but we hope on future occasions they will profit by the arguments which Mr. Wheelwright so ably adduces in his reports. He also well observes,

"Nothing can be more desirable for the complete success of this company than the extension of the line to Panama. Our steam operations would then embrace a continuous coast from the latitude of 9° north, to the latitude of 37° south, a distance, including the sinuosities of the coast, of 3500 miles. To secure these necessary and vitally important advantages, two more steamers are required, one to make a monthly voyage between Lima and Panama, and the other to take the place of either steamer when repairs are necessary; it is utterly impossible to carry on economical steaming except by nursing the steamers and not over-working them; the old adage of "*a stitch in time*" is no where more applicable than to steam: procrastinating repairs is absolute ruin; however great may be our advantages in the mildness of the Pacific, and the very slight wear and tear to which we are exposed, unless these advantages can be sustained by having a steamer to take the place of either when necessary, it would be much better to abandon the enterprise altogether; any interruption of the line is a most serious evil to the inhabitants and ruinous in its consequences to the Company."

We can only regret that Mr. Wheelwright's partisans should have been those who at the recent meeting prevented the extension being carried into effect.

A point, with regard to which Mr. Wheelwright justly expresses great anxiety, is as to the passage of the isthmus at Panama, which he has surveyed, and the practicability of the route over which he has fully established, having on his return to England from Chagres, occupied only 24 hours in travelling by land and water from the Atlantic to the Pacific Ocean. We sincerely hope that this matter will not be lost sight of, but that it will be seriously taken up, and obtain every assistance from the government and the interests concerned.

This has become the more necessary, since we learn from recent Paris advices that M. Parella has been promoted to the rank of mining engineer, and appointed by the French government to sail immediately from Brest for the purpose of examining the isthmus of Panama, and ascertaining the practicability of a communication, by canal or otherwise, to Chagres.

WEALE'S QUARTERLY PAPERS.

Weale's Quarterly Papers on Engineering. Christmas, 1843. Part II. London, Weale, 1843.

The first volume of Mr. Weale's work is now completed, and we can sincerely say that not only does this fact give us great pleasure, but that we wish the series may be as extensive as it promises to be useful. The work supplies a desideratum in engineering literature, inasmuch as it affords provision for many valuable memoirs of great length, which could not otherwise be submitted to the public gaze, being in a Procrustean condition, as too long for our columns, and too short to admit of separate publication. Such is the treatise on the Dredging Machine, which would have been a hazardous experiment to have published separately, and yet here we have a laborious dissertation, with no less than ten copper-plates describing the minutest details.

The first article of the present part is by Mr. F. W. Simms, C.E., on setting out the widths of ground for the works of a railway or canal.

The next is a memoir by Mr. S. Hughes, C.E., of William Jessop, the engineer, being in continuation of the series, commenced in the first number, with memoirs of Brindley and Chapman. Thus engineering biography, a subject of considerable interest at the present moment, when the profession is rising in public estimation, is likely to receive great accessions, and to be put on a respectable footing. William Jessop, the son of one of Smeaton's assistants, was born at Plymouth, in 1745. At the age of sixteen, his father having died, he was left under the guardianship of Smeaton, whose pupil he became, and with whom he remained ten years. He was from that time (1772) employed on the improvements of the rivers Aire, Calder, Hebble, and Trent. About 1792 he was engaged on the Cranford Canal, the Nottingham Canal, the Loughborough & Leicester Canal, the Barnsley, and the Horncastle navigation, and the Ouse navigation. His great work, however, was the Grand Junction Canal. This was succeeded by the Grantham Canal, the Barnsley Canal, and the Great Ellesmere Canal. He was also employed on the Grand Canal, and other government works in Ireland. About the commencement of the present century, Jessop was called upon to take part in the dock establishments, and completed the City Ship Canal, and West India Docks, the first in London, and the Bristol Harbour improvements. It is curious, also, that at this time his attention was closely directed to the railway system, and which, under the form of tramroads, he had been much employed in extending to the mining districts of Derbyshire, Yorkshire, and Nottinghamshire. The Croydon and Wandsworth Surrey Tramway, the first in the metropolitan district, was also Jessop's work. With the Caledonian Canal Jessop was connected as consulting engineer. This great engineer died in 1814, after severe sufferings from paralysis. We should observe, that some controversy exists as to the engineership of the Ellesmere Canal; Telford, who acted as Jessop's assistant, having subsequently claimed for himself the sole merit. Mr. Hughes has entered into this question, and, we think, done justice to Jessop's claims. We are sorry to learn that in the compilation of this memoir, Mr. Hughes has received no assistance from the Messrs. Jessop, which is, we think, far from creditable to gentlemen of their high public standing.

The third paper is on the Dredging machine, in continuation and conclusion of an article published in the first part. It is as we have already said, copiously illustrated with copper-plate engravings.

The fourth paper is by Captain Vetch of the Royal Engineers, on the advantages of employing a framework of malleable iron in the construction of jetties and breakwaters. We shall leave the gallant captain to explain his system in his own words, but he has not certainly said enough to satisfy us as to the practicability of his plans.

"The mode of construction upon this project consists essentially in the application of upright rods of malleable iron, steadied and fixed in their places by passing them through apertures in two parallel and horizontal frames of flat iron, provided with corresponding orifices to receive them; the lower frames being placed about three feet above the low-water mark and the upper frame about three feet above the high-water mark, or at such other convenient distances apart as the circumstances of the case may demand. The horizontal frames may be conveniently constructed in short lengths, say of four feet each, and an additional piece of frame may be connected with the preceding one by round bolts passing through loops, forming so many moveable joints, that the frames may be the more easily raised, lowered, or adjusted to the required level, if from the settlement of the upright rods, they have swerved from their original horizontal position. The new lengths of frames having been bolted to the preceding ones, and retained in a horizontal position by diagonal stays, are ready to receive the upright rods, which are then to be dropped separately through the corresponding apertures of the frames, and each allowed to take its bearing separately by its own gravity, or by such farther pressure as may be deemed proper. When the rods have taken their bearing and settlement, a row of sloping rods have to be added to each side of the jetty, inclining inwards one foot in ten or twelve, to give lateral support; and at this state of the operation, it is proposed to key on to the rods the iron collars for the permanent support of the horizontal frames and the platform."

Obituary.—We have to announce, with regret, the demise of Mr. John P. Briggs, R.A., which took place on the 18th inst., about 5 o'clock, at his house in Bruton Street. Mr. Briggs was long a shining ornament to the profession of the fine arts, and his death will be esteemed a great loss by all the lovers of genius. Mr. Briggs had not been in town above a fortnight, after a tour of six months on the Continent. He has left two children of a tender age to lament his loss.

ON THE PREFERENCE DUE TO CUBICAL STANDARD MEASURES OF CAPACITY.

By T. N. Parker, Esq. A.M.

The pains which have been taken by Parliament, from time to time, to establish a uniformity of measures of capacity throughout the kingdom, have hitherto failed of producing the desired effect, and the greater the labour lost, the more unwillingness is shown for resuming the subject.

I have long entertained a belief, that a cubical standard measure might be advantageously substituted for the cylindrical, as the test of capacity; while cylindrical or vessels of any other form, should be continued, as at present, for common use: but a difficulty occurs in regard to the contents of a measure, which is to be multiplied and divided, into quarts, gallons, &c., without having to deal with any smaller parts than a cubical inch, and at the same time to preserve as nearly as possible, the like quantity in a gallon, bushel, &c. which has been customarily understood to be represented by such denominations. I, at length, luckily hit upon a cube of 4 inches for a quart, which is so near to the customary quantity as to be deserving of much consideration; it is remarkable that it did not sooner present itself, being so obvious, incapable of improvement or modification, as it must be entirely accepted, or entirely rejected.

The Winchester measure, 13 Will. 3, c. 5.		Gallon in cubical inches
Ale	..	282
Wine	..	231
Grain, &c.	..	268 8 tenths.
	3)	781 8 tenths.
Average	..	260 6 tenths.

By the 5 Geo. 4, c. 74, the imperial gallon is adopted, and described as containing 277 cubic inches, and a fraction of 274 parts in 1,000: but so repulsive is the task of approaching the mathematical impossibility of squaring a circle, that the following inaccuracies were found to exist in the Winchester standard measures in the Exchequer:—

		Cubic inches.
The gallon contained	..	270·4
If derived from the bushel	..	266·1
If derived from the quart	..	279·3
If derived from the pint	..	276·9[1]
	4)	1092·7
Average	..	273·1 tenth of an inch.

I shall next examine the difference between the Winchester and the Imperial measures, and I find that the Imperial bushel of 32 quarts contains 33 quarts of the Winchester, and an insignificant fraction of a cubical inch.

The increase in the imperial measure, as compared with the Winchester measure, is equal to 1½ farthing in every shilling, or 3⅛ per cent. And the decrease between the Winchester measure, and the proposed cubical measure, is 2¼ farthings in every shilling, or $4\frac{1}{16}$ per cent.; the cubical measure being that much smaller than the Winchester. But I contend, that the facility of ascertaining the accuracy of the cubical measures by a common rule of a few inches in length would be a very great advantage to all consumers, and more particularly to the poorer and less educated classes.

Lastly, I will endeavour further to explain the advantages of the proposed cubical standard measures.

	sides. in.		in.		depths. in.		contents. cub. in.	shapes.
Quarter pint ..	2	×	2	×	2	=	8	cube.
Half pint ..	4	×	2	×	2	=	16	double cube.
Pint	4	×	4	×	2	=	32	half cube.
Quart	4	×	4	×	4	=	64	cube.
Half gallon ..	8	×	4	×	4	=	128	double cube.
Gallon	8	×	8	×	4	=	256	half cube.
Peck	8	×	8	×	8	=	512	cube.
Half bushel ..	16	×	8	×	8	=	1024	double cube.
Bushel	16	×	16	×	8	=	2048	half cube.
Double bushel ..	16	×	16	×	16	=	4096	cube.

If a cylindrical vessel be required, equal to a given cube or square figure, multiply 1·1283791 by the side of the cube or square: take a cubical quart for instance;

1·1283791 × 4 (side of square) = 4·5135164 diameter of cylinder and the answer is 4·5 in. or 4½ in. for the diameter of the cylinder, so that a cylindrical vessel of 4 in. deep and 4½ in. diameter, is equal to a cub of 4 in., or sufficiently so for all practical uses, as a great measure.

By this rule the quarter pint would be 2in. deep by 2·2 in. diameter of cylinder, and the peck 8 in. deep by 9 in. diameter of cylinder. The standard measure of extension would in this case furnish copies in the shape of graduated rules, say of 8 in. or 9 in. in length, which might be marked also, with perforated points for the diameters of cylindrical vessels of the depths above mentioned.

In the year 1838, I distributed a brief sketch of suggestions on this subject, as an æronaut despatches his pilot baloon to see which way the wind blows, but the current was opposed to my views. I then published and distributed a pamphlet with little more success,[2] for the members of Parliament recollected the tiresome business of legislating on the imperial standard, and would not entertain the notion of another change, although the scheme was generally thought well of.

As a proof, that the introduction of the imperial measure does not tend to the uniformity of measures of capacity, I will quote the prices of grain from a respectable weekly provincial paper, dated 15th November, 1843, relating to four markets in the same county, and one market in the principal town of a neighbouring county: the same paper having been taken up as the latest published, and the only provincial paper which comes regularly to my hands. In this, wheat is taken at 75lbs. per bushel in all the five cases; oats at 225lbs. per bag in two cases, 50lbs. per bushel in one case, and not mentioned in the other two; beans 235lbs. per bag; peas 225 lbs. per bag, the two latter being mentioned only in one case each. But the point best applying to my argument is, that barley is in the five cases quoted at 38 quarts to the strike or bushel, and malt is only once mentioned, and then for the imperial bushel. So that the malsters buy barley at 38 quarts of Winchester measure, considerably greater than the imperial bushel, at which malt is sold as quoted in the said paper. There is therefore a disadvantage to the consumer in the proportion of 38 to 32, besides the outcast in the malting process of about 10 per cent. minus the proportion of 32 to 33 being the difference between the Winchester quart and the imperial quart. Taking the whole of these quotations together we must arrive at the conclusion, that the attempt to establish the imperial measure, is but a retrograde movement towards the uniformity of measures of capacity; which might with more probability be accomplished by the very simple system of cubical standard measuses of capacity, the advantages of which I have endeavoured to describe. Malt is often sold, I believe, at the old fashioned customary measure, the same as barley, of 38 quarts to the bushel.

20th November, Sweeney Hall.

[1] This was taken a few years ago, from some document of good authority, and I believe it was from a report of a committee of the House of Commons.

[2] Sold by Richard Baynes, 28, Paternoster Row, prices 2*d*. and 6*d*.

A FEW REMARKS ON DECORATIVE ARCHITECTURE.

Much as architecture has been valued, studied, and understood in this country, the application of the true principles of the art to internal ornament has been despised, or at least neglected. The plumber, painter, paper-hanger have taken the place of artists, and of architects—patterns and colours have vied with each other in absurdity and ugliness; and even when beauty, either by skill or by chance, has been obtained, it has been arrived at without reference to the general character of the building, and however beautiful, pains, because it is incongruous. When the mere shell of a building, whether public or private, has been erected, when the exterior has been constructed and ornamented, the architect's task is far, very far, from being finished.

Buildings, of whatever character or nature, were meant to be inhabited, and the solemnity of a church, the grandeur of a hall, or the ease and comfort of a private house, must be obtained by internal arrangement, and the glory, the beauty of the edifice should be adapted rather to the select few, the private circle, than meretriciously hung out to the indiscriminating gaze of the gaping multitude.

Nothing can be worse than the present system—a house is finished—Gothic windows or classical pilasters supplied *ad libitum*, and the architect pockets his 5 per cent., and sends a neat paragraph round to the papers to say that "it is to the skill and taste of our talented townsman, Mr. Pecksniff, that we are indebted for this elegant ornament to our rapidly improving town." Then in rush the tradesmen—a marble chimney piece of the severe classic style, a fender of decidedly Brummagem Gothic—and indescribable paper—and unaccountable curtain fixtures—mar the architect's designs, and martyrize the unhappy possessor, should he unfortunately possess an atom of artistical knowledge or an atom of artistical feeling; of what avail is it o an architect to endeavour to do justice to his patrons—to study his ground plan—to be harmonious in his proportions—choice in his cornices, if the lights and shadows he carefully designs are to be botched by a glaring paper—Grecian cornices, disgraced by surrounding Louis XIV papers, and the whole design to be left to the tender mercies of a lot of well-meaning but ignorant artificers? What are the profession about? What is the Institute doing? Will architects never combine together for their mutual assistance and the advancement of their profession, but spend their days in petty squabbles and low envy?

We have been led to these remarks by a recent visit to a house now in the hands of the decorator, No. 37, Westbourne Terrace, Paddington, and we hail this attempt as the dawning of a new era in decorative architecture, as a promise that, hereafter, grace and beauty shall not be confined to the palaces of the rich and powerful, but be diffused through all classes, till they gladden the home, and elevate the condition of the poorest among us. The house alluded to stands in a terrace, designed in a rich Italian style, with bold cornices, and rich columniated windows. The credit, we believe, of the design, is due to Mr. Nelson, and the evident care bestowed on the interior effects, and general ground plan, is a lesson that many of his brother professionals would do well to copy.

The walls of the back and front drawing rooms are painted in a dead ground, and relieved by raised gilt panels in the Louis XIV style, the interior panels are painted in oil, with little scenes of courtly and pastoral life, after the style of the refined and elegant Watteau. These are from the able pencil of Mr. Baines, the artist, and do him much credit in a walk of art that most artists *affect* to despise. We earnestly recommend all architects who have the real good of their profession at heart, to study and agitate this subject. Should they feel inclined to visit the house in question, they will, I am sure, meet a most obliging guide in Mr. Baines himself.

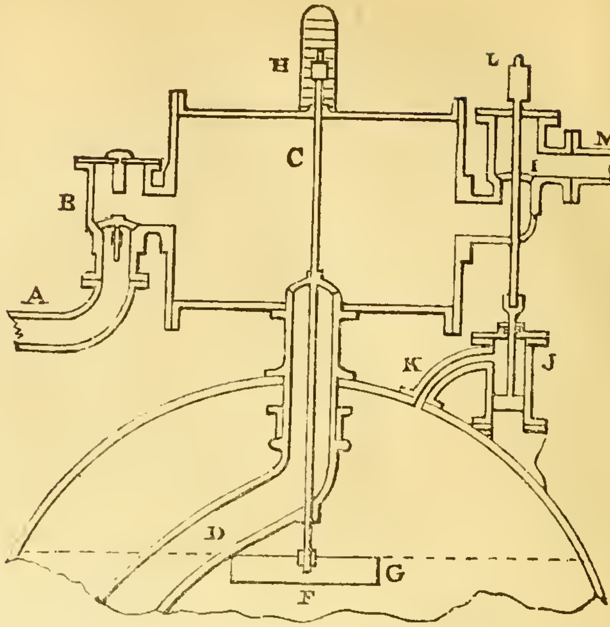
Westminster, January. A. H. Patterson.

FEEDING APPARATUS FOR HIGH PRESSURE BOILERS.

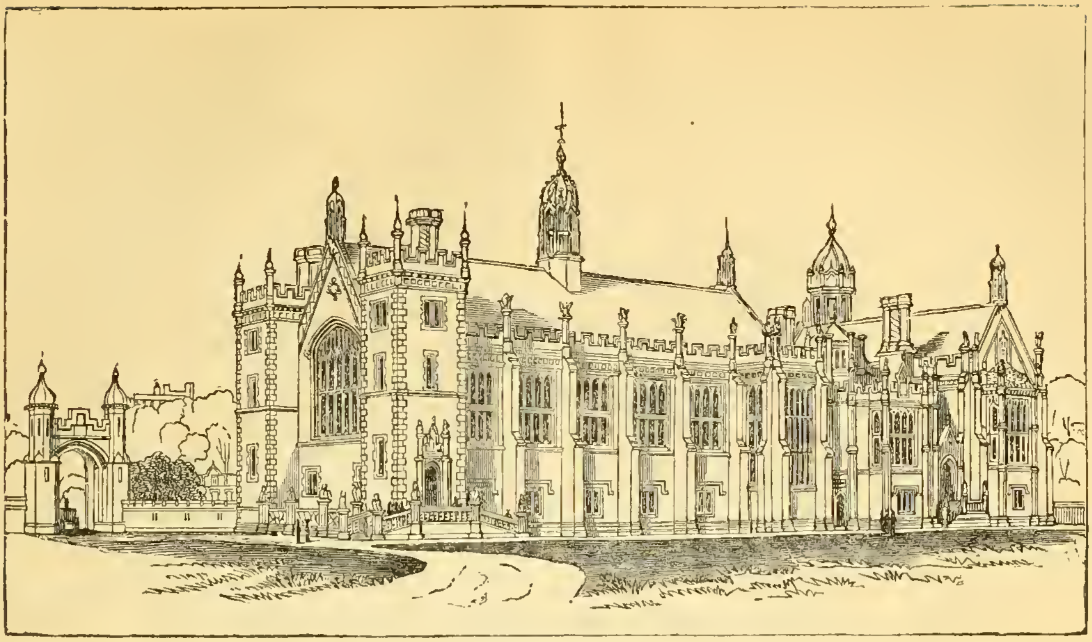
For which the Silver Medal of the Society of Arts, London, was presented to Mr. C. Grafton, of Dover Street, Chorlton-on-Medlock.

It is, I believe, an acknowledged fact, that the absence of any practical self-acting feeding apparatus for boilers in which high-pressure steam is employed, is a deficiency of a most serious nature. The deplorable consequences which may ensue from the neglect of those who have the care of such boilers, in keeping up the requisite supply of water (a neglect which I believe to have been the cause of three out of five of the steam-boiler explosions which have as yet taken place), the wasteful expenditure of fuel, and deterioration of the boiler, which must arise from irregular feeding, when the due level is not maintained equally during the period of working, are consequences of this deficiency so obvious as scarcely to need a comment. It is now a principle, recognised by the highest authorities, that the most economical engine is that in which the expansive property of steam is put forth to its fullest extent, by employing high-pressure steam in one of the ordinary condensing construction, and cutting it off at an early period of the stroke, which will of course neutralise the present system of feeding by means of a column of water; for, supposing that a pressure of 35 lb. on the square inch were employed, it would require a column of water 87 ft. 6 in. high to overcome such a resistance; recourse must then be had to hand-feeding, with all its disadvantages.

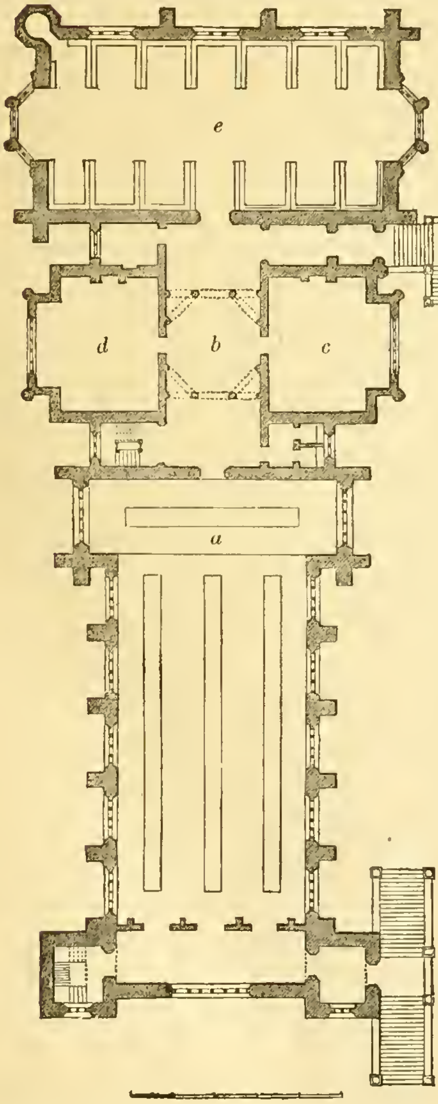
It has occurred to me that possibly a remedy for these evils might be found in the application of a plan which I have endeavoured to delineate in the accompanying section through the feed apparatus and part of an ordinary ten horse high-pressure boiler, mounted in the usual manner with steam nozzle, loaded safety-valve, man-hole, and additional safety-valve; but in place of the common feeding apparatus, I propose to lead the feed-pipe A, provided with a common conical valve at B, into a small tank C, placed immediately over the boiler, through the bottom of which the end of the internal feed-pipe D, fitted with a rising valve E, is introduced; the spindle of this valve is brought down, and passing through a small stuffing-box, is attached to a lever at F, which is loaded by means of a float G, buoyed up by the water in the boiler; a slight brass wire tapped into the stalk of the valve E, and passing through the top of the tank, shows, by means of an index-plate H, the position of the valve. On the opposite side of the tank I would place another valve I, the spindle of which would be attached to the rod of a small piston working in a cylinder J, open at bottom, and of equal area to the valve I, the top side of which is exposed to the steam-pressure of the boiler by means of a pipe K. This valve is also loaded with a slight weight L, and the water, after passing through it, escapes through the overflow-pipe M.



The action of this apparatus may be explained in the following manner:—Supposing the boiler at work with a pressure of 40 lb. on the square inch, I propose that the weight L should exert a pressure of 1½ lb. on each square inch of the valve I, which would be (supposing the valve to be 2½ in. diameter) 7·362 lb. on the whole, which, together with the pressure communicated by means of the pipe K, from the boiler to the piston of the cylinder J, would give a total load of 41·5 lb. on each square inch of the valve J. This pressure would soon be exerted by the force-pump of the engine; but when the water in the tank C, attained more than this pressure, the valve I would rise, and allow the water to escape down the overflow-pipe M. But supposing the level of the water to be lowered, the float G will descend with it, and, aided by the lever F, raise the valve E, and allow the water in the tank to force its way into the boiler till the requisite level is obtained, and the float again buoyed up till it closes the valve E, and the water escapes through the valve I; for, supposing the float G to weigh 4 lb., and the leverage (which might be increased, if necessary) to be as 9 to 1, you would then have a pressure of 7·33 lb. on each square inch of E; but this must be diminished by 1·5 lb., which is the extra weight on the valve I. This would give an *effective* pressure of 5·83 lb. on the square inch to raise the valve E; for it must be borne in mind that (as both these valves are of equal area) by this arrangement the pressure of steam in the boiler is exerted equally to raise the one and depress the other; and therefore, as soon as the equilibrium is disturbed by the descent of the float, consequent upon the diminished level of the water, the extra weight being overcome, the water will rush into the boiler with a force of 1·5 lb. on the square inch more than the actual steam pressure. This is supposing the water to fall entirely below the bottom of the float G, but it is obvious that it would, even with the leverage and adjustment I have given it, not require to fall more than an inch and a half before the valve would be raised, and by a judicious adjustment of the leverage, still greater nicety might be attained. (A small wire might be attached to the float and rise through the boiler, to close the valve E, by hand, if necessary.) It is upon the fact of the pressure upon both the valves E and I being constant, that I rely for success; for all the other schemes of whose existence I am aware have this defect, that the pressure from the boiler is variable, while the pressure from without is fixed; and even in boilers working with common low-pressure steam, that which is technically termed "boiling over," is often noticed when the steam becomes suddenly of a higher pressure than the feed-pipes were calculated to overcome, and the safety-valve is neglected. I have brought this proposition forward as applied to high-pressure boilers, but I am inclined to think that it might be applied with economy, as far as regards the prime cost, even in cases where the jack-head system is effective, as the cost of the extra valves and tank would certainly not be more than that of the great amount of piping required under the above-named system; and the inconvenience to which their height and position expose them, and the absolute necessity which must exist, whenever the pressure is increased, of adding to that height, would be done away with.



Lincoln's Inn Buildings.



50 feet.
Plan of Lincoln's Inn Buildings.

LINCOLN'S INN HALL AND LIBRARY.

This structure is fast approaching completion, having been laboured at night and day with all the vigour which its energetic architect and contractor could bring to bear. The buildings include a library, a dining hall, and a bencher's room, and are in what may be called the early domestic style of the sixteenth century, or reign of Henry VIII. They stand, as our readers are aware, on part of the site of Lincoln's Inn Garden, looking on Lincoln's Inn Fields, and form an important addition to this great inn of court, which hitherto has been rather in arrear in the matter of architecture. In compliance with the practice at the Temple, Gray's Inn, and Staples Inn, these buildings are in a medieval style, but which, in the present instance, does not accord with some of the other prominent edifices in Lincoln's Inn, nor with those in Lincoln's Inn Fields. If, too, Mr. Barry is to erect his New Courts of Law in Lincoln's Inn Fields, the New Hall will sadly put them out of countenance. We hope that now the benchers have begun, they will persevere and give Lincoln's Inn an architectural character, consistent with its legal standing and the many interesting historical and literary associations connected with it.

As much interest is attached to this structure at the present moment, it gives us great pleasure to avail ourselves of the accompanying engravings and description, for which we are indebted to the courtesy of the conductors of the *Companion to the Almanac*, and which afford a very comprehensive view of the design.

To begin with the dining-hall: at the south end, *a*, it greatly exceeds the present one in dimensions, that being only 75 ft. by 32 ft. whereas this is 120 ft. by 45 ft. and 64 ft. high, it is therefore considerably larger also than Middle Temple Hall, supposing the size of this last to be correctly stated at 100 ft. in length, and 40 ft. in width. One characteristic feature of this hall will be an open timber roof of oak; and all the windows will contain a great deal of stained glass emblazoned with the arms of members of the Inn. There will also be two bay windows at the upper or *dais* end of the hall. The vestibule, *b*, connecting the hall with the library and other rooms (*c*, the council-room, and *d*, the drawing-rooms, each 31×24 ft., exclusive of bay), will be lighted by a louvre lantern, which will also show itself conspicuously on the external roof. The library, which runs transversely to the rest of the plan, and therefore gives extent in another direction, is 80 ft. by 40 ft., and 35 ft. high, and will, like the hall, have an oaken open roof. On the ground-floor is a reading-room for the benchers, and various other rooms for the officers attached to the Society: and in the basement are a spacious kitchen and all other requisite domestic offices.

The exterior of the building is of red brick and stone, with an intermixture of darker-coloured bricks, and executed in a superior manner. Architectural effect will be extended both by the terraces connecting the structure itself with the gardens and by the adjoining entrance from Lincoln's-inn-fields.

We should have been better pleased had a more lively-looking material than the dark red brick have been used, as its peculiar hue, in the present instance, gives a very dingy and sombre appearance to the exterior.

The first stone was laid on the 20th of April last, so that the present advanced condition of the building shows the expedition which has been used, and which equally with the design, does great credit to Mr. Hardwick, its able architect.

NOTES OF THE WEEK.

Music has hitherto been more favoured than architecture, with regard to royal and princely professors. We have Prince Albert, Prince George of Hanover, Prince Poniatowski, and many others, entering themselves as candidates for musical honours, but they have not yet dabbled with architecture. This, however, is about to be remedied, and Berlin is to be decorated with a new cathedral, of which Herr Stieler is charged with the execution from ideas given by the King of Prussia. The contribution of notions is but a preliminary step, still we do not despair to see architecture more royal, if not more popular, occupying the pencils, and claiming the superintendence of the high and mighty after this great example. This building at Berlin is to rival those of King Lewis of Bavaria, and be one of the most magnificent in Germany. It is to be in the style of an Italian basilica, and enriched with all the adornments of painting and sculpture. In the vaults are to be interred the mortal remains of the members of the Prussian royal family, and the tombs of former members now scattered in different cities are to be removed to the new mausoleum. The cost of the edifice will not be less than 10,000,000 thalers, or £1,500,000.

The hotel of the minister of the navy at the Hague, has been unfortunately burned down.

The celebrated monastery of Saint Jerome, at Grenada, the supposed model of the Escurial, has suffered much from civil war, the recruits quartered in it at different times, recently, having wantonly destroyed many of the works of art.

The erection of monuments in France, to men of eminence, is making active progress, particularly in the provinces. Among other places the following are cited as having thus celebrated their illustrious great. Cambrai, Dijon, Meaux, Bordeaux, Perigueux, and Montbard, have monuments to Bossuet, Fenelon, Buffon, Montesquieu, and Montaigne; Chateau Thierry, La Fontaine; Laferte Milon, Racine; Caen, Malherbe; Clermont, Pascal; Rouen, Corneille; Paris, Moliere; Strasburg, Guttenburg; Havre, Bernardin de St. Pierre, and Casimir Delavigne; Marseille, Belsunce; Lyon, Jacquard; other cities Cuvier and Duguesclin. This is a great contrast to the state of affairs in England; while columns and monuments are awarded to generals, admirals, and statesmen, the only public memorials of men of literature and science, in the places of their birth, are, we believe, Dr. Johnson at Lichfield; Dr. Dalton, at Manchester; Watt and Tennant, at Glasgow; Bell, at Greenock; and Chatterton, at Bristol. Shakspeare, Milton, and Bacon, and all our great names, which are consigned to oblivion by those cities derive so much glory from their birth. London, with all its public monuments, has none to literary men, while more honour is paid to Shakspeare abroad than here, the king of Saxony having just placed a bronze statue of the great bard on the façade of the New Theatre at Dresden, something better than the affair at Drury Lane.

The Palais de l' Industrie, for the *exposition* of 1844, in the Champs Elysées, is getting on with rapidity. The construction of the canal and basin of La Villette, has greatly increased the prosperity of that quarter of Paris, and at the present moment a church, town-hall, and school, are being built. The French Minister of the Interior has commissioned M. David to execute two colossal figures for the tomb of Napoleon. A magnificent chapel to the Virgin, in the Byzantine style, richly decorated, has been completed in the church of St. Gervase, at Paris. The painted windows are by Messrs. Cousin and Pinaigrier, and the decorations and gilding by M. Delorme. A new illustrated monthly periodical, on a large scale, has been commenced at Paris, called the Revue Pittoresque. It contains articles and engravings by the first hands, and is published at the low price of 5*s*. a year.

The King of Bavaria, in the new year, has given the cross of the order of the Bavarian Crown to the artists Shnorr, Hess, and Schwanthaler.

An attempt is being made to bore for water at Calais, under the direction of M. Mulot, and the artesian well has already reached 300 metres, about 1000 ft. in depth. This is the extent to which the contractor was bound to go for £1440, and a new contract must be made to carry on the works further, and to save the expense already incurred. It is expected that water will be found at 400 yards, as the chalk, which has been reached, is becoming greyer and greyer, seeming to denote an approaching change to the green sand formation. The boring, down to 72 metres, was in gravel, sand, clay, and flint; then chalk mixed with flints; at 263 metres the whiteness of the chalk began to be affected, and at 277 metres it became grey.

The number of miles of railway open in Germany is about 249 German miles, or about 1160 English miles.

A fine deposit of asphalte has been discovered at Velder, five miles from Hanover. It is said to be 14 ft. thick, and only a few feet below the surface. It is said to be similar to the asphalte of Seyssel and the Val de Travers.

An eruption accompanied with flames and ashes, has taken place at Olopad in Sclavonia.

M. Dufrenoy and Elie de Beaumont, in their remarks accompanying their new geological map of France, make the following calculations as to the supply of coal in the rural countries of Europe. The coal district in this country forms about 5 per cent. of the superficies; in France only ½ per cent.; in Belgium 4 per cent. Italy, Greece and Turkey appear to be very badly off, as also Denmark, Sweden and Norway; Russia is also very inadequately supplied. Wurtemburg, Bavaria, Austria Proper, Moravia, the Tyrol, Styria and Illyria are deficient rather than otherwise with regard to coal. Hungary has some mines on the Danube. Bohemia is pretty well provided, as also Saxony and Poland; but Prussia is best off in its possessions in Silesia and at Sarrebruck. Spain and Portugal have some good basins towards the north, and the Asturian mines have excited a good deal of attention as affording the means of an export trade towards the south of France. The French basins are generally thin, poor and small; while the Newcastle basin covers 1,200,000 acres, the north basin, the greatest in France, extends over only 125,000 acres. As an instance of the rise of manufacturing towns where an abundant supply of coal is at hand, Decazeville in France, is cited, where 20 years ago there was only an old barn, and now there are 4000 people.

The *Vulcan*, an English iron vessel of 318 tons, excited much attention at Havre, for although of 318 tons register, and carrying 400 tons of coals, she draws only 11½ ft. water, and can pass all the difficult places of the Seine. She has carried her cargo up to Rouen. The advantages she possesses in her lightness of draught, arising from the material of which she is constructed, have powerfully impressed scientific and commercial men in France, and the result will be most probably a great extension of the coal export trade, and perhaps the creation of a new branch of trade in the supply of iron vessels. For river service ships of this material seem particularly well adapted, and as they are able to ascend the rivers, they are expected to save the expense and trouble of transhipment from lighters with regard to all bulky cargoes, as coal, corn, timber, &c.

A new iron steamer is being built at Ulm for the Austrian company, to navigate the Upper Danube, and to be called the *Danube*. The voyage between Linz and Ratisbon has already been reduced five hours in duration by the competition, and something more is expected.

The Austrian Lloyd's company have launched at Trieste their fourteenth steamer, the *Empress*, on the 22nd ultimo.

The French are now claiming screw propulsion as their invention, and the government have granted to M. Sauvage £100 as an indemnification for the experiments he has made on the subject during some years.

We are glad to see that a movement is being made at Edinburgh to provide baths for the working classes; we wish something were done here. London has peculiar advantages in its river, and abundant supply of water, yet neither the city corporation, the commissioners of Woods and Forests, nor any other authorities, have made any provision for establishments so necessary to the health of the population. The tides offer great facilities for easy supply and removal of water, and we hope the subject will not be forgotten in connexion with the proposed embankment of the river.

The subscription statue of Sir David Wilkie has been placed in the National Gallery, being the first honour of the kind awarded, though we trust by no means the last. The floor of the National Gallery is so weak that it has had to be secured under the pedestal of the statue, though it would naturally be supposed that such a building was intended for the reception of works of sculpture. The statue is by Mr. Joseph, and is a good though not a striking likeness of the celebrated painter.

At Newcastle there are two new banks in progress, and at Seaham Harbour the north dock is about to be enlarged, for which purpose the commissioners have advertised for tenders to remove 40,000 cubic yards of limestone, the estimated expenditure of which is £10,000. The works are under the superintendence of Lieutenant Usher, R.N., and Mr. Walker as engineer. A branch railway from the Newcastle and North Shields Railway is spoken of under the auspices of the directors. As to the high level bridges—1st. Mr. Green's is of wood; 2nd. Mr. Grainger's, of cast iron, raised on the piers of the present stone bridge; and 3rd. Mr. Dobson's, of cast iron for railway traffic, (the two first only for road traffic,) under the auspices of the Carlisle Railway. Mr. Green's is under the Brandling junction and Mr. Hudson's patronage, who ask the corporation of Newcastle to give the approaches and £5000, or make the footway as well as give the land for approaches. The common council reported in favour of the latter. In the plans deposited no details are given, except the height above low-water, and two piers would be in the river; borings are now making on the site of Mr. Green's bridge to ascertain the nature of the foundation.

Mr. Robert Hawthorn, C.E., of Newcastle, has patented a locomotive to work the steam expansively, by cutting it off at any portion of the stroke; it is said to reduce the quantity of coke one half, or half a pound per ton per mile, and to materially reduce the priming and coughing or puffing of the engine.

The Newcastle papers state that plans and estimates have been prepared with a view to introduce to public notice the utility and practicability of a tunnel under the river Wear, below the present ferry boat landing. They say that parties are willing to contract for the same, to be completed within six months from the commencement, and the projectors are very sanguine as to the undertaking proving one of a remunerating character.

Six iron vessels, as we stated in last week's number have been contracted for by the Government, of the same class as the *Locust* and the late *Lizard*, and are to be employed as dispatch boats, each to be fitted with engines of

150 H.P., on the side lever or beam principle, and with tubular boilers. Three of these boilers are in the hands of Messrs. Ditchburn & Mair of Blackwall, to be supplied with engines by Bolton, Watt & Co., by Penn & Son, and by Seaward, Capel & Co. Mr. Robert Napier, of Glasgow, is to build the other three, and also to supply the engines. One of the improvements to be introduced, is to have the coal boxes built as part of the vessel and perfectly water-tight, and also to have water-tight bulkheads.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.—Session 1844.

January 16.—The President in the Chair.

The Annual General Meeting of the Institution was held on Tuesday evening, when the usual report of the Council was read. It appeared that the progress of the Society was satisfactory, and the increase of members was equal to that of preceding years, but the amount of arrears of subscription was larger. The members were pressed to transmit papers for reading, for, as was justly stated, scientific societies can only be supported by useful and interesting communications, and by raising such discussions upon them, as are the distinguishing feature of the meetings of the Society of Engineers.

Memoirs of Professor Wallace of Edinburgh, of Mr. Buddle of Newcastle, and of several other deceased members were read.

Telford medals were presented to Messrs. F. W. Simms, W. Pole, and T. Oldham, for communications presented by them to the Institution.

Telford and Walker Premiums of Books were also presented to Messrs. D. Mackain, D. Bremner, D. S. Hope, R. Mallet, W. J. M. Rankine, W. L. Baker, S. C. Homersham, J. O. York, G. D. Bishopp, and G. B. W. Jackson, for their papers and drawings, which had been read and exhibited at the meetings during the past session.

Mr. J. Walker, the President, addressed the meeting upon the internal management of the Society, the election of His Royal Highness Prince Albert, as an honorary member, the valuable addition to the library presented by the Duke of Buccleuch, the course of study and practice most beneficial for young engineers, and the opportunity afforded by the Institution for coming advantageously before the world; he then, among other novel subjects connected with engineering, spoke of having lately visited the atmospheric railway near Dublin, and said, that without prognosticating as to the future, the experiments he witnessed appeared more promising than those with locomotive engines at a corresponding early period of their introduction upon railways.

He then gave a short notice of the connexion of Colonel Stoddart with the Institution as its honorary secretary, in the years 1834-5; alluding to the exertions now making by a committee of gentlemen under the direction of Captain Grover, for ascertaining the fate, and, if possible, of obtaining the release of both Colonel Stoddart and Captain Conolly, who, there was every reason to believe, were really still alive, although detained in a sort of captivity. In confirmation of this, Lieutenant Colonel Humfrey stated that Captain Grover had been informed by Lord Aberdeen, that authentic intelligence had been received from Constantinople, and from the British Consul at Trebizonde, to the effect, that some pilgrims recently arrived direct from Bokhara, had seen both Colonel Stoddart and Captain Conolly alive and at liberty, although strictly watched; that they were both employed in the military service of the Ameer, and that evidently they were restrained by some powerful reason from attempting to make their situation known, as it was not probable, otherwise, that two officers of such merit should allow themselves to be reported dead, and their names to be struck off the army list. The favourable reception of Dr. Woolff at the various places he had hitherto passed through was noticed, and a spirited subscription to the Stoddart and Conolly fund was immediately commenced among the members of the Institution, who all appeared anxious to aid in the restoration to his native country, of a gentleman who had, whilst connected with them, gained so many friends.

The ballot for the Council took place, when the following gentlemen were elected:—J. Walker, President; Messrs. W. Cubitt, B. Donkin, J. Field, and H. R. Palmer, Vice Presidents; W. S. Clark, F. Giles, G. Lowe, J. Miller, W. C. Mylne, J. M. Rendel, G. Rennie, R. Sibley, J. Simpson, J. Taylor, F. Braithwaite, and W. Cubitt, other members and associates of Council.

The following papers were announced to be read at the next meeting, on February 6, until which time the meeting adjourned:—

"Description of a water-wheel constructed by W. Fairbairn, Esq., and erected in Lombardy," by S. B. Moody, Assoc. Inst. C. E. "Description of a new chain bucket water-wheel," by J. Wight. "Description of Whitelaw's horizontal water-wheel," by J. Whitelaw. "Description of a water meter," by P. Carmichael.

BRISTOL AND WEST OF ENGLAND ARCHITECTURAL SOCIETY.

A general meeting of the members of this society was held on Tuesday evening, December 19, in the theatre of the Institution, Bristol, and was numerously attended.

The Ven. Archdeacon Thorp, on being called to the chair, observed, that the present meeting might be considered an anniversary meeting, as the report of what had been done by their society during the year would be read, as also the statement of their accounts. It was gratifying to find that the principles contended for by the society were rapidly gaining ground; although they had not at the present moment to report the formation of new societies, they had to congratulate the friends of the society on its making a steady progress; that there had been an increase of members, which was hardly to have been expected, after the novelty of the society had ceased to excite. The chairman alluded to the rule of this and similar societies, by which a member of one society was also a member of the other societies, and said that much benefit had been the result. In carrying out the principles of the society they were mainly endeavouring to promote the welfare of the Church. It was not merely for the sake of promoting the elegancies of art that they were concerned, but in all their proceedings they were anxious to bring all the aid that art or science could afford into the service of their church. It was peculiarly gratifying to him to observe that they were not looked upon any longer with suspicion by a large and influential body of gentlemen who were professionally devoted to architectural pursuits, but that instead of being deemed intruders into the profession, they were considered as amongst its ablest promoters. The principles of church architecture and restoration, for the encouragement of which the society was formed, were a very few years ago unknown or unacknowledged. Churches were built and restored, without considering who were the persons to be engaged in religious worship, or the manner of worship to be celebrated. The service of the church had not been in accordance with its ritual. But now a better state of things had obtained, and he confidently believed that many of the heart-burnings which prevailed in the church would be subdued in proportion as the church principles of architecture were more understood. Persons who were formerly greatly averse to this society, were now, after seeing its principles carried out, its friends. Distinctions between the worshippers in the church had been made where God never intended them to exist, and persons had been excluded from its service for whom the church was specially bound to provide. The austerity evinced by some to pews he had himself at one time thought too great, but he now thought the time was rapidly approaching when pews would altogether be abolished. Churches had been built without regard to the service to be performed in them,—rather for the worship of Mussulmans, Indians, or Egyptians than that of Christians. But now, after the numerous examples which had been set, it would not be deemed necessary to have pews fitted up with every convenience for domestic comfort, and persons instead of being driven to dissent, would find the internal accommodation of the church consistent with its ritual. The Venerable Archdeacon concluded a long and able address by observing that the interest of that and kindred societies were favourably progressing, and that great practical beneficial results had been effected, and instanced the church of St. Sepulchre, at Cambridge, which, instead of being a place not fit for a pig-stye, was likely to be one of the most beautiful churches in the kingdom.

The Rev. J. R. Woodford, the secretary, then read the report, which stated that they had concurred in several undertakings which seemed calculated to advance the end the society had in view—the restoration of the ecclesiastical edifices in the diocese, and the prevention of the introduction of architectural improprieties in the new buildings which were rising around them. They had forwarded a memorial to the Commissioners for Building additional Chapels and Churches, with reference to certain objectionable points in their rules, viz., the introduction of galleries, the toleration of pews, and the position and materials of the font. The committee had been active in promoting the circulation of *The Bristol Archæological Magazine*, as it was believed the wider its circulation, the greater degree of usefulness would be obtained. The committee had undertaken the restoration of the south porch of Slimbridge church. A grant of money had been made towards the repairs of the tower of Bitton church. A font, of the Norman period, had been erected under the superintendence of the committee, in All Saints' church, in this city, the cost of which was defrayed by the vicar. The report concluded by recommending four gentlemen for election as vice-presidents.

The Rev. Eccles Carter read a paper on "*The Church of Slimbridge*," situated 11 miles from Gloucester, on the left side of the road from Bristol to that city. The church is an object of interest to travellers from its lofty and very graceful spire, which rises amidst the dense foliage of that flat but fertile vale. Its more peculiar beauties are, however, concentrated in the interior. The edifice, in its pristine and perfect state, for completeness of plan, elegance of proportion, and elaborate execution of general design, could scarcely have been second to any of its own style and date. The church is said in the history of the county to have been dedicated to St. John the Evangelist, but there is no tradition or commemoration whatever of this fact. The church consists of a chancel, 32 ft. 9 in. by 16 ft. 3 in.; nave, 60 ft. by 18 ft. 3 in.; tower at west end, 11 ft. 10 in. square; north and south aisle, 57 ft. 9 in. by 13 ft. 2 in.; south porch, 7 ft. 9 in.; vestry, on the north side of the chancel, 9 ft 10 in. by 11 ft. 1 in. The church does not stand due east, but is rather to the south of east. The east window consists of three lights, decorated. In the centre light is a shield of richly stained glass, bearing the arms of the Berkeley family. The chancel is elevated one step; two altar steps run the whole width of the chancel. As there was formerly a chantry dedicated to St. Katherine, it is supposed that the place now used as a vestry was also a chapel dedicated to that saint. There are five piers carrying four arches on either side of the nave. The clerestory is about 40ft. high, containing four windows. The pulpit, of carved oak, stands in the interior of the second pier, on the north side of the nave. The whole of the nave and aisles are pewed with large square deal pews to the height of 4 ft. 9 in. There are some good encaustic tiles scattered over the pavement, but the patterns are broken by grave-stones. The font, of lead, is close to the western arch; it bears the date of 1640. The height of the tower is about 84 ft.; out of it rises the spire to the height of 75 ft., which is particularly graceful and slender, its chief beauty arising from its being set so very straight from the base. The whole of the interior of this beautiful church was formerly covered with white and yellow wash; the window jambs and mullions had been broken away, and repaired with plaster; the pier arches and caps were so thickly coated with plaster that it was impossible to guess what might be contained under it. The mullions, &c., of the windows in the chancel have, however, been restored in the best possible way, the splay and sash of the east window being cased with freestone instead of mortar and wash. The wash and plaster have also been removed from nearly all the piers, caps, and pier arches. Two large pews of 6 ft. 7 in. by 6 ft. 3 in. and 5 ft. 4 in. high. on each side of the chancel, have been removed, and are being replaced by two stalls. The expense of these restorations, amounting to 70*l.*, has been defrayed by the rector, with the exception of 5*l.* from the rural dean, and 5*l.* from the farmers of the parish. The south porch had been restored through the generosity of the Bristol and West of England Architectural Society. Speaking of gilding in the church, the paper continued—" If symbolism is to retain its full force, the present is not the time for painting and gilding our churches. At a time when the church, if not peculiarly under the harrows, is just emerging from a worse condition, it would seem that, however much we are bound to use every endeavour to extend her circuit and take care that she goes in solemn and costly attire, yet the time is not come when we may clothe her in that joyous and triumphant garb which we fully trust awaits her, fully wrought with gold purified in the fire of affliction." The rev. gentleman, in conclusion, said, that the cost of the proposed farther restoration of the church was estimated at £2,000.

An interesting conversation ensued upon various subjects connected with the church architecture, in which the chairman observed that a work was in course of publication for determining the direction in which churches were built. It was frequently observed that churches were not built due east, which had been accounted for by supposing that respect had been had to the point of the sun's rising on the festival of the saint to whom the church was dedicated. The *Orientator* was accompanied by a calendar, by which the sun's rising on the festival days could readily be ascertained. The venerable chairman also observed that much more good would ultimately be effected by building one church at a cost of £20,000, than four at £5,000 each, inasmuch as men's minds would be called to the due distinction and honour which ought to be given to a building dedicated to the service of God.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

January 8.—C. Barry, Esq., R.A., V.P., in the chair.

A communication was read from W. M. Higgins, Esq., " *On the recent restoration of the spire of St. Stephen, at Vienna.*"—It proceeded to state, that the ancient church of St. Stephen is supposed to have been founded, in the year 1144, by Heinrich Jasomirgott, afterwards the first Duke of Austria, one of the twenty-three children of Agneseus, to whom the Klosternenburgh owes its foundation. The church seems to have been several times injured by fire, and, in 1519, by severe earthquakes, which did great injury to the buildings in Vienna and the vicinity, and on these occasions to have been partly rebuilt, and much enlarged. The tower, as built, or restored, in 1519, in process of time, deviated out of the perpendicular to a considerable extent. An iron bar was carried through it as an axis for the support of the spire, which, having a considerable tendency to vibrate, might be considered as an element of destruction, rather than of strength; consequently the thin wall of the lower portion of the spire was reduced almost to a ruin, and at length became in such a dangerous condition, as to require rebuilding. The removal of the old spire was commenced in August, 1839, and in the following spring all the condemned part had been removed. The mode of construction adopted in the restoration, was novel and ingenious; the slight masonry of the spire being supported by means of a framing of vertical iron ribs fastened, at their lower extremities, to a cast iron plate or base, and united to each other at intervals by horizontal rings of rolled iron. These rings are made to project from the inner surface, so as to admit of a person ascending, with the assistance of ladders, to the top of the spire. All the wrought and rolled iron employed in the construction of this iron skeleton, the weight of which was only 123 cwt., was prepared in the government works at Neuberg, in Styria. The cast-iron plates or rings were furnished from the government iron works at Marie-zell. In the autumn of 1842, when the whole of the masonry of the spire had been completed, the upper portion, consisting entirely of iron work, was fixed. This also was attached to a strong cast-iron circular plate, similar in construction to that below. This portion of the framing, with the other iron work employed in the spire, weighed about 80 cwt., so that the entire weight of iron was about 203 cwt. The new portion of the spire was connected to the old by means of an arrangement of iron work, very appropriately called " anchor fastenings." The portion of the spire restored, (viz., from the gallery of the tower to the top of the cross) is about 182 ft., the cost thereof being about 130,000 gulden, of which sum 15,500 gulden were expended in taking down the old spire, and in the construction of the necessary scaffolding. Objections have been raised, at Vienna, to the extensive use of wrought iron in the reconstruction, from an apprehension of injury arising from the dilatation of the metal under changes of temperature; it appears, however, from careful experiments made, that the expansion of a bar of wrought iron 40 ft. in length, under an alteration of 40° Reaumur, is not more than three lines, even in a horizontal position, and would be less in a vertical position, in consequence of the pressure of the upper parts on the lower; and the opposite effect would increase with the diminution of temperature, the effect being still less when a number of pieces are united, forming a system (as in the iron work of the spire), than when the same length is in a single piece. It further appears, that Bolinger, the mechanical engineer, found the dilation of one of the iron ribs, between the temperature of summer and winter, to be only one line, and that of the iron framework, when completed and exposed to the direct rays of the sun before it was covered by the masonry, to be imperceptible.

At the next Meeting, on Monday Evening, the 22nd instant, the following papers will be read:—" A description of the new bridge over the River Moine, at Clisson, near Nantes," by William Bromet, Esq. M.D., F.S.A. " Some observations on the Church of St. Peter and St. Paul, at Kettering, in Northamptonshire, by Mr. R. W. Billings, Associate.

ON BRONZE FOR STATUES.

By Captain Charles Hoffman, of the Prussian Artillery.

(Translated for the Civil Engineer and Architect's Journal from the Berlin Gewerbeblatt.)

Bronze should be of a good colour, and yellowish red is preferred: it should be capable of being wrought with the file and the chisel; it should have the fluidity requisite for filling perfectly all the cavities of the mould, and producing an exact impression, and it should be capable of taking patina or a green colour by the application of a mordant. The first quality is best obtained in those alloys of tin and copper in which the tin is in a proportion of from 15 to 6 per cent, the red colour of the compound, and its tenacity increasing in inverse proportion to the quantity of tin contained. But all the combinations of copper and tin are formed by the mechanical mixture of anterior combinations of copper and tin, of which one containing exactly 61⅔ per cent. of copper, and 38⅓ per cent. of tin, is distinguished by a bluish tint and crystalline fracture, and possesses considerable hardness; whilst the other contains nearly 95⅓ per cent. of copper and 4⅔ per cent. of tin, and has a bright yellow colour tinged with red, and presenting a close grain, on fracture, a rough surface, and much tenacity. The first combination, which is the harder, contains exactly 3 atoms of copper and 1 of tin, and the second 30 to 40 atoms of copper to 1 of tin. These two combinations may be considered as representing hardness and tenacity, the due development of which properties of cohesion can only exist as the combination is uniform throughout the mass, an effect difficult to be produced in pieces of bronze very dissimilar, and cooling with a different degree of rapidity. These reasons form a considerable objection to the use of copper-tin bronze for statuary founding, besides which, although a sufficient proportion of tin will give fluidity so as to fill the mould well, such an alloy is bad for the chisel, flying off in little bits, which prevents the work from looking well; neither do these alloys present a good patina.

The capability of being wrought by file and chisel is afforded by copper-zinc alloy, provided the zinc does not exceed 25 per cent. nor fall below 5 per cent.; but it is often obstinate to handle, and yet is not hard enough in delicate parts to withstand the action of chiselling. The colours are a yellowish red, verging often to a citron yellow. Some of these alloys are very fluid, but do not fill the mould well, to effect that, 50 or 58⅓ per cent. of zinc must be introduced, but which alloys are hard and brittle under the chisel. Copper-zinc, therefore, is not a good alloy, but zinc added to copper is susceptible of a good patina.

Profitting by these several properties, Professor Hoffman has made some experiments to obtain a good statuary bronze, and recommends the alloys ranging between the two following cases.

1st. To produce the reddest bronze.

88¾ copper-zinc (7 atoms copper, 1 atom zinc.)
11¼ copper-tin (3 atoms copper, 1 atom tin.)
———
100

2nd. A cheap bronze with a bright yellow colour almost golden.

93½ copper-zinc (2 atoms copper, 1 atom zinc.)
6½ copper-tin (3 atoms copper, 1 atom tin.)
———
100

The combinations between these two, Captain Hoffman ranges in five classes, possessing various properties.

REGISTER OF NEW PATENTS.

UNDER this head we propose to give abstracts of the specifications of all the most important patents as they are enrolled. For this purpose we shall feel obliged if patentees will favour us with abstracts of their patents, immediately after their enrolment. If any additional information be required as to any patent, the same may be obtained by applying to MR. LAXTON at the Office of this *Journal*.

STANDING RIGGING FOR SHIPS.

JAMES JOHN GREERS, of Woolwich, Surgeon, for "*Improvements in apparatus for securing, or fixing, standing rigging, and chains, and other tackle.*"—Granted July 1; Enrolled January 1.

THIS invention of certain improvements for fixing standing rigging, chains, and other tackle, relates first to an improved lanyard, and consists in the application of a screw with a right and left handed thread, each of which are made to fit into a boss, having a hook at the outer end, for affixing the same to certain parts of the rigging: it will therefore be seen, that, on giving motion to the screw, which is effected by means of a tommy, or spanner, which is made to fit on a boss, or enlarged part formed in the centre of the screw, the two bosses will be simultaneously drawn together or separated, so as to slacken or tighten the parts of rigging to which they may be attached at pleasure.

The second part of the invention relates to a hook which is constructed at the lower part where the curve takes place, with a hinge joint; the two parts of the hook thus formed, when affixed to the rigging, are secured by a cord or "mousing." These improvements, with respect to the screw lanyard, are stated to be preferable to the present mode of securing rigging, for this reason, that they can be slackened or tightened in any weather without impeding the vessel's course, and in the application of the above to vessels of war, the inventor presumes that, on account of the cylindrical form of the screw lanyard, a shot would glide off, and thereby preserve the shroud, whereas, by the present mode of constructing them, the lanyard would be cut, and the shroud disengaged, and thus cause danger and inconvenience to those working the ship. Lastly, the hook, which may be used in connexion with the screw lanyard, for securing the shrouds, being secured by the mousing, may, in case of sudden storm, or where it is necessary to cut away the masts and rigging, be disengaged at a moment's warning, by simply cutting the cord or mousing, which will allow the hook to fly open.

The inventor claims, first, the mode of working a double screw into two separate boxes bored out to receive the screw, and applying the same to standing rigging. Secondly, the exclusive manufacture of a hook or hooks with a joint or hinge, and the privilege of attaching such hook to chains or standing rigging.

FLATTENING GLASS.

JAMES HARTLEY, of Wear Glass Works, Sunderland, Glass manufacturer, for "*Improvements in the manufacture of glass.*"—Granted July 6; enrolled January 6, 1844.

THE present mode of flattening cylinders of glass, appears, from the specification to be defective, inasmuch as the heat of the cylinder to be flattened is the greatest on that side next the flattening stone, which side of the cylinder, being towards the fire, becomes highly heated, in consequence of which, such side will flatten, whilst the other side, being comparatively little heated, will retain much of its stiffness; the first part of this invention, therefore, consists in the application of a rotary stone of about 10 in. diameter, which is fixed at the right of the flattening stone, in the position where the cylinders are usually put before being moved to the flattening stone: on the under surface of the rotary stone is an axis which is caused to rotate in suitable bearings, so that the workman may readily turn round the stone with the cylinder of glass upon it, so that the heat of the glass can be kept equal on all sides. The patentee, in the second part of his improvements, states that some difficulty is experienced in getting a cylinder of glass, after it has been cut open, flat upon the stone, in consequence of the air which is between the flattening stone and the glass; to obviate this, Mr. Hartley perforates the flattening stone with a number of small holes, about ⅛ of an inch in diameter, which allows the air to escape from underneath the plate of glass; it is possible that a stone so perforated would mark the face of glass, but where such plate is to be ground and polished it is of no consequence, as the marks would be removed by the operation of grinding. The third part of the invention relates to certain improvements in the bed or table upon which plate glass is ground; the mode hitherto employed has been, to form a bed of plaster of Paris; in place of this, a bed is formed by a sheet or sheets of india rubber cut about ⅜ of an inch in thickness, and of a size dependent upon the plate to be ground; owing to the adhesive quality of india rubber, the plate of glass will be found to adhere very firmly during the process of grinding and polishing.

Lastly, in the manufacture of crown glass, it is well known, that just before introducing the glass into the flashing furnace, the nose of the glass is heated in a furnace constructed at one side, and which is called the nose-hole; the air which causes the rush of vapours through the nose hole, is introduced below the fuel; by which means the draft causes a dust and certain vapours to pass this nose-hole, which is found to be prejudicial to the glass; the mode of obviating this is by constructing air tubes which proceed from the outside of the glass house; by these tubes air is conducted to the furnace, and allowed to enter in streams at the sides, or front, and above, to the fuel, which entirely obviates the defect above referred to. The claims are for the improvement in the flattening kiln capable of rotating; for successively receiving the cylinders of glass to be flattened before they are moved on the flattening stone. Second, the application of a perforated flattening stone. Third, the use of india rubber for the purpose above described. Fourth, the peculiar mode of constructing a furnace for heating the nose of crown glass before introducing the same into the flashing furnace.

METALLIC ROOFS AND JOISTS.

JAMES BRYDELL, Junior, of Oakfarm iron works, near Dudley, Staffordshire, Iron master, for "*Improvements in the manufacture of metallic roofs and joists and improvements in joining sheets or plates of metal for various purposes.*"—Granted July 6; Enrolled January 6.

THE mode of constructing metallic roofs, according to the first part of this invention, is as follows; the rafters are made with a groove along the upper edge; and the plates forming the covering, which are of a rectangular form, are bent down at the sides, so as to form a right angle with the surface; one end of each of the plates is also bent down in like manner, and the other end bent upwards, so that when the plates are put together, the lower end or that bent downwards, laps over the upper end of the plate adjoining, the end of which is bent upwards, the lateral edges of each of the plates fitting into the grooves formed in the rafters, into which they are secured by means of wedges, the space between the plates is then filled with asphalte: another mode is by forming a groove in the rafters as described, and also in the stretchers, which, on being put together, form a rectangular or oblong groove, the edges of the plate in this case are bent one way, and made to fit the rectangular groove; the plates in this case are secured by wedges, and the water prevented passing through the joints by filling the space with asphalte.

The second part of the invention relates to a mode of joining metallic battens or laths; in this case the rafters are formed with a mortice on the upper edge, and the ends of the battens so constructed as to fit in the same, which are to be constructed as above described. The third improvement consists in forming the rafters partly of wood, and partly of iron; this is also effected by forming a groove in the edge of the rafter, which is afterwards to be filled with wood, so that the laths or battens, when tiles are to be employed, may be nailed to the rafters.

Fourth, and lastly, this part of the invention relates to a mode of welding iron plates, and bars of iron together; for this purpose the patentee erects a pair of rollers close to the mouth of the furnace; the plates intended to be welded may be affixed together by a lap joint, or a bar of iron may be placed upon the plates so as to cover the joint. The plates are then to be secured by means of rivets or clamps, and placed in the furnace; the rollers are so constructed that the top roller is capable of being raised, so that the workman can put a pair of tongs between, for the purpose of taking hold of the plate; when the plates have got to a welding heat, they are withdrawn, and one end placed between the rollers, which on being set in motion, will draw the plates from the furnace, and the parts will be welded together by the pressure. When it is required to strengthen a plate of iron, a number of small pieces may be placed upon the surface in various devices, and the plate heated and welded as above described.

The inventor claims first, the mode of constructing metallic roofs by employing iron rafters with grooves and metal plates turned at their edges. Second, the mode of making metallic roofs by applying iron rafters with grooves for receiving iron laths. Third, the mode of constructing wrought iron rafters and joists with grooves for wood. Fourth, the mode of joining plates or sheets of iron, by causing them to be welded by means of the pressure of rollers.

RECTILINEAR INTO ROTATORY MOTION.

JAMES BOOTH, of Liverpool, clerk, and doctor of laws, for "*Certain improvements in the means of converting rectilinear into rotatory motion, and of converting rotatory into rectilinear motion.*"—Granted July 6; enrolled Jan. 6.

THE specification, after referring to the various mechanical arrangements which have been employed for the above purpose, proceeds to state that it is a well known mathematical principle that if a right line of fixed length is in motion, and its ends move in two right lines that are at right angles to each other, the centre or middle point of such right line will describe a circle, whose diameter is equal to the length of the given right line; let A B, fig. 1, be the right line, and C D, E F be right lines, at right angles to each other, and O the middle point of A B; then if the extremities move alternately on the lines C D, E F, the point O will describe a circle, whose centre is I, and diameter A B; it is from the above principle that the inventor bases his invention, which is as follows. Fig. 2, is a sectional elevation; A A is a framework of iron, supported by pillars B B, C is the cylinder of an engine, D the piston rod, attached to a cross head, each end of which passes through a slide *d*, made to work freely in the grooves or openings E E, of the framework A A. Fig. 3 is a view of the framework A A, showing the arrangement of parts for converting the rotatory into a rectilinear, and the rectilinear into a rotatory motion. G is the main or crank shaft, H the crank, and I a connecting or coupling, one end of which is attached to the slide *d*, working in the vertical groove, the other end being connected to a slide working in the horizontal groove E, and the centre or middle point connected to the outer end of the crank H. It will be evident, that on motion being imparted to the piston rod, the extreme ends of the connecting link (or slides) will move in a horizontal and vertical direction, which combined movements will give a rotatory motion to the crank shaft. It is perhaps worthy of notice, that if the cranks (there being two) be placed in opposite directions, or in a line with each other, the shafts to which they are affixed will revolve in opposite directions. Mr. Booth claims the conversion of alternate rectilinear motion into continuous rotatory motion, and *vice versa*, by the combined action of the ordinary working cranks, in connexion with arms or sliding cranks, the ends of which are caused to move in grooves at right angles to each other, as described.

Fig. 1.

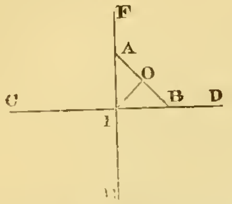


Fig. 2.

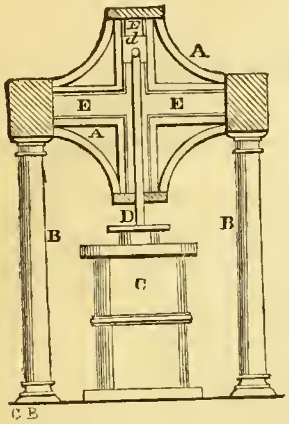
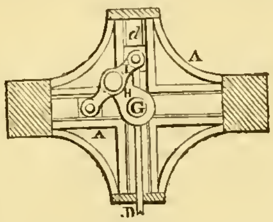


Fig. 3.



IMPROVEMENTS IN PROPELLING.

James Joseph Brunet, of Limehouse, Middlesex, Esq., for "*Improvements in propelling*."—Granted July 6; enrolled Jan. 6.

The first part of this invention relates to an improved paddle wheel, the float boards of which can be forced outwards, or drawn in, or reefed or unreefed as may be desired. This improved wheel is constructed with two float boards to each arm of the wheel, one placed at the front side of each of the arms, and the other at the back, and attached together by means of a diagonal arm, so that the floats are in two different places, but so situated with respect to each other, that the inner edge of one coincides with the outer edge of the other; in place of bolting the floats to the arms of the wheel, they are so constructed as to be disengaged from the arms, or in other words, to be locked and unlocked, with respect to the arms, at pleasure; this is effected by means of two wheels, one of which the patentee terms the compression wheel, and the other the reefing wheel; these wheels are made to turn freely on the shaft of the paddle wheel, and have motion given them by means of an arrangement of gearing and a winch; to each pair of float boards is attached, by means of a pin joint, one end of a diagonal arm, the other being attached, in like manner, to the periphery of the reefing wheel, which, in being put in motion by the aforesaid gearing and winch, the floats will be drawn towards the axis of the wheel, and the same will be unlocked, or disengaged, from the arms of the wheel.

The second part of the invention consists in another modification of the above, the difference being that the floats are placed further apart, as in the ordinary paddle wheel, and in a line, or some circular plane with each other, at equal distances from the axis; in this case, each alternate float only is connected to the reefing wheel, and is capable of being reefed and unreefed, the other being bolted to the arm of the wheel. The inventor claims the reefing and unreefing of floats of paddle wheels by the combined action of reefing wheels and connecting rods.

The third part of these improvements consists in a mode of propelling vessels without the aid of paddle wheels, or other external propelling machinery. This is effected by causing a continuous stream of water to be drawn through a number of openings, either at the bow or sides of the vessel, and then ejecting or forcing the same through a number of openings at the stern of the vessel, whereby a retractive force is obtained, which propels the vessel forward. For this purpose a steam engine of sufficient power is employed to work a three-throw crank, which gives motion to three pumps that inject and eject the water in a continuous stream, thereby propelling the vessel forward.

The last part of the improvements consists in a new mode of connecting and disconnecting the cranks of the paddle shafts of steam vessels, and the cranks of the engine; this is effected as follows:—A piece of iron of the form of a washer, having a portion of its circumference, equal to the diameter of the hole, cut out, is affixed to the end of the crank of the paddle-wheel shaft by means of bolts; the opening in the above is in a lateral direction and of sufficient size to receive the end of the "toe-pin," or crank-pin, which pin is fixed to the crank of the engine shaft in the ordinary manner; the mode of securing the end of the crank-pin into the opening of the piece of iron bolted on the crank of the paddle shaft, is by a strong iron ring, which in the first place is passed over the crank-pin, and the ends of the two cranks brought together, so that the end of the crank-pin passes into the opening of the piece of iron, and is there held by slipping back the ring, and passing it over the aforesaid piece of iron bolted to the crank of the paddle-wheel shaft. The patentee claims the mode of propelling a vessel by causing water to flow from the outside into and through pipes, and to be ejected continuously through orifices placed near the stern, by means of two or more pumps.

Lastly, the mode of connecting and disconnecting the crank of the paddle wheel shaft to the crank of the steam engine shaft.

PORTABLE ROOF.

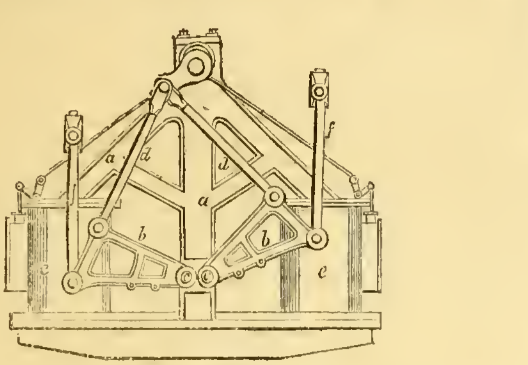
George Parsons, of West Lambrook, near South Petherton, Somersetshire, gentleman, for an "*Improved portable roof for agricultural and for other purposes*."—Granted July 6th; Enrolled January 6th.

The portable roof, as described in the first part of the specification, consists of an iron boss or socket, having a collar at each end; in the circumference of one of the collars there is a number of mortices for receiving the upper ends of the rafters, the lower ends being attached to a suitable framework of a circular form, supported by the lower part of the socket; the roof so constructed is made to slide over a pole made in the form of a screw, by nailing or otherwise fastening thereon a number of segments of metal, which, when joined together, are of a spiral form; the screw pole so constructed is made to pass freely through the socket, within which is an antifriction roller that rests upon the plate or plates of metal forming the screw: it will be seen that this description of roof can be easily removed, as it is only required to provide a block or pedestal having a hole in the top for receiving the screw pole and keeping the same in a vertical position; and in order to raise or lower a roof in constructing or removing a hay rick, so as to protect it from the weather, it is only necessary to give a rotary motion to the roof, and the same will be raised or lowered as may be required. Another description of roof, which is of an oblong form, is supported by two poles, but in place of raising and lowering the roof as above described, at each end of the roof there is a pulley, each pulley being provided with a ratchet wheel: round one of the pullies there is a rope or chain, which passes in a horizontal direction to the pole adjoining, and over a guide pulley to the top of the pole, where it passes over another guide pulley to the top of the other pole, and from thence in like manner once round the other pulley at the opposite end of the roof; thus by giving motion to the axis of each of the pulleys by means of a winch, the roof can be raised or lowered at pleasure. Another mode of supporting and raising the roof, is effected by boring a number of holes in each pole and passing pins through, upon which the ends of the roof are made to rest. The patentee claims, first, the arrangement of a roof formed round a sliding socket capable of being moved up and down at pleasure, on a pole. Second, the peculiar method of raising and lowering a roof, first by a spiral worm and antifriction roller in the socket; and, secondly, by a ratchet wheel and pulley. He also claims the application of a gauge rod, which is fixed to the lower collar of the socket of the roof first described, which gauge is capable of being moved round independently of the roof, for the purpose of regulating the diameter of the hay rack about to be constructed.

IMPROVEMENTS IN STEAM ENGINES.

Jacob Samuda, of Southwark Bridge Iron works, Surrey, Engineer, for "*Improvements in the construction of steam engines, particularly applicable to the purposes of steam navigation.*"—Granted July 10, 1843; Enrolled January 10, 1844.

The first improvement consists in a novel construction of the steam engine, whereby the cylinders are placed almost over the keel of the boat; the steam cylinder, piston rod, cross head, and side rods, are of the ordinary construction, but in place of the side lever beams, Mr. Samuda employs a lever of a triangular form moving upon centres, which gives motion to the connecting rod; the cylinders of this engine are not exactly in a line with each other but a little sideways, and in an opposite direction to each other, so that the connecting rods may work close to each other, but if it is desirable to have the cylinders in the same line, it can be effected by cranking one of the connecting rods, so as to receive the other: the following sketch, which is an elevation of the engine with one side removed, will serve to illustrate more clearly the novel construction of the same; *a a*, is the framework of the engine, *b, b* two iron triangles working on centres *c, c*, fixed to the framework; *d, d* the connecting rods, the lower ends of which are connected to the ends of the triangle by pin joints, and the upper ends to the single crank pin; *e, e*, the cylinders, *f, f*, the side rods connected at one end to the cross head of the piston, and at the other end to the triangle by a pin joint as shown by the drawing.



The second part of these improvements consists in a modification of the above, but in place of one cylinder being employed at each end of the frame, there are two cylinders placed abreast of one another; in this case there are four air pumps employed which are worked from the cross head, but if preferred one only may be employed, which may be placed in the centre of the frame and worked from the crank shaft; the condensers are underneath the bed plate of the engine. The cylinders in the third part of these improvements are elevated upon brackets cast or otherwise fixed to the framework, so that the pistons descend and are connected to the ends of the triangles by short links; the eccentrics in this case are fixed one on each shaft, and the crank pins are connected by a link, so that the engines in case of an accident, can be worked independently of each other. The fourth part of these improvements shows the application of the above to vessels moved by submarine propellers. Some idea may be formed of this part by inverting the annexed sketch. In this case the triangles are placed above the main shaft, which latter passes through the stern of the vessel, and upon it is fixed a drum having arms of plate iron made in a spiral form, so as to have the effect of forcing a very solid body of water through, the reaction of which has the effect of propelling the vessel. Fifth improvement consists in the arrangement of two vibrating cylinders inclined at an angle of 45 degrees, and an open topped air-pump placed between them, all of which are worked from one crank pin. Sixth improvement relates to a mode of working the exhaust valves of steam engines, the steam valves being constructed in the usual way. For this purpose, two segments of metal sufficiently long to cover the exhaust passages are made to fit the inner circumference of the cylinder; these segments of metal, which are connected together by a rod, are actuated by the motion of the piston, that is to say, when the piston has nearly finished its upward stroke it comes in contact with the segment at the top of the cylinder, and closes the exhaust way at the top, and opens that at the bottom, and *vice versa*. The seventh relates to a mode of regulating the expansion valves of steam engines and so as to cut off the steam at any point of the stroke; each expansion valve is worked by a cam or eccentric having a boss cast on one side, and bored out so as to fit the crank shaft and work loosely upon it through the circumference of the boss, and about one third or fourth of the way round is made a slot; a hoop is then bored out to fit nicely upon the boss of the eccentric, and through the circumference of this hoop is made a spiral slot; a pin is then passed through the slots of the hoop and eccentric, and is fixed into a hole formed in the circumference of the shaft; the hoop it should be observed, is prevented turning round upon the boss of the eccentric by means of keys; it will therefore be seen that on moving the hoop endwise, which is effected by a bell-cranked lever actuated by a screw, that the eccentric will be turned round upon the shaft, whereby the expansion valves can be regulated so as to cut off the steam at any required part of the stroke.

The eighth and last improvement is for a mode of constructing a governor for regulating the discharge of the saturated brine from the boilers; to effect this a valve box is made in the discharge pipe, having a conical valve, on the spindle of which there is a helical spring which acts against a collar formed on the end of the spindle, so as to raise the valve and thereby increase the size of the aperture; the action of the steam and brine upon the base of the cone, will of course have the effect of closing the aperture by forcing into it the apex of the cone, and the same will be regulated according to the pressure of steam in the boiler.

STONE SAWING MACHINERY.

William Hutchison, of Ivy-bridge Lane, Strand, Middlesex, marble merchant, for "*improvements in machinery for cutting or sawing marble and other stones.*"—Granted July 13, 1843; enrolled January 13, 1844.

This improvement consists in the application of a saw guide, or frame fixed above the block of marble or stone to be cut, whereby the sawing of stone is rendered very easy, and capable of being done by any man or boy of sufficient strength to move the saw frame.

The saw guide consists of two pieces of timber parallel to each other and a few inches apart; these timbers or guide are placed above the stone, and supported at each end by transverse pieces, which pieces are capable, by means of screws, of being raised or lowered at pleasure. At each end of the saw frame (which may be of the ordinary construction) there are two anti-friction rollers which work between the guides, and serve to keep the saw frame in a vertical position; in addition to the screws above referred to for raising the pieces of timber that support the ends of the guide frame, there are also screws for moving and adjusting the said guide frame laterally, by means of which the saw can be set to any part of the face of the block of marble or stone when it is required to cut it into slabs, and the guide frame by the arrangements above described, can also be set to any required height. Another improvement in this apparatus is in the application of a weight for bearing up the saw frame, so that the sand and water may get freely under and pass the blade of the saw; for this purpose a pulley, capable of adjusting itself to the position of the saw frame, is suspended from a bar affixed to the roof of the building; a rope, having a counterbalance weight at one end, is passed over the pulley, and attached to the frame of the saw, which will have the effect of supporting the same as may be required. The claims are for the mode of guiding saws worked by hand by means of guides, together with the moving of the guides laterally or vertically by means of screws; also the application of the anti-friction rollers, and lastly, the mode of suspending a pulley that moves with the saw guide.

STEAM PROPELLING MACHINERY.

Joseph Maudslay, of Lambeth, Surrey, engineer, for "*Improvements in machinery used for propelling vessels by steam power.*"—Granted July 13, 1843; enrolled January 13, 1844.

The first part of these improvements relates to a mode of transmitting power from one shaft to another, for the purpose of driving or giving motion to a submarine propeller. The main or crank shaft in this case is in a line with the keel of the vessel; on the end of the shaft (which may be prolonged to any convenient distance towards the stern of the vessel) there is a drum, having a number of grooves in its periphery. On the end of the propelling shaft, which is placed below and parallel with the crank shaft, there is another drum of smaller diameter having a like number of grooves formed in its periphery; these drums are keyed on their respective shafts in such manner with regard to position, that the grooves in one of the drums are opposite the spaces of the other drum: the mode of transmitting motion from the drum of the crank shaft to that of the propelling shaft, is by a rope which circulates with repeated convolutions around the two drums. The rope in the first place is passed over the drum of the crank shaft at one end, it is then conducted by means of two guide pulleys to the opposite end of the drum, and made to pass under the drum of the propelling shaft into that groove nearest the end of the drum; it is then passed over and under the two drums until it reaches the opposite end, at which place the two ends of the rope are spliced together. Between the two drums there is another pulley fixed on the end of a moveable lever, actuated by a screw; the object of this apparatus is to tighten the rope when required, which is effected by causing the pulley to press against the rope. The patentee claims the improvement in machinery for propelling vessels by steam power, which consists in the application of an endless rope or ropes circulating with repeated convolutions around grooved drums, for the purpose of transmitting motion from one drum to another. The second improvement consists in the application of a revolving propeller having two, three or more oblique vanes, and also in the application of two rudders in place of one, which rudders are placed behind the revolving propeller, as seen in the accompanying diagram. Fig. 1 is a side elevation of a portion of a vessel, showing one of the rudders and the revolving propeller. Fig. 2, an end view of the same: *a a*, is the revolving propeller fixed upon the end of the shaft *b*, which passes through the stern of the vessel, as shown by dotted lines. The propelling shaft receives its motion from the

Fig. 1.

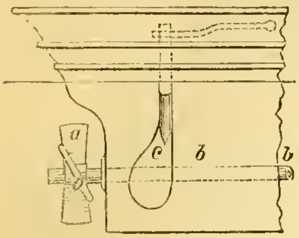
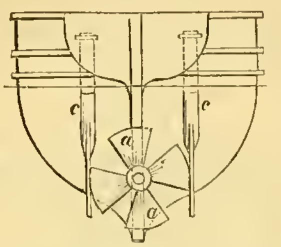


Fig. 2.



crank shaft of the engine in the manner above described, or the same may be driven by spur wheels: *c, c*, are the two rudders, the situation of which will be seen by the drawing. Mr. Maudslay claims for this part of the invention the improvement in machinery described for propelling vessels, which consists in the application of any revolving propeller by oblique action, being situated behind or abaft the stern post of the vessel, and substituting for the ordinary rudder two rudders, when such rudders are used in combination with the revolving propeller.

STREET CLEANING APPARATUS.

Stephen Geary, of Hamilton Place, King's Cross, Middlesex, Architect, and Civil Engineer, for "*Improvements in machinery, or apparatus, for clearing, cleansing, watering, or wholly or partially covering with sand, or other materials, roads, streets, or ways; and which machinery is also applicable to other similar purposes.*—Granted July 13, 1843; Enrolled January 13, 1844.

The machine, as described in the first part of the specification, consists of a large drum or cylindrical case of wood, or other material, mounted in a frame running upon two wheels; to one of these wheels is fixed a spur wheel, which takes into and drives a wheel keyed on the end of a horizontal shaft, which passes through the centre of the machine; upon this shaft, and within the machine or cylinder, there are keyed two wheels, or circular pieces of wood, having notches or openings in the periphery, which receive the ends of two or more pieces of wood or metal, which are denominated the "stock;" between these pieces of wood or metal, the brushes or brooms, formed of any suitable material, such as "birch, cane or whalebone," (or scrapers of wood or iron), are secured by means of screws or rivets. It will, therefore, be seen, that on motion being given to the machine, a rotary motion will be imparted to the axis, upon which is keyed the circular pieces of wood, and the brushes (which may be arranged in consecutive order, or alternately with scrapers, or scrapers alone may be employed) are caused to act against the surface of the ground, whereby any accumulation of dirt will be removed by the brushes, which are in close contact with the internal surface of the cylinder, and the same will be conducted by the brushes or scrapers, and deposited into a receiver formed within the machine, and from which it can be removed through an opening formed for that purpose. The claim is for the construction and application of revolving brushes or brooms when acting against a fixed curved surface, or portion of a cylinder, with which they are in close contact, for the purpose above described.

The drawings show another modification of the machine above described, in which the receptacle for the dirt, in place of being within the machine, is placed in front; in this case the receiver may be placed on a pair of wheels, and so constructed as to be detached from the machine itself. Another part of these improvements relates to the application of certain parts to the machine first described, whereby the said machine may be rendered available for the purpose of watering the streets or roads, when the machine is not required for the purpose of removing dirt or soil. In order to convert the aforesaid machine into a watering machine, it will be necessary, in the first place, to throw the wheels out of gear and remove a portion of the brushes. The reservoir, in this case, is constructed with openings at the lower part, to which are attached the branch pipes, provided with a valve or stop cock, and delivery pipe, which is perforated in like manner to those in ordinary use. The next step is to fill the reservoir with water, when the machine is fit for use, and can be employed for the purpose of watering streets, roads, or ways. The claim is for the general combination and arrangement of parts constituting a machine for the purpose above described.

Another part of these improvements relates to the application and arrangement of certain parts to the above mentioned machine, whereby it may be employed for the purpose of distributing sand or other material, over and upon the surface of roads, so as to afford a better foothold for horses, and also more secure for pedestrians. Presuming the machine last above described to be employed for this purpose, it will be necessary to remove the pipes, &c., and the reservoir, which is constructed with a flange, has another portion affixed to it by means of bolts, which, when put together, form a circular reservoir, with an opening at the lower part for the delivery of sand, or other material, which is regulated by a slide or hopper. The patentee does not claim any of the separate parts of the machine above described, except so far as the same may be employed in the general combination and arrangement of parts constituting a machine or apparatus for the purpose above described.

PROCESS FOR OBTAINING AMMONIA AND CYANOGEN.

Richard Laming, of Radley's Hotel, New Bridge Street, Blackfriars, gentleman, for "*Improvements in the purification and application of ammonia to obtain certain products.*"—Granted July 13, 1843; enrolled January 13, 1844.

In order to obtain ammonia according to the first part of this invention, sufficiently pure for the arts, the patentee employs a solution of muriate of lime and gas water, as follows: a sufficient quantity of muriate of lime in solution is mixed with gas water, in order to convert the ammonia which is present into muriate of ammonia; the carbonate of lime is then separated, and the remaining solution boiled for an hour, and then left to cool; it is afterwards mixed with a sufficient quantity of hydrated oxide of iron to combine with all its sulphuretted hydrogen, and secondly with sufficient lime to saturate the muriatic acid which is present, after which the solution may be distilled, when the ammonia will be found in the water in a tolerably pure state. The second part of these improvements is the application of ammonia to the production of cyanogen, so as to make prussic or hydrocyanic acid the primary result, and at a price so low as to admit of its application to the economical production of the cyanurets, ferrocyanurets, and hydrocyanates. Generally the process is as follows: the inventor provides an iron cylindrical retort about 1 ft. 6 in. diameter and 8 ft. long; this cylinder, which is lined with fire bricks, and filled with pieces of charcoal, is set vertically in a furnace, and brought to a red heat; ammonia in the form of vapour, with certain other substances, which do not prevent the desired result, is introduced by a pipe near one end of the retort. In its passage the ammonia is deprived of part of its constituent hydrogen, while the remaining part, together with its nitrogen, combines with carbon to form prussic or hydrocyanic acid, which finally escapes from the heated vessel in the form of vapour, mixed with other matters, amongst which will be some of that substance in an undecomposed state. The prussic acid vapour thus obtained may be condensed in water, for subsequently making the compounds of cyanogen and for other purposes, or it may be brought at once into communication with the several substances with which it, or its constituent cyanogen, is to be combined; for instance, it may be received into water containing certain metallic oxides, with which it will make the corresponding metallic cyanurets or hydrocyanates, &c. The patentee claims the making of prussic or hydrocyanic acid by the re-action at a red heat of any convenient form of carbon and ammonia, by whatever means such re-action is established: also the use of prussic acid so made for saturating and dissolving bases; and thus giving existence to cyanurets and hydrocyanates, and for other purposes, to which prussic acid is or may be usefully applicable.

Condensation of Carbonic Acid by Charcoal.—The cells of wood charcoal have a diameter of about 1-2400th of an inch, and if a cubic inch consisted entirely of cells, their united surface would amount to 100 square feet. By experiment it can be shown that the cells constitute five-eighths of the whole cubic contents of the charcoal, and, allowing for the space occupied by the charcoal, the actual surface of the cells will be about 73 square feet. When charcoal is plunged into carbonic acid gas, it absorbs into its cells no less than 56 times their cubic contents at the ordinary temperature and pressure, and, consequently, the gas is condensed to 56 atmospheres. But according to the experiments of Addams, carbonic acid liquifies under a pressure of 36·7 atmospheres, and we are hence compelled to conclude that above one-third of the carbonic acid which is condensed on the walls of the cells is in the liquid state.—*Mitscherlich.*

THE PHILOSOPHY OF DESERT FORMATIONS.

No. 5.

Were the love of learning to be revived among the Arabians, and did their philosophers turn their particular attention to the modern science of geology, their opinions and theories, suited to the phenomena before them, would be peculiar to themselves, and such as embrace a system of oceanic deposits alone, excluding many of the phenomena now so familiar to even the unlearned reader: instead of describing a succession of catastrophes, so strikingly manifest in many of the formations of Europe, their ideas would be confined to the extreme simplicity of the desert strata, and to those changes which have taken place in fossil bodies and fossil beds, and by which changes, dependent upon climate and position, the mineral kingdom is produced: and could they not avail themselves of modern discoveries, facts which speak for themselves, requiring no interpretation, their ideas would be narrowed to the days of Woodward and others, and their theories would be equally ridiculous. On the other hand, did modern geologists take the trouble of visiting and exploring these lands, submitting with resignation and cheerfulness to the necessary privations and dangers attending these journeyings, there is little doubt but great changes would take place in their respective theories: they would undoubtedly learn and unlearn much.

In the preceding chapter I have confined my observations to oceanic fossil formations, and in these are naturally included all desert soils; but, inasmuch as the mineral kingdom is extensively developed in these wastes, it becomes necessary, in order to explain with perspicuity and simplicity the phenomena of nature, to enter into more minute details of the causes of effects manifest in the creation of rocks, stones, earths, and metalline bodies. The multitude of fossils found in all parts of the earth, arranged in groups and families, forming in many instances entire strata, and generally disseminated over the surface or in the interior beds, attest to the wonderful changes which this planetary body has undergone during the revolutions of Time. Exclusive of the magnificent fossil formations of the deserts, which are very often some hundreds of feet in thickness, and which, in fact, compose the entire strata, every portion of the earth exhibits the like phenomena of oceanic and mineral formations; the chalk deposits, extending over a great portion of the British isles, northern France, Germany, Denmark, Sweden and Russia, as also in North America, however dissimilar in their lithological composition, agree in their character of oceanic organic bodies; and such may be said of the oolite and shell limestones. On searching into the lower strata, we invariably find fossil bodies analogous to those now forming beneath the waters, or but recently abstracted from them, and so perfect is their state of preservation, that we are enabled not only to identify the genera or order to which they belong, but also to discover the sequence of events and the manifold influences under which they were produced; we distinguish in the Ichthyosauri, ammonites, echini, clumps of coral, and families of shell fish, the once living occupants of quiet seas and tropical heat, which must have lived and propagated their kind in those places where we now find them; and as Cuvier truly remarks, they are found in elevations far above the level of the ocean, and in places where the sea could not have been conveyed by any existing cause. They are not only included in loose sand, but are often embedded in the hardest stones. Every country, every continent, every island of any size, exhibits the same phenomena. To what other conclusions, therefore, can we come, but that the most elevated parts of the earth were once covered by the waters, that those vast chalk and oolite deposits, hills of carbonate of lime, and valleys of oceanic marl, owe their origin to oceanic organic bodies? The varied phenomena also testify, that, although by changes of the earth's axis of rotation, some portions of these elevated lands have been again, and perhaps again submerged, the general appearance of the earth testifies to the operation of very slow causes of effects manifest, as well as to the gradual but universal decrease of the waters. The earths produced by atmospheric influences, although wonderful to contemplate in their variety and extent, are as nothing compared to the oceanic formations, to the existence of which the former owe their origin and many of their peculiar properties; with the exception of several varieties of schist and basalt, the bulk of aggregate, and in general the entire mass of rocks forming the prominent features of the earth, are exclusively oceanic, and most of the mineral bodies included in the carboniferous beds are produced by oceanic influences.

The protean powers of nature are strikingly manifest in the changes which take place from the living body to the mineral compound, the same species of shell fish is seen under a variety of forms: it resolves into marl or chalk, it silicifies as flint, it is identified in limestone or shell marble, it sometimes consists of several distinct minerals, thus chalk and flint often form separate parts of an echinite, and in Derbyshire, chalk, calcareous spar, bitumen and quartz, are frequently incorporated in the same shell; many of the after changes are still more beautiful: thus some are converted into Egyptian jasper, others into amethyst quartz, chalcedony, or carnelion. It is only when we follow the order of these changes, and become acquainted with the laws which govern and direct them, that we are enabled to form a correct idea of their extent and importance in nature: thus many of the chalk and oolite formations, and the limestones, have no appearance of organic remains left, in consequence of the general decomposition of the fossil bodies of which they are composed; but the material of these bodies is left as an undeniable record of their previous existence, as sure and certain as the comminuted particles of land vegetation, termed earth, denote the previous existence of terrestrial vegetable earth; and in corroboration of these facts, the same slow but certain changes are continually taking place before our eyes, until they are lost sight of in crystalline bodies.

Did this earth exist merely by decay and re-production, the phenomena of nature would similate to the causes in action, the rocks would moulder into sands and pebbles, and the terrestrial and oceanic matters would be so intimately blended together as to defy classification: but, is such the case? the oceanic earths, consisting of varieties of sands, marls and calcareous matters, limestone rocks, and siliceous bodies, are throughout the by far greater portion of the earth of unmixed qualities; thus vegetable earths are not found in the vast desert beds of the earth, nor does alumina enter into their composition, until such time as they become blended with terrestrial earths, or exposed to long atmospheric action: the syenites, porphyries, basalts, &c., simply siliceous bodies composing these oceanic tracks, are peculiar to them, and peculiar to their respective localities: the carboniferous formations bear an analogy to the formations of Europe and America which have not been intruded upon, by herbaceous plants and other organic products of dry earth: every portion of their soils is the product of organic action, or of action resulting therefrom: every stone is a group of fossil organic bodies, the body or fragment of a body of some inhabitant of the deep: the sands in their primary state principally consist of the comminuted particles of mollusca, but the shelly texture soon disappears after exposure to atmospheric influence: the animal oils have become mineralized, and either preserve their quality as naphtha, or they enter into combination with other substances, and thus disappear partially or wholly from the view. In all, and through all, we acknowledge the fossil kingdom as the basis of, and the proximate cause of the production of numerous mineral bodies.

The deserts of Persia are exceedingly extensive, and according to Chaudin, not more than one-tenth part of that country was cultivatible in his time. On the east of the Tigris a considerable desert commences, pervaded by the river Ahwaz, and extending to the north of Shuster, about 140 miles in length and 80 in breadth. The great Saline desert, including the great desert of Kerman, is about 700 miles long by a medial breadth of 200 miles; attached to this is the desert of Mekran. This immense area, extending 200 miles, is impregnated with nitre and other salts, which taint the neighbouring lakes and rivers. The whole country is distinguished for its deficiency of rivers, and a multitude of rocky mountains without vegetation. The soil of the plains is in general stony, sandy, barren, and everywhere so dry, that if it be not watered, it produces nothing, not even grass: even the clays on the banks of the Euphrates are strongly impregnated with muriate of soda. Separated from the great desert of Kerman, and bounded by mountain ranges and the Indian Ocean, are other extensive deserts of Baloochistan. The great desert of Zaharah stretches from the shores of the Atlantic to the confines of Egypt, including a space of 2500 miles in length and 700 in breadth, the whole of which, except a few insulated spots of comparative fertility, are sterile and desolate, consisting of barren plains, shifting sands, and ranges of hills composed of that peculiar class of rocks common to oceanic deposits, and sometimes wholly composed of rock salt. Its borders towards the Atlantic present in many places a succession of sea beaches, the table land rising upwards of 20 feet above the present level of high water. All the great deserts of the earth are most unquestionably ocean beds whence the waters have gradually receded, or otherwise have been suddenly thrown off by changes in the earth's plane of position, occasioning local or general catastrophe; where they have gradually retired, is evidenced by immense deposits of muriate of soda covering the surface of valleys, and forming hills of considerable magnitude, as well as entire strata disposed beneath the surface: on the other hand, their sudden retiring is denoted by the violence done to the elevated strata, and by the peculiarity of the valleys, which exhibit by strong water lines the rapid retreat of the ocean waters. Most deserts have their peculiarities thus the deserts of Lybia, Syria, Cobi, Hindostan and Persia, are noted for their sands; the Suez and Nubian, and Arabian deserts, for their saline and fossil beds, some of the Persian deserts, the desert of Ava, and others, for their immense quantities of naphtha, petroleum or mineral pitch; all of them abound with fossils, of species analagous to those now inhabiting the bordering seas, with petrifactions in which many species of fish may be distinguished, commingled with natron, the sulphates, and muriates, gypsum, limestone, magnesia, ocean marl, and other peculiar products, which denote oceanic origin: such is the general composition and character of the exterior beds, and such it appears to be beneath the surface, so far as the discoveries of man extend. Even the rocks of syenite, basalt, porphyry, sandstone and limestone, partake of the same nature, and from the simplicity of their components, and the total absence of potash and other peculiar products of terrestrial vegetables, must be exclusively assigned to the ocean. In and throughout the whole, the coral formations are exceedingly extensive, passing by a variety of transitions into rocks and earths, and silicified stones, and in the latter state lying loosely spread over the valleys, resembling in appearance, and being often mistaken for trunks of trees.

"The Arabian Desert," says Niebuhr, "bears every mark of having recently been a part of the bed of the ocean; and its little elevation above the sea would require but a small rise of its waters to restore this desolate track to its former condition. Its subsoil like that of the deserts is a grey clay, with a large proportion of sand intermixed with marine exuviæ, extending to a great distance from the sea. It contains large strata of muriate of soda, which in some places rise up in hills of considerable elevation. Its gentle and uniform slope towards the sea seems to indicate that it has gradually emerged from the ocean, which is still receding from it." The advance of the land upon the Gulf of Persia is exceeding great; indeed Charles T. Bell calculates it to be more than 280 miles since the last catastrophe, and there is certainly every reason to suppose that the whole extent of the great salt desert was at no very distant period covered by the waters of the Gulf, everything upon and beneath its surface demonstrating oceanic origin. The great salt plain at the head of the Red Sea is of like composition with the surrounding deserts, and in the days of the early kings of Egypt, must have been entirely covered by the ocean waters, and indeed the whole of the Suez, Egyptian, Syrian, Lybian, Mesopotamian, and Nubian Deserts bear incontestible evidence of their marine nature; the elevated plateau being almost wholly calcareous, or consisting of extensive fossil formations, and beds of salt. The soils of Syria, Palestine, and a great portion of Turkey in Asia, are of fossil formation, the greater portion of which is still uncovered, and unaffected by terrestrial vegetable matters. Syria abounds with salt lakes, and the soil of Palestine is so impregnated with bitter acrid salts and sulphur, as to render it wholly unfit for cultivation, even the waters of the river Jordan during the dry season, are brackish and unwholesome, flowing through hills of ocean marl of the consistence of clay: in fact, divested of its historical reminiscences, Palestine, composed of barren mountains and numerous deserts, is, considered as one whole, far from being favourable to the happiness or increase of the human race, depending entirely upon the rise of its rivers and periodical rains for its agricultural produce, and in periods of drought, which often occur, it too often suffers the triple scourge of famine, pestilence, and plague. Nor can we forget the Dead Sea, which is disposed in a valley of salt and mineral pitch: the hills by which it is surrounded are chiefly calcareous and abounding with fossils. Passing eastward over the great desert of Bockhara towards the Persian Gulf, we find the sea retreating from Baloochistan on the one side, where a great sandy desert is formed, and from Cutch on the other side; the great run being one vast sandy flat, containing immense quantities of muriate of soda, and covering a surface of 7000 square miles; but, however extensive, it is comparatively insignificant compared to the great desert with which it is united, embracing the important provinces of Agmere and Rajpootana. The drying off of inland seas is also an undeniable fact; thus the communications between the Caspian and the Black Sea, and the Red Sea and the Mediterranean, have been broken up, and the land is still encroaching upon the waters to a vast extent. One of the deserts of the Caubul territory is about 400 miles in length, and composed of sand hills and indurated clay.

Besides the acrid or saline deserts which more immediately embrace the rainless regions situate within the tropical band, there are other immense tracks of waste and unproductive soil termed STEPPES. The Steppe of the Dnieper comprehends a vast plain between the Dnieper and the Bogue, of a dry and sandy quality, containing many salt lakes and salt plots. The Steppe of the Don and Volga, comprehends all the space between the Don, the Volga, and the Kuban: it is a very large acrid steppe, containing several salt lakes and salt plots, and abundance of sulphur. Within the confines of this steppe is what is called the Kuman Steppe, in which lie the salt lakes of Astrakan, several bitter lakes and warm springs, having every appearance of being a dried up sea: this being rendered more probable by the appearance of the flat shores of the Caspian and Azof Seas, the shallowness of their coasts, the low situation of the Steppe, and the nature of its compounds. The Steppe of the Volga and Ural, called the Kalmuck Steppe, consists of a far stretching ridge of sandstones, extending from the middle of the mountains to the Caspian, and of the vast extent of plain on either side of these mountains: its constituents evidence its having been the bottom of a sea, rock salt and salt lakes being thickly diffused over the whole plains. Other Steppes there are stretching towards the north, and partially or wholly waste.

In South America there are also very extensive steppes consisting of beds of sand, saline deposits, and other products of sea water, by which they are rendered barren and desolate, there being only a few acrid plants and scrub wood dotting their surface. The slight elevation of the Llanos, of Varinos, and the Caraceas; the Bosques and forests of the Amazon; and the Pampas of Buenos Ayres, make it appear that the waters of the Atlantic formerly covered this great extent of land; forming immense gulfs in the dry land, reaching the base of the Andes.

The nature of the changes produced in the oceanic earths depends on the nature of the local affections to which these earths are subjected; thus, for instance, in Arabia Felix, the salts, phosphates, carbonates, and sulphates, being produced, remain unchanged from age to age: but on the Abyssinian side of the Red Sea, a distance of only a few leagues, in consequence of the abundance of rains, the salts and other volatile and vaporous products, which are inimical to life, are washed into the bowels of the earth, and are thus united with compounds composing the lower strata, or in their union with each other, form neutral bodies: at the same time, the shells of mollusca either decompose, or gradually indurating, separate in their parts, and pass by transition into stones and pebbles. The decomposed masses of carbonate of lime unite as rock, and the earth soon becomes covered with coarse grasses and scrub wood, to be replaced by the acacia and eventually by trees of a nobler growth, more complicated, and of a higher order of development. Animal species and genera no sooner find their food covering the new made soil than they repair to it, and propagate in their generations, and very often the locality has both animals and vegetables peculiar to itself. In whatever part of the world we view nature, in production and reproduction, the very determinate effects of local influences are strikingly manifest in the production of organic and inorganic bodies.

Removed from the influences of terrestrial matters, produced by the animal and vegetable orders, genera and species are eventually produced, and as a necessary consequence, various compounds and fossil and mineral formations are generated. The young oceanic earth rests in its own strength, and the changes which take place in the various depositions of matter are wholly governed by local influences. In those parts of the earth where the heat is excessive, and the rains seldom or never fall, nature slumbers for ages in organic production, confining her operations to the mineral kingdom, or if genera, orders, and species, of animals and vegetables are developed, they are such as are conformable to the sterility of the soil, being in the simplicity of organical structure; thus the land is desert, ever presenting the like monotonous view to the traveller, who treads interminable plains of sand, intersected with groups and chains of hills equally barren and unproductive, abounding with noxious exhalations, poisonous gases, bitter salts, and sulphur, all around speaking of imperfection, the organic body decomposing, and the mineral body forming: of the beauty and variety common to a more favourable soil and climate, nothing is to be found but a few crystalline bodies of comparatively little value; not one spark of animal life appears to cheer the dreary scene. In this desert sterile state the earth reposes, free from the continued action and addition of accumulating matters producing in other localities: but even in regions the most forbidding and destructive to organic creatures, nature acts unceasingly in creating mineral bodies and mineral beds from the fossil soils spreading forth on every side; the cast off clothing of mollusca and fishes, preserved from decomposition, in the re-combination of their atomic structure, become things of other name and nature; the beds of the valleys become covered with petrifactions, the sands sparkle with crystalline or efflorescing salts, the decomposed masses of commingled oceanic matter are converted into gypsum, alabaster, marble, sandstone and other species of rock, and a degree of order takes place where confusion and disunion previously revelled triumphant. The periods necessarily required to effect these multitudious changes depend entirely upon association and climate: excess of dry heat, or excess of moisture alike militating against the development of terrestrial organic bodies. When incessant dry heat acts upon the thirsty soil, it oxidates all bodies of a calcareous nature, and causes the coral reef, and the beds of shell fish, to decompose in dry friable masses, and in this state they remain, until by the agency of water, the disintegrated masses are united as one consolidated or crystalline body. Where the rains are unfrequent, and in many extensive regions they are seldom or never known to fall, here nature sleeps over the creation of living creatures, and the scanty vegetation consists of those few plants which love a hot dry climate and an acrid soil, while here and there, in more favoured spots, may be observed a few miserable acacias standing as guides to wandering Arabs, or as signs of a well of wretched brackish water being within the reach of the expiring wanderer: of the animal creation there are none, save a few vultures, kites, and ravens, which flit rapidly over the burning waste, or follow in the wake of the expiring camel, as though conscious of its approaching death. No living form could possibly exist in some of these regions, there being no springs of water, no shelter from the continuous vertical heat, no form of food, animal or vegetable; the soil throughout is alike inimical to the development, sustenance, and propagation of living species. Such are the characteristics of the African and Asiatic deserts, and of the numerous islands of the Red Sea, and wherever these lands are disposed in the rainless regions, there they continue barren and desolate from generation to generation, preserving there their characteristic traits, by which their origin and nature has been handed down from generation to generation, extending over a period far beyond the records of man, and being evidently produced ages before man was a denizen of the earth.

(To be continued.)

CEMETERIES.

Report on the Sanitary Condition of the Labouring Population of Great Britain. A Supplementary Report on the Practice of Interment in Towns.—By Edwin Chadwick, Esq., London, 1843.

On the Laying out, Planting, and Managing Cemeteries.—By J. C. Loudon. London: Longman, 1843.

In no one thing has the march of intellect more fully shown itself, and under the most favourable auspices, than in the strong public feeling which has been growing up of late years, in favour of improving the health of towns by scientific and enlightened administration. Many circumstances have favoured this, the remarks of staticians, the operation of the Registration Act in particular, which by giving the elements for local comparison, showed incontestably to what an extent population is affected by unfavourable circumstances. It might formerly be matter of opinion how far drainage, or the adequate supply of water could influence health, and knowledge and intelligence were kept at bay with the assertion, that the results were but matter of opinion, and that one man's opinion, *i. e.* the ignorant man's opinion, was as good as another's. It is now, however, very different, and we can point to regions of the metropolis, where, by defective administration, the life of the labouring population is abridged to a fearful extent, while in others better cared for, a higher standard of vitality is to be recognised. At the same time the problem of vitality is better understood, its moral and economical bearings have been detected and elucidated, and the fearful consequences of ignorance and neglect clearly eliminated. It is undeniably ascertained that the operations of unfavourable external circumstances is not merely to doom to death so many per cent. of the population, but to strike down the experienced and able-bodied adult, to throw widows and children pauper burdens on the public funds, and to increase the population with an excess of helpless infants; for in an unhealthy and abnormal population, the increase of that population is not checked by misery and death, but it is a natural law, as it were, that the void created by the extinction of the adult should be filled, and how filled?—not by an adult necessarily—not by an individual educated in some way, useful to society, and able to earn his livelihood, but by the infant, who must for years be fostered and maintained from the common stock. This is an awful punishment upon ignorance and inattention, one which, in its operation leaves no class unscathed; the poor man sees the scythe indeed, but the rich does not escape its edge. The fevers generated by a close population invade the habitations of the wealthy, while the poor rates, enormously increased, become a burden on their purses. These are facts, which, if humanity could be silent, if religion were to be stifled and its dictates disowned, would still force a remedy from the most selfish and most obtuse. The labours of the Commission of Sanitary Inquiry have disclosed the most appalling facts as the consequence of evil, while they have, on the other hand, as clearly shown the immediate and permanent good which results from intelligent and well directed measures. In these inquiries the public is deeply interested, but the architect or engineer is not less interested, it being his professional duty to be acquainted with the evils, and to be able to apply the remedies. It has not, however, been the case that the members of these professions have been active in such investigations, and it will in the end certainly result, that if they do not take care, they will have no part in the subsequent measures that may be adopted. The medical profession have taken a much more prominent part, and particularly the medical officers of unions, in communicating the results of their experience, and it might be said that the parochial medical officers form a corps well organized for the acquisition of information. It must not, however, be forgotten that the surveyors of highways, and the surveyors of sewers are not less local officers, possessing local experience, and being able to bring a large amount of practical knowledge to bear on the state of the arrangements for securing public health. We cannot however say that they have come forward to do so; with a few exceptions, no professional name occurs. We see, indeed, the names of Mr. Mills and Mr. Roe, of the Finsbury Division of Sewers, quoted by Mr. Chadwick, and we are pleased to see, by the exertions of Mr. Sopwith in the Newcastle Committee of Inquiry, that he has effectually shown what the practical and scientific experience of an enlightened man can do. We call the attention of professional men most strongly to this fact, that it is important for them to be on the alert, and that unless they do exert themselves and show their competency as public servants, they will be superseded by the medical men, and passed over in the Boards of Health, which will no doubt ultimately be formed. A strong public feeling has been manifested with regard to sanitary measures, the government has felt itself called upon to do something, and permanent arrangements will no doubt speedily be made. It has been for some time a matter of regret to us, that no step has been taken by professional men, as a body, to interfere in these measures, though it is naturally to be accounted for, the Institute of Architects occupying itself solely with artistic subjects, and the Institute of Engineers with the details of science, and neither of them having time or scope for the discussion of professional etiquettes or professional interests, at the same time that many events of great importance have recently occurred where the intervention of an organized body would have been of the highest benefit. Indeed a great many of the subjects entertained by the Metropolitan Improvement Society are purely professional in their bearings, while there is no opportunity of discussing or protecting professional interests. With regard to the Building and Drainage Acts, the want of this organization was strongly felt, and also with regard to the contemplated survey of London, the protection of private interests is left to isolated efforts. We cannot doubt that a centralization must take place of the Metropolitan Sewers and Pavings Boards, and any legislative enactment for the purpose will require to be closely watched. Under these circumstances we think it would be of the greatest benefit if an Association of Architects, Engineers, and Surveyors, were formed, not for the discussion of matters of art or science, which are already adequately provided for, but for the protection of professional interests, and we earnestly recommend that some step should be immediately taken.

The report of Mr. Chadwick is supplementary to that on the sanitary condition of the labouring classes generally, and is more particularly directed to the practice of interment in towns. It is one of the finest documents of the kind which has ever been laid before the public, characterized by elevated and enlightened views, a liberal and kindly disposition, and far-seeing policy. It takes up many subjects of the highest interest, particularly in connexion with the general laws of mortality, and which we regret that the special tendencies of our publication prevent us from investigating. On the subject of interments it is full and precise, and discloses a multitude of most striking facts, which cannot be without their influence on the legislature. Through a work so abounding in details we must proceed cautiously, and, however careful we may be, we must omit much matter of interest, and much evidence of value, but we shall endeavour to give a succinct view of the contents of the report.

Mr. Chadwick shows fully the nocuousness of the emanations from human remains, and he very ably combats the negative evidence of Parent Duchatelet and other physiologists, who had been relied upon as authorities to the contrary. On this point Mr. Roe and Mr. Mills gave evidence, that where the sewers come in contact with church yards, the exudation is most offensive, (St. Pancras for instance) and that whatever precautions are taken, exudations to a certain extent pass through the brickwork of the sewers. Evidence to the bad effect of the drainage of churchyards on wells, was also given by Mr. Roe. This latter effect is well known.

"In consequence of various investigations in France, a law was passed prohibiting the opening of wells within 100 metres of any place of burial; but this distance is now stated to be insufficient for deep wells, which have been found on examination to be polluted at a distance of from 150 to 200 metres. In some parts of Germany, the opening of wells nearer than 300 feet has been prohibited."

The production of deleterious gases from the decomposing bodies is fully proved, particularly by Professor Leigh of Manchester. Mr. Chadwick next proceeds to show, that as the labouring classes reside chiefly in one room, the most injurious effects, both moral and physical, result from retaining the corpse among the living. When coming to consider the economical results of an excess of interments, Mr. Chadwick observes:—

"If the proportion of deaths to the population in the Whitechapel union were reduced to the proportion of deaths to the population in Herefordshire, then, instead of 2,307 burials, there would only be 1,305 burials per annum; and if the cost of the remaining burials were reduced 50 per cent. of the average present cost, then the saving of funeral expenses to the Whitechapel district would be at the rate of more than £23,000, or nearly 3*l.* per house on the inhabited houses of the district; about half that sum being deemed sufficient to defray the expense of the proposed structural improvements. The funeral expenses in the parish of Hackney on the proportion of burials amongst them, are at the rate of 5*s.* 2*d.* per head on the living population. Were the burials in Liverpool reduced to the same proportion, 1 in 56 instead of 1 in 30, at the rate of expenses for funerals in London, nearly £50,000 per annum would be saved to the population of Liverpool, being more than sufficient to enable them to pay 30 years' annual instalments, the principal and interest, at five per cent., of a sum of £845,065 sterling for structural arrangements."

It is very clearly shown that the present parochial establishments are very inefficient, and that any system founded on parochial administration may be liable to great objections, as to which we fully concur. The report before us also proves the growing disposition among all classes of the public, to prefer interment in the great cemeteries in preference to the intra-urban churchyards, and that the labouring classes are disposed to make considerable sacrifices to insure this object. The objection to churchyard interment seems to become stronger every day, and even family vaults are frequently abandoned by wealthy individuals. Mr. Chadwick, advocates as part of an improved system of interment, an inspection of the body by a competent medical officer of health and the deposit of the body immediately after the supposed death, in what may be called a dead-chamber, where constant attention shall be given to see if any signs of life are manifested, and by which great advantages will accrue to the living. He proposes, also, the performance of the funeral rites by a public establishment, so that the services of religion may be more efficiently administered both to rich and poor, accompanied by the singing of anthems, and the assistance of a full choir. This is a feature which we cannot omit, for we feel assured that by cultivating the higher feelings we are rendering the public mind more susceptible in matters, of art, refining the manners, and developing the kindly emotions of the heart. We will not repeat the hackneyed quotation as to the emollient influence of the liberal arts, but we know no case in which their solemn and religious influence would be better and more permanently felt, than in connexion with the last offices to the dead. The chanting of the choir, the devont ministering of the clergy, the orderly attendance of the assistants, will be most touching in the presence of the beauties of nature, and the apt memorials of art, amid which the relics of the dead are entombed. A feeling of holiness and solemnity, softened by the external influence of surrounding objects, cannot but fail to soothe the mourner, and beneficially impress the visitant and spectator in communion with the departed dead. A wide field, under such circumstances, exists for the exhibition of a refined and chastened taste, for not merely is there the general disposition of the ground and buildings, which can afford but restricted occupation, but every tomb admits of a careful and original treatment, with a due regard to the sanctity of the place, and the noble impressions to be produced. Such opportunities are to be courted, for the occupation of the English architect is too restricted; instead of being able, like the artist of old, to display his taste in many small works, affording him daily and hourly occasions for its cultivation, he erects only a few large buildings, and those perhaps stereotyped in their details. The field of taste, like the field of agriculture, must be constantly and carefully cultivated; the fallow shows unprofitable husbandry, and he whose taste in leisure hours is occupied in worthy pursuits, can scarcely fail to show himself at least respectable on great occasions. Neither can the studies here recommended be injurious; it is not frittering the mind in detail and minutiæ, but it is the laudable exercise of the great principles of art. The narrow-minded copyist may busy himself on a sepulchral memorial, marring the ideas of his predecessors, and producing nothing of his own but his errors; but a noble and simple conception in a small work will not detract from the highest genius. Indeed, it is now beginning to be recognized that the sphere of the architect's labours is more extensive; in the dwelling it is his business to design the ornaments, and take care that the furniture and accessories agree in character with the style of the building itself. We look, therefore, with pleasure to the opportunities which are now likely to be afforded, and the more so as the works will be exhibited to the public gaze, not like the secluded examination given to a private dwelling, while the architect will be brought into competition with the sculptor, the painter, and the enlightened amateur, and will be led to the study of the higher attributes of art, now too much neglected or conducted upon a false basis. We are aware that at present our cemeteries have much that is meretricious, but we know no better mode of correcting this than by elevating the tone of public feeling with regard to the practice of interment. We may observe, too, that Mr. Chadwick recommends that some of the metropolitan cemeteries should be on the banks of the Thames, affording economical conveyance for the poorer classes, and the means of great funeral pomp on what the poets have called "the silent highway." Those who recollect the grand funeral procession of Nelson, will bear testimony to the solemnity and grandeur which may be ensured in such scenes.

Mr. Chadwick is of course an advocate for interment in the free soil, and a higher tone of public feeling seems to prevail as to this practice. If we reflect on the associations attached to the burial places of great men, our impressions are not confined to the sight of the tomb, but they extend to the surrounding soil; the tomb of Virgil sanctifies the country around, though the bones have long since mingled with their native earth; the tombs of the kings in the valley near Jerusalem bring their votaries from afar, though many centuries ago their ashes must have faded; the Holy Sepulchre has been the veneration of ages, though only serving as the tomb of a day. So, too, the memory of Napoleon, although his remains have been exhumed, still brings pilgrims to St. Helena, for it is not the mortal relics that we venerate, but those efforts of intellect which illumine the world in all ages, and bring us from our distant homes to pay tribute to the memorials of genius, which it has consecrated to itself in the cradle, its residence, or its last long home. Incorporation with the soil of a holy and consecrated place, must surely then be more to be sought than fruitless expedients to evade the common lot, which honour not the dead, and are injurious to the living. The state of the public feeling, too, on this point, materially affects the cemeterial arrangements to be made on any comprehensive scale. In another point of view we are happy to bring the opinion of Mr. Chadwick in evidence to illustrate the moral influence of improved arrangements.

"The great moral force, and the consolation to the dying, and the incentive to public spirit whilst living, derivable from the natural regulations of a public cemetery, is almost entirely lost in this country, except in the few cases where public monuments are provided in the cathedrals. In the metropolis it would be very difficult to find the graves of persons of minor fame who have advanced or adorned any branch of civil or military service, or have distinguished themselves in any art or science. Yet there are few occupations which could not furnish examples for pleasurable contemplation to the living who are engaged in them, and claim honour from the public. The humblest class of artisans would feel consolation and honour in interment in the same cemetery with Brindley, with Crompton, or with Murdoch, the artisan who assisted and carried out the conceptions of Watt; or with Emerson, or with Simpson, the hand-loom weaver, who became professor of mathematics at Woolwich; or with Ferguson, the shepherd's son; or with Dollond, the improver of telescopes, whose earliest years were spent at a loom in Spitalfields; or with others who "have risen from the wheelbarrow," and done honour to the country, and individually gained public attention from the ranks of privates; such, for example, as John Sykes, Nelson's cockswain, an old and faithful follower, who twice saved the life of his admiral by parrying the blows that were aimed at him, and at last actually interposed his own person to meet the blow of an enemy's sabre, which he could not by any other means avert, and who survived the dangerous wound he received in this act of heroic attachment. The greater part of the means of honour and moral influence on the living generation derivable from the example of the meritorious dead of every class, is at present, in the larger towns, cast away in obscure grave-yards and offensive charnels. The artisans who are now associated in communities, which have from their beneficent objects a claim to public regard, might, if they chose it, have their spaces set apart for the members of their own occupation, and whilst they derive interest from association with each other, they would also derive consolation from accommodation within the same precincts as the more public and illustrious dead."

In considering this subject, the praiseworthy labours of the great Wren could not pass unnoticed, who in his report on the re-building of London, reprobated all interment in churches, and advocated the foundation of cemeteries outside the town. Mr. Chadwick, resuming this idea, calculates that the annual saving to the inhabitants of the metropolis, by a comprehensive system for the interment of the dead, would be no less than £374,743, and we do not think he has overrated the amount. This saving, he shows, if applied to remedying the sanitary arrangements of the metropolis, would fully effect it, and relieve the public from a large amount of poor-rates, increase the labouring power of the population, and extend the duration of life, health and strength. Mr. Chadwick then proceeds to propound his plan, which is, that the practice of interment should be placed under government direction, the structural arrangements being confided to the Commissioners of Woods and Forests. The present practice of burying in towns to be entirely abolished. The expenses of national cemeteries to be raised by loans bearing interest, the repayment of the principal and interest being spread over a period of 30 years, and charged on the several interments. Compensation is also to be given from this fund to the new cemeteries, which it is recommended should be purchased, and in some cases retained for the purpose of interment. The general economical result, it is very clearly shown, would be the reduction of burial charges to at least one half of the existing amount.

With regard to the choice of ground for cemeteries the report observes—

"The progress of the decay of the body is various, according to the nature of the soil and the surrounding agencies. Clayey soils are antiseptic; they retain the gases, as explained by Mr. Leigh; they exclude the external atmosphere, and are also liable to the inconvenience of becoming deeply fissured in hot weather, and then allowing the escape of the emanations which have been retained in a highly concentrated state. Loamy, ferruginous, and aluminous soils, moor earth, and bog, are unfavourable to decomposition; sandy, marly, and calcareous soils are favourable to it. Water, at a low temperature, has the tendency, as already explained, to promote only a languid decomposition, which sometimes produces adipocire in bodies: a high and dry temperature tends to produce the consistency and permanency of mummies. A temperature of from 65° Fahrenheit and upwards, and a moist atmosphere, is the most favourable to decomposition. The remains of the young decompose more rapidly than those of the old, females than males, the fat than the lean. The remains of children decompose very rapidly. On opening the graves of children at a period of six or seven years, the bodies have been found decomposed, not even the bones remaining, whilst the bodies of the adults were but little affected. The process of decomposition is also affected by the disease by which the death was occasioned. The process is delayed by the make of some sort of coffins. The extreme variations of the process under such circumstances as those above recited, is from a few months to 30 years or half a century. Bones often last for centuries."

"Attention to these circumstances by qualified persons in Germany has led to different regulations of the depth of graves at different ages. At Stuttgart the different depths are as follows:—For bodies of persons under 8 years, 3 ft. 9 in.; 8 to 10 years, 4 ft. 7 in.; 10 to 14 years, 5 ft. 7 in.; adult, 6 ft. 7 in. At the Glasshutte, in the Erzgebirge, the depths are as follows:—Under 8 years, 3 ft. 8 in.; 8 to 14 years, 4 ft. 7 in.; adults, 5 ft. At Frankfort the average depth prescribed for graves is 5 ft. 7 in.; at Munich, 6 ft. 6 in.; in France, 4 ft. 10 in. to 6 ft.; in Austria, 6 ft. 2 in., if lime be used."

We should observe, indeed, that the views of Mr. Chadwick, with regard to the laws regulating the duration of life, are most valuable and original, but being out of the immediate range of our occupations, we are unable to discuss them. The doctrines illustrating the effect of good accommodation upon health and disease, are also enforced by the example of the four provinces of Ireland, where the proportion of mud cabins is found to indicate the lowest average of life.

We have now to consider the mode of administration pointed out, and we feel bound at once to give in our accession as to the necessity of a comprehensive plan, and the ineligibility of parochial management. We do not, however, like in this or any other case to give up the principle of popular control, one of the oldest and dearest in our constitution, and a disposition to abrogate which, and to advocate centralization, has too frequently manifested itself of late years, and too readily met with public acquiescence. The evils of parochial jobbing and sectarian bigotry, we should be foremost in attacking; but we do not think the only resource is administration by a government board, certainly not in the metropolis and the large towns. We think a municipal administration would fully meet the circumstances, would ensure efficient control, and be free from the evils of the parochial system. It is true that a municipal body does not exist for the metropolis, and that the Woods and Forests has been made a kind of nurse-tender in many cases, while attempts to give regular municipal institutions have been evaded by the government; but we see no difficulty in providing for the present case, which must also be considered in reference to future legislation, as to the Sewer and Paving Commissions. Although apathy may exist as to the administration of cemeteries, yet surely professional men would not like such an example brought forward on the occasion of the centralization of the Sewers Commissions for instance, and the whole matter coolly handed over to the Woods and Forests; yet it is evident that such case must be met not merely on its own grounds, but with reference to a general principle. The question is, whether the principle of government administration, not recognized with regard to metropolitan roads, paving and sewers, is to become predominant, and the whole profession be placed under the rule of Her Majesty's Commissioners of Woods and Forests and Land Revenue.

OBSTA PRINCIPIO.

THE CONSERVATIVE CLUB.

Architects, Sydney Smirke and George Basevi, Jun.

(With an Engraving on Steel, Plate I.)

Club architecture is a new class, which has sprung up of late years, and which forms an important feature of the Pall Mall district. It may be divided into two classes, the classic school, to which the earlier specimens belong, and the Italian school, in which Mr. Barry led the way by the erection of the Travellers' Club. Year after year has gone on adding to the magnificence of these structures, and we hope not without a beneficial influence on the taste of the architects concerned. The artists, who have chiefly exerted themselves in this department, have been four, the two Smirkes, Decimus Burton, and Barry, each of whom has contributed at least two specimens. In the Athenæum Club Mr. Burton introduced the novel feature of an extended sculptured frieze, which, although not original, yet being a copy of that from the Parthenon at Athens, preserved among the Elgin marbles, is an ingenious and appropriate adaptation. Mr. Barry took the next step, by adopting the Italian style for the Travellers' Club, the old garden front of which has been justly admired for its chasteness, and which, even in its altered form, has not lost its character. Mr. Sydney Smirke's Oxford and Cambridge Club was a happy attempt to produce effect by sculptural decoration, the emblematic panels giving dignity and elegance to the façade, at the same time that they indicate the classes to whom the edifice is devoted. The Reform Club sank in the shade all its competitors, rising in giant majesty over the surrounding edifices. The taste which presided in the distribution of its details, and in its internal decorations, has been ably commented upon by some of the contributors to our columns, though the effect of the grand front is in some degree marred, by the fatal necessity of the interior arrangements, so that on the Pall Mall side it looks too windowy, having indeed symmetry, but affording little relief to the eye. In the side elevation, the grouping of the windows avoids this monotonous appearance. It was felt, however, that the erection of the Reform Club had thrown its neighbours into insignificance, particularly the Carlton Club, and the necessity of a new conservative club soon became evident, and resulted in the erection of the edifice of which the engraving is now before us. We have felt that these edifices have strong claims on our readerss, on the one hand as affording many useful studies, and on the other, as illustrating the practice of some of the most eminent men, and the progress of what we may call social architecture, an acquaintance with which in its highest forms, is of great value to our metropolitan and provincial brethren, in the erection of clubhouses, chambers of commerce, newsrooms, literary institutions, &c. We have accordingly given elevations of the Reform Club, (Vol. III, pp. 144, 336,) Oxford and Cambridge University, (Vol. I, p. 15,) Club Chambers Association, (Vol. II, p. 319,) with the present article, that of the Conservative Club. Plans of the same buildings will also be found in our volumes, Reform Club, (Vol. III, p. 109,) Oxford and Cambridge Club, (Vol. I, p. 59,) and Club Chambers, (Vol. II, p. 319.) A section of the Reform Club, and details of the windows, cornicione, &c., are given in our third volume, (pp. 336, 409,) making altogether about fifteen plates and engravings, which we have appropriated to this subject.

The Conservative Club is the joint work of Mr. Sydney Smirke and Mr. George Basevi, Jun., and is placed on the west side of St. James' Street, near the Palace. As a rival to the Reform Club it has one of the largest façades, as the annexed table will show.

The front of the Conservative Club consists of two stories or orders, the lower rusticated and without columns, except at each wing, as described below. The upper story is Corinthian, and consists of entire, but attached columns and pilasters upon the usual podium, and having the entablature surmounted by a balustrade. In the intercolumniations are windows with enriched dressings and pediments. Over the windows and ranging with the capitals of the columns, is a frieze of carved foliage, for the most part of classical character, but having the Imperial Crown, encircled by an oak wreath, occasionally introduced. The front is of uniform height, but the wings are slightly advanced. In each wing the lower order is Roman Doric, that on the left contains the porch entrance, deeply receding, with groups of columns and pilasters on either side. In the right wing the leading features are uniform with the porch, but instead of an entrance is a bow window, which was introduced as essential, in the opinion of some members of the club, to the morning room, affording the loungers a view of Pall Mall and St. James's Street. The whole front is of Caen stone, and with the rest of the building has been carried up in about six months, the foundations having been commenced in the middle of June, and the whole clubhouse being now roofed in, with much of the interior plastering far advanced. The contractors are bound to complete the building by the end of the present year.

	Built.	Architect.	Lgth. of Front. feet.	Height. feet.
University Club	1822-6	Wilkins & Gandy	76	..
Union Club	1825-7	Sir R. Smirke	65	57
Senior United Service	....	....	105	..
Athenæum	1829	D. Burton	76	..
Travellers'	1831	Barry	74	50
Carlton	1835-6	Sir R. Smirke	90	..
Oxford & Cambridge	1836-7	Sydney Smirke	93*	57
Reform	1837	Barry	120†	68
Do. with side entrance	....	....	135	..
Club Chambers	1839	D. Burton	76	55
Conservative	1843-4	S. Smirke, G. Basevi	117	69

* The length of this is elsewhere given as 87 feet.
† According to some authorities the length without the entrance to the dormitory, is 117 feet.

It will be recollected that Mr. Sydney Smirke was one of those who sent in designs for the Reform Club, (Vol. I, p. 67,) when he proposed a building with a grand tetrastyle portico. Mr. Barry's design was then preferred, but on the present occasion Mr. Sydney Smirke, conjointly with Mr. Basevi, has had the opportunity of exhibiting his talents on one of the finest sites in London, and he has well availed himself of it. Difference of opinion will exist with regard to the merits of the Conservative Club, but at any rate the design is not hackneyed, while the grandeur of the edifice cannot be denied. It now forms the most prominent feature in St. James's Street, and the half view from the front of the Palace is very good. A difficulty existed in the shelving nature of the ground, but that has well been mastered by the able architects.

OBSERVATIONS ON GWILT'S ENCYCLOPÆDIA OF ARCHITECTURE.

By Henry Fulton, M.D.

This work, although reviewed in former numbers of this *Journal* by an abler and more experienced pen than that which now takes up the subject, is by no means exhausted. Our author says in his preface, that his object has been to impart to the *student* all the knowledge indispensable for the exercise of his profession, but should the perusal of it serve to form, guide, or correct the taste even of the *mere amateur*, he will not consider that he has laboured in vain. A work which could effect all this is much to be desired, but as far as the book before us is concerned, it is to be feared that the attempt is a failure. The fact alone of professing to treat of no architects or their works, subsequent to the end of the 18th century, renders this an incomplete encyclopædia for publication in the middle of the 19th, and the reason given for the omission is "the fear of coming into contact with cotemporaries and their connexions, which if not dangerous and fearful, might be unpleasant." But let not the reader suppose that these sentiments, be they right or erroneous, at all embarrass our author, either in relation to himself or others, whenever he pleases to deviate from it, for, in page 726 he tells us of "the execrable mass of absurdity to which the government who sanctioned it have facetiously given the name of National Gallery." And in what he calls "a catalogue of the principal and most useful works to the student of architecture," we find the name of our author recorded eight times. To do him justice, he mentions the name of Wilkins also in this catalogue, as the author of the Antiquities of Magna Græcia; to be sure Mr. Gwilt in some measure takes this work out of the list of the "most useful works to the student of architecture," for he adds to it, "an ill-drawn work," and that too, without making almost any special observations in praise or dispraise of any of the other productions mentioned in the catalogue.

But although Mr. Gwilt gives us his own name, and that of his works eight times, yet no mention is made of Hosking's Treatise on Architecture and Building; no doubt this was out of sincere regard to Mr. Hosking, for if mentioned at all, he would have been forced to add as a pendant, *an ill written work!* But although he had done all this, that treatise must be read and esteemed even when students shall spring up "who know not Joseph," and in the meantime "the mere amateur" will find it better calculated to "form, guide, and correct," his taste than even Mr. Gwilt's Encyclopædia. If Mr. Gwilt had desired to leave out all mention of the "ill drawn work," he might have substituted *Rovine Della citta di Pesto. Di P. Paoli,* fol. Rome, 1784. This, and another work omitted, I happen to have, viz. *Pincturæ Antiq. Cryptarum Rom. et Sepulcri Nasonum.* A. J. P. Bellorio et Mich. Ang. Causseo, fol. Rom. 1750. I could mention the names of 32 other works omitted, and which are in the library of the Royal Dublin Society, many of them of merit. Mr. Loudon's *Architectural Magazine* is named, but the *Civil Engineer & Architect's Journal* is not; were it worth the trouble of the search, no doubt the moving cause of the high honour conferred on the Magazine might be found to consist in the merits of some review of Mr. Gwilt's publications. I trust that this article alone may procure insertion for the *Journal* in the next edition of the Encyclopædia.

We shall now proceed to some of the other chapters. That on the Architecture of Russia is both defective and erroneous. From what I have already written on that barbarous country, it cannot be supposed that I now enter the lists, in opposition to our author, as a panegyrist, such as Dr. Grenville, but in justice, I must admit the public edifices and street architecture of St. Petersburgh, and the private palaces of Moscow, are in better taste than those of London. Mr. Gwilt knows of no Russian architect of the 18th century; but as he speaks of the "church of our Lady of Kevan," meaning, I suppose, that of Casan or Kasan, he ought to have told us that it was erected from the designs of Woronikin, a Russian architect; but he tells us "that on account of its columns it has obtained more celebrity than it will acquire for the beauty of its composition." Woronikin took St. Peter's at Rome for his model, but instead of falling into the error of its architects, made the Kasan of the same order throughout; the colonnade in front having 150 Corinthian columns; the cornice of the wings ranges horizontally with that of the portico, which gives it a great advantage over St. Peters; nor has he made part of the colonnade at right angles to the portico as in St. Peter's, but semicircular throughout, so that its ground plan may be described without a diagram by representing it as the curve of an arch, the portico forming as it were a dipping key stone. The interior, in which both workmanship and material do justice to a magnificent design, is not dishonoured by a comparison with St. Peter's or our own St. Paul's. I regret that I cannot describe the St. Isaac lately finished in the Russian capital and said to excel any other church in the world.

Mr. Gwilt mentions, "Ivan IV. as a great patron of the arts:" if he means the Czar Ivan Vasilovitch, which from the date given I presume he does, he was Ivan II., and his patronage of the arts can scarcely be extolled as "great," if by that he means desirable for the artists themselves, for having procured an unfortunate Italian to erect the church of St. Vasil at Moscow in 1538, he put out his eyes lest he might be able to erect any other building as *great* or greater elsewhere. This church, which contains 20 chapels of nearly equal size under the same roof, is not of great dimension, and is entirely in the Tartar style.

The chapter on the art in China is neither satisfactory nor laudatory. I regret that I did not see it with the eye even of a "mere amateur," or I should be better able to set Mr. Gwilt right; still the impression left is favourable, and I may say without praising it too highly, that its ornamental details are better than those of the style called that of Louis Quatorze, and as good as many of the Gothic. I trust we shall soon, either by some native or foreign artist, be made better acquainted with its details.

Our author, quoting from Sir William Chambers, says that the shops form the fronts of the dwelling-houses. This is not so, and I doubt if it were the case when Sir William was in Canton, for there, as in all the cities of the East, even in Russia, the shops are for the most part in open bazaars, quite detached from the dwelling-houses. In ground plan the dwelling houses in China present a striking similarity to those of Pompeii, and like them have no opening to the streets except doors. Again, in the ground plan of the temples, particularly that of Honan, we have almost a copy of those of Egypt; we need not be surprised at this latter circumstance, when we know that an intercourse must have been kept up between the two countries at a very remote period, as is proved by Chinese vases having Chinese characters on them, which can be understood in the present day, being found in the mummy tombs of Egypt.

Mr. Gwilt only mentions the large circular openings, which I believe are peculiar to Chinese architecture. There is scarcely a house or pleasure ground in which they are not introduced, forming open doorways and windows from six to eight feet in diameter. The effect of them in our own country would be very good, where, as in gardens and pleasure grounds, the doorway is not required to be closed.

In the chapter on the pointed style, a view is given of the west front of the Duomo at Milan, which is not correct. It would appear from it that the doorway is a circular arch springing from two columns, and above it there appears to be a kind of pointed arch also placed on two columns; whereas these, as also eight of the other openings at their sides, have segmental and triangular pediments with the centre of the horizontal cornice broken away. This breaking away of the cornice forms a principal feature in the erection called York stairs, London, and of which Mr. Gwilt favours us with a view and the following eulogium, page 207, "York stairs, another of his (Inigo Jones) examples, exhibits a pureness and propriety of character which appear afterwards unappreciated by his successors, with Wren at their head." Alas, Sir Christopher, is it come to this? and from a Palladian—*et tu, Brute*. But although our Encyclopædist is severe, he is not consistent, for at page 745 he tells us "that no pediment should be tolerated composed otherwise than of two raking unbroken and one horizontal unbroken cornice."

The description of the Duomo, which accompanies the plate, is not very lucid, at least to a "mere amateur;" he says, "In the third story from the bottom" (very precise) "a painted" (?) "window, separated by three mullions, is introduced. The rest" (?) "of the façade is vertically divided by buttresses into five parts, &c."

I have given one example of unsophisticated contradiction. We shall now have another of a different complexion, made with so much caution, so much acumen and foresight, that it would almost appear he had provided for the enjoyment of the literary sin, and at the same time secured a retreat in case of an indictment being framed against it. The safety valve shall here be given in italics:—page 57, "In all imitations of that" (Greek) "style, its" (arch) "introduction produces discord which no skill can render agreeable to the educated eye. Attempts have been made by the modern German architects to introduce the use of the arch with Greek forms; but they have been all signal failures, and that because it is incapable of amalgamation with the solemn majesty and purity of Greek composition. *Before such blending can be accomplished with success, the nature of pure Greek architecture must be changed.*" Now the whole of this was written as a kick at the German school, which he never omits giving when opportunity serves—but to the contradiction, page 718, "an arcade or series of arches is perhaps one of the most beautiful objects attached to the buildings of a city which architecture affords." No doubt can be entertained of the nature of these arcades, which when not in German hands find so much favour in Mr. Gwilt's eyes; they are neither arcades without columns nor yet Gothic compositions, but the pseudo Greek arcades, of which he gives a number of examples from Vignola, Palladio and Chambers. No doubt our author will say that the style is successfully changed by the Italians but not by the Germans before the addition of the arches. On one occasion an eminent architect, knowing I was only a "mere amateur," kindly offered to show me a *Greek dome* of his own designing: of course he knew better, but he did not think that I did; however, on my expressing a doubt of the Greeks having known anything about domes, his reply, though not so terse, was tantamount to what Mr. Gwilt might give on the present occasion. "*Nous avons changé tout cela.*"

It would be too *german* to our author's antipathies not to admit that his work has some merit, and that in 1053 pages the reader may find much information, which can only be gleaned from a more extended surface elsewhere. The ground plan (if we may so speak) is well arranged, and has the advantage of some ground plans in leaving plenty of room for improvement in the filling up. The application of a highly condensing power to literary effusions, except in the actual process of elimination, is bad; it ought to be applied to the ore in the author's head, and not to the metal in the printer's form. The type is too small for continuous reading, and three volumes might be given to the binder instead of one. And this arrangement would be of advantage to the "mere amateur," as the principal part of the second book on mathematics can be learned more fully elsewhere.

Having concluded, at least for the present, the notice on the Encyclopædia, which is given with all the modesty and hesitation of a first appearance in the character of a reviewer, the writer feels called on to say a few words in defence of giving his name to what he writes. That it may be well in most cases for writers in the miscellaneous periodical press of the day, to write anonymously, is readily conceded; but no necessity calls for it in a respectable professional journal, where all who contribute should have but one object in view—the advancement of science. A name, although (as in the present instance) it may have no intrinsic merit attached to it, yet encourages some to read and others to write.

LORD ROSSE'S TELESCOPE.

At a meeting of the Belfast Natural History Society, the steps by which difficulties were overcome in making the speculum, were explained by Mr. Stevelly in detail, under the following heads:—

Metal for the Speculum.—The metallic alloy for the speculum consists of four atoms or chemical combining proportionals of copper to one of tin, or by weight 126·4 copper to 58·9 tin. This alloy, which is a true chemical compound, is of a brilliant white lustre, has a specific gravity of 8·811; a twelfth of a cubic foot, or 144 cubic inches of it, weighing, therefore, a little over $45\frac{3}{4}$ lb. avoirdupois, or to allow for all waste when casting, 50 lb., which is the rule by which Lord Rosse estimates the weight of metal he requires. This alloy is nearly as hard as steel, and yet is almost as brittle as sealing wax. Of this most unpromising material Lord Rosse has cast, ground, and has ready for polishing, a circular mass 6 ft. in diameter, $5\frac{1}{4}$ inches thick, and weighing upwards of three tons, with a surface perfectly free from crack or flaw, and quite homogeneous. The next head is

Casting.—On the first castings having flown into pieces, finding that the fragments no longer fitted each other in their former places, he perceived that they had been in a state of violent strain arising from the cooling and setting of the outer parts, while the inner parts, yet fluid, were also largely expanded by the heat; this, and the porous surface, led him by many stages and trials to the remedy, which is simple and complete. The bottom of the mould is made of a ring of bar iron, packed full of slips of iron hoops set on their edges, which lie in parallel chords of the ring. These, though packed very tightly together, and so closely fitting that the melted metal cannot run between them, yet allow any air that is carried down to the bottom of the mould when the metal is cast in, to pass out through the interstices. After the ring is packed, it is secured in a lathe, and the face, which is to be the bottom of the mould, turned true to the convex shape to fit the concave speculum required. It is then placed flat on the ground by spirit levels (between the furnace in which the metal is melted, and the annealing oven), and the mould completed at the side with sand, in the way practised by founders, but left open at top. The metal is then melted in cast iron crucibles; wrought iron would be corroded by the speculum metal, and injure its properties, while fire clay crucibles will not answer. Unless the crucibles be cast with their bottoms downward, they will be porous, and the melted alloy will run through their fine pores. When the metal is melted, and still much too hot to pour, the crucibles are brought by a crane, and set firmly, each in a strong hoop iron cradle, which turns on gudgeons, and so arranged round the mould that when the handles of the cradles are depressed, they pour out their molten mass direct into the mould. An oxide forms rapidly on the surface of the metal while too hot—this is as rapidly reduced back to the metallic state by constantly stirring it with a pine rod; as the temperature sinks, the instant this reduction of the oxide begins to cease, is seized on as the proper moment for pouring. The liquid mass descends with a few fiery splashes, and after waving back and forward for a few seconds, the surface becomes still. The setting process begins at the hoop-iron bottom, where a thin film first sets—the process extends upwards in horizontal layers and at length the top, though red, becomes fixed in form; the mass is then as tough as melting glass, and being turned out of the mould upon a proper truck, with the face upwards, is drawn into the oven to undergo the process of

Annealing, or very slow cooling. Here it is built up into the oven, previously heated red-hot, and fire is kept up under the floor of the oven for some days; the under fire-places are then stopped, and all left for weeks to cool down to the temperature of the air. The six feet speculum was left here sixteen weeks. Here the particles of the alloy slowly arrange themselves into the arrangement in which the aggregating forces are in equilibrium, or natural and equal antagonist tension. When the oven is opened, the speculum is removed to the workshop, to undergo the process of

Grinding, which process was illustrated by working a model. In the workshop it is placed on a circular table, in a cistern filled with water, of temperature, say 55° Fahrenheit, with the face to be ground upwards. The circular table is turned round by the motion of the grinding-engine. But first, the edge is made truly cylindrical by being surrounded by many pieces of deal board set in an iron ring pressing against the edge; emery being introduced as it turns round, soon grinds it cylindrical; it is then placed in the box in which it is to be used; here it is firmly secured by a ring of iron brought to embrace, firmly yet gently, its now truly cylindrical edge. The box and speculum, with the face to be ground placed upwards, is now again placed on the circular table in the cistern of water. Emery and water being placed upon it, the grinding disk is laid on, which is a cast iron plate turned at one surface to the shape to fit the speculum when ground, and grooved on that surface with many annular grooves concentric with the plate, and with many straight grooves running across at right angles to each other. The back of this grinding plate is ribbed with six or eight radial ribs, to give it stiffness. This plate sits rather loosely in a ring of iron a little larger in diameter, which is driven back and forward by the motion of the steam-engine. This ring has two motions, longitudinal and transverse. The engine causes it to make $24\frac{1}{2}$ strokes for one turn of the speculum on its axis under the grinding disk, about 80 strokes taking place in a minute; the length of this stroke is one-third of the diameter of the speculum. The motion is produced by an eccentric pin. The transverse stroke takes place 1·72 times for each turn of the speculum, and its extent is, at the centre of the speculum, $\frac{27}{100}$ of the diameter of the speculum; it is produced by an eccentric fork. A fourth motion takes place by the grinding disk, while for an instant free of the ring, at the turn of the eccentrics, being carried round a little by the speculum, on which it is then lying as it were free; this causes it to turn once for about 15 turns of the speculum. Emery and water being constantly supplied, the surfaces of the grinding disk and speculum in a few hours grind each other truly spherical, whatever be their original defects of form. The process is finished, when, upon drawing off the grinding disk with one steady long pull, the surface of the speculum is left everywhere uniformly covered with the fine emery arranged in uniform lines, parallel to the line in which the disk was drawn off. A slight polish being now given to the speculum, its focal length is tested by a very simple process. The floors of the loft above the workshop, in the tower of the castle, contain trap-doors, which are now opened, and a mast crected on the top of the tower, which carries at its top a short cross-arm, to the under surface of which a watch-dial is fastened, the face of the dial looking down on the speculum, now directly under it, and at a distance of 97 ft. A temporary eye-piece erected in the upper floor of the tower, soon finds the place of the faint and still imperfect image of the watch-dial, the proper place of which is a matter of simple calculation, if the speculum be ground to the expected focus. If it be found incorrect, the grinding disk is rendered a little more flat, or a little more convex, and the grinding process is renewed, and so on, until the spherical face of the speculum is given its proper length of radius. When this is accomplished, the brilliant reflecting surface, and true form for producing a good image, is given to the speculum by the final process of

Polishing.—In this, two matters require attention, the polishing powder and the surface of the polisher. The powder used by Lord Rosse is not putty or oxide of tin, as used by Newton and his followers, but red oxide of iron procured by precipitation from green vitriol or sulphate of iron by water of ammonia; this is to be heated carefully in an iron crucible, for it has a tendency to take fire, and thus run many particles into one, and render the polishing powder too coarse. The surface of the polisher used by Newton was pitch in a very thin layer. Instead of pitch, which Lord Rosse found too full of gritty impurities, he uses resin tempered with spirit of turpentine. A large quantity of resin being melted, the spirit of turpentine is poured in, and well mixed and incorporated (about a fifth by weight suffices.) The proper temper is known by taking up a little on an iron rod, and putting it into the water until it acquires the temperature, say of 55° Fahrenheit. Then if the thumb nail make a slight but decided impression, it is rightly tempered; if not, more resin or more spirit of turpentine is added, until the proper temper is attained. The tempered resin is now divided into two parcels: to the one parcel a fourth part (by weight) of wheaten flour is added to give it tenacity and diminish its adhesiveness. This is incorporated by stirring until it becomes clear. To the other parcel an equal weight of resin is added, which makes it very hard. Upon this, when cooled to 55°, the nail will scarcely make an impression. The grinding disk, with its spherical surface turned upwards, is now heated by fire underneath, and the resin rendered tenacious by flour laid on with a brush in a thin even coat about, 150° Fahrenheit. This coat and the grinding disk are then allowed to cool down to about 100° Fahrenheit, when a thin coat of hard tempered resin is laid on as evenly and thin as possible. The smooth ground concave speculum is now covered with a creamy coat of the fine polishing powder and water, and the warm polishing surface turned down upon it at about 80° Fahrenheit, when it soon takes the form of the speculum as in a mould; care must be taken not to put on the polishing plate too hot for fear of cracking the speculum, which the interposed creamy polishing powder helps to protect; nor too cold, else it will not take the proper figure. The grinding engine now gives the same motions to the polishing plate as before, but its weight is much diminished by counterpoising it. The soft tenacious coat below, and the grooves on the surface of the grinding disk, permit the proper lateral expansion, while the hard outer coating retains its form, and holds firmly embedded the particles of polishing powder. The polishing now proceeds rapidly, and as soon as what is technically called the black polish is attained, the defining power is judged of by examining the minute divisions of the image of the watch dial under an eye-piece of high power. The true form is known to be given as the polishing proceeds, if the focal length slowly increases in a tabulated proportion to the time. The six foot speculum it is expected will be finished after six hours' polishing.

NOTES OF THE WEEK.

The Wilkie statue in the National Gallery has been the subject of much interest and much discussion, and very different opinions have been expressed as to its merits, according to the standard by which it has been judged. It is the same with Chantrey's horse in Trafalgar Square; those who look to precedent and consider prancing horses as legitimate, condemn it as tame; those who maintain that it is unnatural to have a fixed statue in a prancing attitude, praise the artist's skill in preserving propriety, at the same time that the vigour and life-like character of the animal is so well expressed. Mr. Joseph has represented Wilkie as a young man in the act of sketching on his tablets some vivid idea which has struck him. An objection to the expression of the countenance has been found in the fact that it does not give strongly enough the national harsh features which the painter possessed, and Mr. Joseph has softened down. How far it is legitimate to do this, will, of course, be decided agreeably to the different views different parties entertain. Wilkie being represented standing by the trunk of a tree and draped in a cloak, is considered by some as improper, as if the artist could not as well be represented pursuing his labours in the open air as in his studio, while it is not unnatural to imagine him struck by one of those peasant groups, which he has transferred to canvass. The whole figure and its details have been minutely scanned, and even the way in which the crayon is held has been the subject of criticism. Neither has the place in which the statue is put between without its commentators, its location among the umbrella takers awakening the ire of some. For our own part, we must confess that it appears in some degree derogatory that the artist should be kept waiting at the porch, instead of being admitted to the cella of the temple of art; but, alas! such are the sad necessities of that unfortunate building, the National Gallery. If, indeed, the ground-floor could not without props support the weight of a statue, how could the safety of the upper stories be jeopardized. It is lamentable that every year brings to light fresh defects in connexion with this ill-conceived structure. Taking the statue of Wilkie as a whole, and allowing for the necessities of its position, we are much pleased with it. The merit of Mr. Joseph cannot be contested, though a difference of opinion may exist as to details of treatment, and as to the fact of the statue being erected, and we are glad to take it with all its defects, as a first offering to men of art in the national building. If Wilkie is to be honoured, surely others cannot be neglected, and we hail, therefore, with pleasure the prospect of a proper commemoration of ancient individuals. If statues are awarded to painters and sculptors, the honour of architecture cannot be forgotten, and we hope to see the day when Wren, Inigo Jones, and Chambers will receive due homage.

The public works, which have been brought forward recently, seem almost without exception to have met with strong support, and there is every probability of a great number of new railways being authorized in the ensuing session. This will be a most seasonable relief to professional men, whose employment has been so seriously interfered with by the restrictive legislative enactments.

The basins for the fountains in Trafalgar Square have been asphalted. The contract for paving the whole of the square has been taken by the Bastenne Bitumen Company, who will proceed immediately to lay down their composition.

We are sorry to see that the foundations for the buildings in 'Change Alley, or rather Freeman's Court, are being proceeded with.

A new Concert Hall has been opened at Rotterdam from the designs of Mr. W. N. Rose.

The painter Ferdinand Deurer died at Munich on the 9th, aged 67. The lithographer Piloty died in the same city on the 15th. He was one of the oldest lithographers, having begun in 1808.

The new English steamer for the Main Steam Navigation Company arrived at Frankfort on the 9th. She made the passage in two hours less than the old boats.

The first steam towing boat for the Company of the Palatinate has been launched at Strasburg.

The works for the rebuilding of Hamburg get on well. At the end of December, the bridges in the Gorttwiete, the Steintwiete, and of the Exchange were finished, and in use. The quay on the Monkedamm is in active progress. The bridges over the Kastenschleuse and the Resendamm are begun.

At the last meeting of the magistrates for Middlesex on the 18th instant, Mr. George Legg was elected district surveyor for the united parishes of St. Andrew, Holborn, St. George the Martyr, and the Liberty of the Rolls.

The Assize Court at Cambridge, designed by Wyatt and Brandon, is to be decorated by a series of four colossal statues of Law, Power, Justice, and Mercy.

The Eastern Counties' contract for the Northern and Eastern extension is, we understand, signed at about £12,000 a mile, for everything. Grissell and Peto are the contractors.

Another large hotel, 150 feet larger than the present, will be begun at Folkestone in the course of next month.

Mr. Macqueen has brought out a voluminous pamphlet, which we have had the good fortune to see, in which he enters most fully into the details of the management or rather mismanagement of the Royal Mail Steam Navigation Company. It is certain to make a great sensation, and we shall take an early opportunity of entering into the subject. Mr. Macqueen's vindication of himself seems complete; as to his inculpation of other parties, that must be matter of investigation.

Another large work has been published at the expense of the Pope on the Etruscan Museum Gregorianum; it is in two volumes, and contains upwards of 200 plates.

Of *Durand's Parallèle*—one, however, not quite so well planned as it might have been—a new edition has lately been brought out at Brussels, containing a great many additional, and also several unedited subjects. Among them are La Madeleine, Notre Dame de Lorette, L'Ecole des Beaux Arts, Le Palais du Quai d'Orsay, and several other recent monuments of Paris: further, the University at Ghent, the Palace of the Grand-Duke Michael at St. Petersburg, the Royal Palace at Stockholm, some buildings in Germany, the Royal Palace at Naples, and that at Madrid. Among them all, however, there is not a single example of any of the numerous buildings erected in England and Scotland within the present century. It would therefore seem that our architecture is not held in greater esteem on the Continent, than foreign architecture is by some here at home. Or possibly, the omission may not so much have been intentional as occasioned by the difficulty of obtaining authentic materials for the purpose. In other countries, those who have done most and best, have published their own designs—at least have contributed some of their principal ones to collections of the kind; but such practice, we regret to say, does not prevail among the architects of this country. Even could such reserve be imputed to humility, it would be a more strange than satisfactory excuse. Rather, we fear, must it be attributed to indifference on the one hand, and an illaudable economy on the other. Profit, indeed, could hardly be promised them, therefore, if there be no higher inducement than that of bringing out works of the kind, we have no reason to expect them; yet surely those—and some there are—who have accumulated wealth by a long and prosperous career, could well afford to renounce all ideas of profit, and even to abide by a certain loss. There is another reason—a most valid and cogent one, but we will leave it to the sagacity of our readers to find out, it being one that will hardly be confessed to.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

January 22.—T. L. Donaldson, Esq., in the chair.

Several donations were announced, and among others a rubbing of a brass intended to be erected in the country as a sepulchral mural monument. —As the impression was a very effective one, Mr. G. Godwin, jun., inquired whether any particular process had been used to obtain it?—Mr. Cox said it was done with the common heel ball, but as the brass was not fixed, the heel ball could be used more freely, and a sharper impression obtained. He hoped it would be seen, by the specimen before them, how very effective this mode of celebrating the departed was, and that it would not be without its effect in influencing the revival of this neglected branch of art.

The Chairman concurred in this wish, and observed that the practice of consecrating painted glass windows as monumental memorials of departed friends was now becoming prevalent, and was also worthy of praise.

Mr. Poynter then made some remarks on a plan and section of the transept of Minchinhampton church, in Gloucestershire, presented by Messrs. Foster & Son, of Bristol. The transept was, he said, a very curious one of the 14th century, and it was most remarkable that the roof, although supported by stone joists, was built as if it were of timber. The transept was not large, being 29 ft. long and 15 ft. wide, and the roof was carried by six stone ribs; the height to the crown of the arch being 32 ft. The appearance was very irregular, the windows also being narrow. The roof was originally covered with slabs of stone, but is now tiled.

The next paper read was by Dr. Brömett describing a bridge over the Moine, at Clisson, near Nantes, in Brittany. The river here runs in a deep ravine, and is a rapid, unnavigable stream, formerly crossed by a bridge at the bottom of the hollow made for purposes of fortification, as difficult of access as possible. The present construction is not so properly a bridge as a viaduct, and consists of 15 arches with two large abutments, being 106 metres (348 ft.) in length. The abutments rest on a coarse granitic foundation, but the structure itself is of a fine white granite, and the stones of large size, well jointed with fine white mortar. The foundations are six feet below the bed of the river, the height from the bed of the river to the springing of the arches 33 ft. and the total height from the foundation to the top of the parapet 61 ft. The total width at the top is 30 ft. 3 in. at the widest part. The viaduct is placed at right angles to the stream. The chief peculiarity of its construction is, that the piers are pierced with the pointed arch intersecting the cylindrical intrados of the main arches in the direction of the length of the viaduct, so that the roadway rests on a groined vault, which, seen from the abutments, have the appearance of the aisle of a Gothic cathedral. The same principle is adopted in the bridge of St. Maxence, built by the celebrated Peyronnet, about 70 years ago. The Clisson viaduct was completed in 1842, but it was opened for traffic a year or two before.

Mr. Billings proceeded to make some remarks on the Church of St. Peter and St. Paul, at Kettering, in Northamptonshire. As Mr. Billing's illustrations of his subject were principally sketched by himself at the moment, and describing minute points, we regret that we cannot follow him through his whole subject, as to many of those details great interest is attached. He described the Northamptonshire district as being characterised by churches with lofty towers and spires, and stunted bodies. At the same time, they are invaluable as studies at the present moment, as the cost of them is entirely within the means devoted to church building. There was an early church at Kettering, on the plan of which the present church was built, in the 15th century, all the remains of the old church being destroyed, except the chancel and the north doorway of the church. It so happened that the new building was first begun on a different line, and the tower at the west end being the first part of it, it was built at a very different angle from the rest of the building, so that the tower looks completely atwist. Ultimately, however, the church was built on the old foundations, but in the perpendicular style. The porch, also, was another anomalous appendage, for to suit the entrance to the church-yard, that is also atwist; indeed the tower and spire are at 15° angle in one direction, and the porch about as much in another direction. There was a curious thing with regard to the tower, and it appeared as if in that case, as in some others, it had been intended that the tower should have been isolated. The tower was finished on the inside with buttresses and ornaments, so as to afford a view of it from the interior. "This shows," said Mr. Billings, "that the old architects sometimes made mistakes as well as we do, by putting more work than is necessary." This remark caused much amusement. He proceeded to say, that the plan of the church was a square of 64 ft., and contrary to the usual proportion allotted to aisles, the church was so divided that it might be said to have three equal aisles. There being five compartments on each side of the nave, there were twelve piers, which, if the symbolists were right, would stand for the twelve apostles. At Harrow it was a very interesting circumstance, that with twelve compartments, each niche was occupied with the statue of an apostle. He then described the columns, the caps of which were, in his opinion, very beautiful. As to the roof, there was nothing remarkable in that, except the blunders committed in its design and construction, and particularly with regard to the great beams, which were not long enough to reach from wall to wall, and consequently they rested on a piece of timber at each end, and were supported by two most bungling struts and knees. The doorway at Kettering he notices as very pretty, and a window, in the chancel, as curious; one of the windows in the clerestory he considered as perfect. There was also an instance, in a chapel of a late date, in which the pointed arch was nearly lost in a circle, and for his own part he was strongly inclined to believe, that had not the progress of architecture been arrested, the tendency was to a revival of the ancient round arch style of architecture. The plan of the spire and tower he considered as the most extraordinary portion of the whole building; the tower being a square within which diagonals had been drawn, and the angles of these being cut off, an octagon remained, which represented the base of the spire. The question of entasis or swelling of the spire, which created great interest, Mr. Billings said he had minutely examined, and measured Kettering spire, and there was no sign of it; it was formed by right lines. At Stamford he had been told there was an entasis on one of the spires, but, on examining it, attentively, he found the appearance merely arose from the spire being formed of two lines at a different angle. He did not, however, mean to deny that bulging might exist, though the bulging was in most cases done purposely. The introduction of rain pipes at Kettering instead of gurgoyles, he considered as one of the oldest instances. In answer to a question from the Chair, Mr. Billings said the materials were of lead.—The Chairman remarked, that it was not unusual to find old rain pipes of that material.—Mr. Billings said he was aware of that, and particularly in domestic building. There had been paintings, he said, at Kettering, usually called fresco, but which, in reality, were distemper. Among others was a Saint Christopher, with brilliant azure breeches, decorated with gold stars. Having concluded his remarks on Kettering, Mr. Billings made some remark on the book he had published on the subject, and, in order to prevent speculators subsequently bringing out the work at half-price, to the annoyance of subscribers, he had brought the work out at half price in the first instance.

The Chairman, after passing a vote of thanks to Mr. Billings, and paying a great many compliments to him, proceeded to assert, that he had seen a church in Northamptonshire, where there were very old pews, and that the use of pews was an established practice of the ancient church in this country.

Mr. Billings, on the other hand, said, all the spires in Northamptonshire had been built by the protestants, which caused much laughter, and also that all the pews had been built by them.

The Chairman contested this.

Mr. Poynter, in reference to entasis, said, there was a decided case of a curved line in a spire at Newark, though, in most cases, the appearance arose from the spire being made on distinct lines. He had recognized as many as three distinct lines.

Mr. Billings said, that in St. Mary Redcliffe, Bristol, there were two distinct lines observable.

This subject being concluded, the Chairman called the attention of the members to a subject generally interesting to the profession. They were, perhaps, aware, that the Westminster Division of Sewers had determined to extend their staff by the appointment of a new assistant surveyor, and new clerk of the works. They had advertised, and they had determined on putting certain questions to the candidates, to ascertain their competency, which questions he had prepared in conjunction with Mr. Walker, Pres. Inst. C. E., and Mr. Gwilt, Surveyor of the Surrey Commission; 33 candidates appeared, but on the questions being put to them, and three hours being assigned as the time to write out the answers, several of them immediately retired. Ultimately, six candidates were selected, who were considered the best, and not one surveyor or architect was among them; they were all engineers. This struck him most forcibly, and he felt himself disappointed. He urged, therefore, on the younger members of the profession, the necessity of keeping pace with the tide of knowledge, and the spirit of the times, or they would be undoubtedly outstripped by the engineers. It was indispensable for them to acquire the higher branches of knowledge; it could no longer be considered that mathematics was unnecessary, or natural philosophy, physics, or geology, nor any department of practical knowledge. They would find, too, in their own profession, several brilliant instances of acquirement: as mathematicians, Mr. Gwilt, and Mr. Newman, had procured the admiration even of engineers; neither must it be supposed that the engineers had carried off all the honours. Mr. Walker, it was true, held several appointments, but Mr. Gwilt, Mr. Newman and Mr. Ianson, were all architects. The profession must, however, exert itself, many valuable appointments would be open to competition, for success in which, interest could no longer be looked to, but they must depend on their own merits. They might rely upon it, that they must not be below the age, nay, they must not be merely equal to the age, but they must be in advance of the age, if they wished to maintain that position, which, as architects, they ought to hold in the public estimation. Mr. Donaldson then proceeded to read several of the questions, which all related to practical points with which it is requisite candidates should be acquainted, as, the nature of the different cements, the mode of constructing sewers, shoring houses, &c.

The meeting then adjourned to Monday, February 6.

THE ROYAL SCOTTISH SOCIETY OF ARTS.

January 8.—GEO. BUCHANAN, Esq., F.R.S.E., Vice-President in the chair.

The following communications were made:—

1. *On the Comparative Value of different kinds of Parrot Coal for yielding Gas*, &c. By ANDREW FYFE, M.D., F.R.S.E. In this paper the author laid before the Society the results of experiments which he had undertaken, with the view of ascertaining the comparative illuminating power of gas from different kinds of parrot coal; and also, whether gas is altered in its quality by its transit through the street pipes. The coals used were those from Lesmahagow, Monkland, Knightswood, and Skaterig, in the west of Scotland; Torryburn and Wemyss, in Fifeshire; and those from the Marquis of Lothian's, from Dryden and Arniston, in the neighbourhood of Edinburgh—being, in all, ten varieties. Taking the average of the different trials, the comparative illuminating power of the gases, as ascertained by the usual tests, was as follows:—For equal consumpts of gas—Skaterig, 1; Knightswood, 1; Marquis of Lothian's (B), 1·76; Torryburn, 1·8; Marquis of Lothian's (A), 1·9; Lesmahagow (F), 2; Lesmahagow (D), 2·48; Monkland, 2·5; Arniston, 2·9; Wemyss, 3. The coals above-mentioned were found to yield different quantities of gas, and, taking this into consideration, along with the difference in the illuminating power, the comparative value of the coals for yielding gas, without having any reference to the other products, such as the ammoniacal liquor, the naphtha, &c., was—Knightswood, 1; Skaterig, 1·12; Marquis of Lothian's (B), 1·8; Marquis of Lothian's (A), 2·1; Lesmahagow (F), 2·2; Torryhurn, 2·2; Monkland, 2·8; Wemyss, 3·4; Arniston, 3·4; Lesmahagow (D), 3·5. The second object of inquiry was to ascertain whether the gas is affected in its quality by passing through the pipes to the place of consumption. For this purpose the illuminating power of gas in different towns was tried at the manufactory, and at the greatest distance to which it was conveyed. At the Edinburgh works the gas was found, by a particular test, to indicate an illuminating power, as 13·16; at the distance of a mile it was 14. In other trials, the distance from the works being three miles, the results were as 13·5 and 12·5; in others, as 14 and 14. Similar results were obtained in other towns. In one place, at the distance of six miles from the manufactory, they were as 14·75 and 14·25. From these and other experiments, Dr. Fyfe concluded, that if there is any diminution in the illuminating power of gas when carried to a distance from the gas-works, it is so very trifling as to be altogether unworthy of notice.

2. *Description and Drawing of an Improved Apparatus for Levelling small Theodolites.* By Mr. JOHN SANG, land-surveyor, Kirkaldy. The apparatus exhibited is an elegant addition to the theodolite, and renders the instrument much more easily and quickly adjusted to the level, one hand being only needed in place of two, and, when once brought to the level in one direction, requiring no second adjustment, from the disturbing influence of the other screws at right angles, which render the usual method so tedious and troublesome. The apparatus was not only invented, but constructed in so perfect a manner by Mr. Sang, that it elicited praise from opticians who were present. Referred to a committee.

3. *Model and Description of an Improved Double-acting Cross-cut Saw.* By Mr. ROBERT DICK, wood-forester, Scone.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM DECEMBER 28, 1843, TO JANUARY 23, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

Richard Archibald Brooman, of the Patent Office, 166, Fleet Street, London, gent., for "*Improvements in figure weaving machinery.* (A communication.)—Sealed December 28.

Thomas Murray Gladstone, of Swan Garden Iron Works, Wolverhampton, iron master, for "*Improvements in machines for cutting or shearing iron or other metals, which improvements are applicable to other like purposes.*" Dec. 28.

George Benjamin Thorneycroft, of Wolverhampton, iron master, for "*A machine for rolling, squeezing, or compressing puddled balls of iron, and also for crushing or grinding other substances.*" Dec. 28.

Robert Noyes Elven, of Southampton Street, Camberwell, shoemaker, for *Improvements in the manufacture of boots, shoes, galoshes, and clogs, which improvements are applicable to the manufacture of leather hose and buckets.*" Dec. 28.

Henry Lowcock, of Westerland, Devon, yeoman, for "*Improvements in ploughs.*" Dec. 28.

Edward Budd, of Swansea, Glamorgan, copper merchant, and William Morgan of the same place, refiner of copper, for "*Improvements in treating or reducing of copper ores, and in the construction of furnaces for treating such ores, part of which improvements are applicable to other ores.*" Dec. 28.

George Gwynne, of Regent Street, gent., and George Fergusson Wilson, of Belmont, Vauxhall, gent., for "*improvements in the manufacture of candles, and in treating fatty and oily matters, to obtain products for the manufacture of candles and other uses.*" Dec. 28.

James Champion, of Salford, Lancaster, machinist, and Thomas Marsden, of the same place, machine-maker, for "*improvements in drawing and spinning cotton and other fibrous substances.*" Dec. 28.

Alexander Denoon, of Adams Court, Broad Street, London, merchant, for "*improvements in the mode of making carbonate of soda.*" Jan. 1.

Alexander Denoon, of Adams Court, Broad Street, London, merchant, for "*improvements in the mode of making muriate of ammonia.*" Jan. 1.

William Longmaid, of Plymouth, Devon, accountant, for "*an improvement in the manufacture of copper, tin, zinc, and peroxide of iron.*" Jan. 1.

John Hinks, George Wells, and Joseph Finnemore, all of Birmingham, Warwick, metallic penmakers, for "*improvements in the manufacture of metallic pens, and in machines for manufacturing metallic pens.*" Jan. 4.

William Wright, of Duke Street, St. James's, Middlesex, surgeon, for "*improvements in rendering leather skins or hides impervious to wet, more flexible, and more durable.*" Jan. 11.

Laurence Hill, jun., of Glasgow, civil engineer, for "*improvements in machinery for manufacturing shoes for horses and animals.*" (A communication.)—Jan. 11.

William Hale, of Woolwich, Kent, engineer, for "*improvements in rockets.*" Jan. 11.

Robert Foulerton, of the Jamaica coffee-house, Cornhill, London, master mariner, for "*improved machinery for moving vessels, and other floating apparatus.*" Jan. 13.

Anthony Movillon de Glimes, of Panton Street, Haymarket, gentlemen, for "*improvements in apparatus for propelling vessels on water, and also in machinery capable of communicating manual power to work the same, which machinery is also applicable to raising heavy bodies, and exerting power for various other purposes.*" Jan 13.

Henry Bessemer, of Baxter House, St. Pancras, engineer, for "*a new pigment or paint, and the method of preparing the same, part of which method is also applicable to the preparing and treating of oils, turpentine, varnishes, and gold size, when employed to fix metallic powders, and metal leaf, or as a means of protecting the same.*" Jan. 13.

James Lindley, of Cranbourne Street, Middlesex, gent., for "*improvements in coffins.*" Jan. 16.

Thomas Aspinwall, of Bishopsgate Church-yard, Esq., for "*an improved cannon, formed either of wrought iron, or steel, or wrought iron and steel combined, and also instruments and machinery used in making, and method of making the said cannon.*" Jan. 16.

Charles Cameron, of Liverpool, chemist, for "*improvements in extinguishing fires in buildings.*" Jan. 16.

Benjamin Cheverton, of Pratt Street, Camden Town, sculptor in ivory, for "*improvements in machinery for cutting wood and other materials.*" Jan. 16.

William Edward Newton, of Chancery Lane, civil engineer, for "*improvements in machinery or apparatus for facilitating the tracing and copying of designs, drawings, and etchings of all kinds, either of the original size or upon an enlarged or reduced scale.*" (A communication.)—Jan. 16.

William Watson, jun., of Leeds, manufacturing chemist, for "*improvements in the manufacture of sulphate, muriate, and other salts of ammonia.*" Jan. 16.

William Nichol, of Edinburgh, printer, for "*improvements in lithographic, and other printing presses.*" Jan. 16.

John Fielding Empson, of Birmingham, manufacturer, for "*improvements in the construction and manufacture of buttons, and other fastenings for dress.*" Jan. 16.

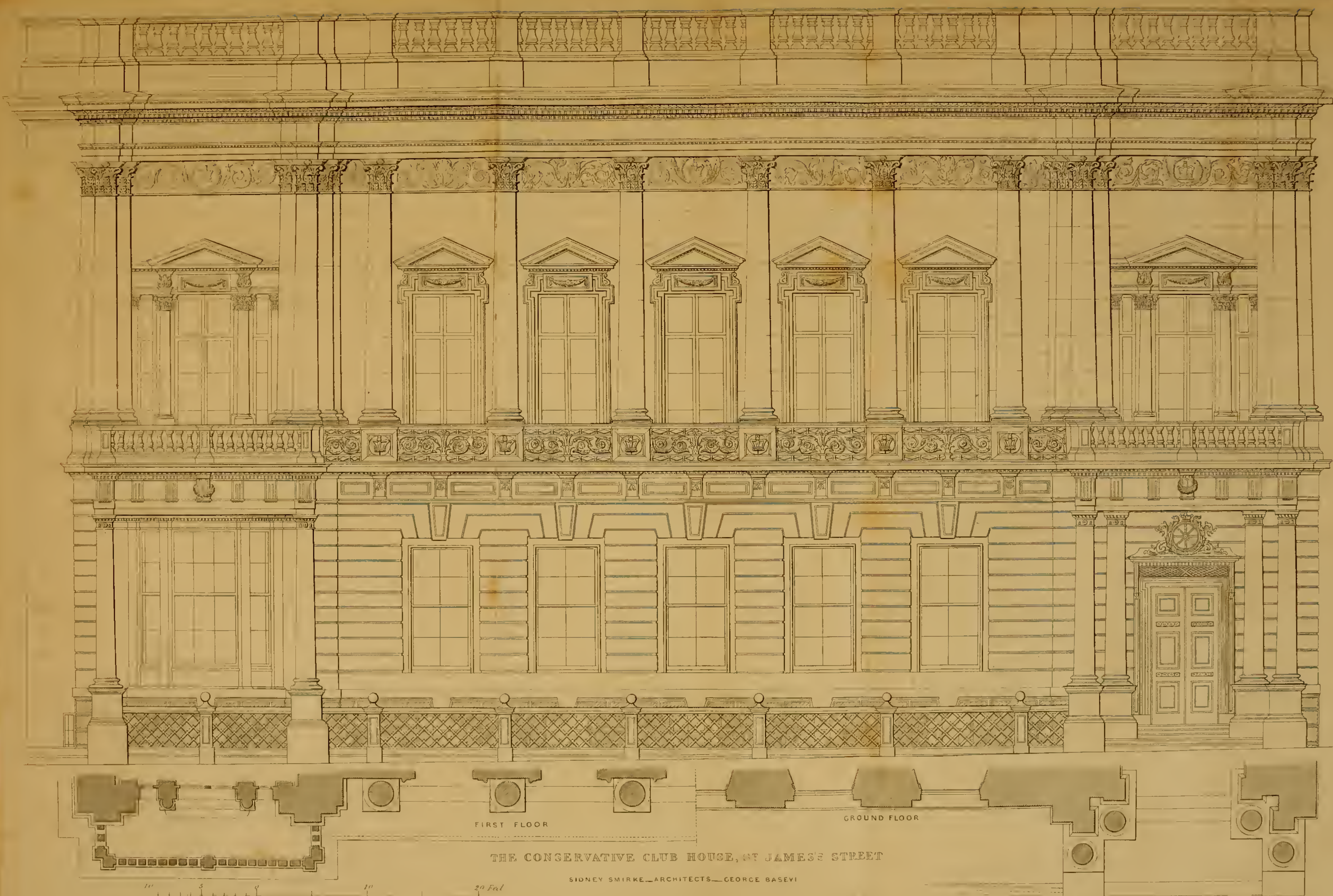
William Basford, of Burslem, Stafford, brick and tile manufacturer, for "*improvements in the mode of manufacturing bricks, tiles, quarries, and certain other articles made or composed of brick, earth, and of burning and firing the same, and certain articles of pottery and earthenware.*" Jan. 23.

Claude Francois Jules Petit, of Regent Street, merchant, for "*improvements in fastenings for gloves.*" (A communication.)—Jan. 23.

Samuel Wright, of Shelton, in the Staffordshire Potteries, for "*a manufacture of ornamental tiles, bricks, and quarries for floor pavements, and other purposes.* (Being an extension of former letters patent for the term of seven years, from the 26th instant.)

Thomas Nash, of Paul's Cray, Kent, paper manufacturer, for "*improvements in the machinery for the manufacture of paper.*" Jan. 23.

Henry Davies, of Norbury, Stafford, engineer, for "*improvements in the construction of vessels for conveying goods or passengers on water, also certain improved arrangements of machinery fo recommunicating motion to such vessels.*" Jan. 25.



THE CONSERVATIVE CLUB HOUSE, ST JAMES'S STREET

SIDNEY SMIRKE — ARCHITECTS — GEORGE BASEVI

Engraved by H. Banks for the Civil Engineer & Architect's Journal Feb. 1844

WATSON'S PATENT IMPROVEMENTS IN DRAINING.

The serious difficulties which railways have had to contend with, particularly in the vicinity of the metropolis where there are deep cuttings in the London clay, in consequence of the continued slipping or rather sliding of the banks, mainly owing to the filtration of the surface water or the springs percolating through the substrata, induced Mr. Watson to turn his attention to the evil, to see how far it might best be corrected, and that with economy. For this purpose he invented iron drain pipes with conical perforations, the smaller end of the cone being on the outside, and the base or larger end inside; or instead of holes the pipes are sometimes made with slits, having a small aperture on the outside of the pipe enlarging towards the inside; by thus making the outer apertures smaller than the inside, they do not become clogged up. These pipes are shown in the annexed figures A, B, C & D; they are cast in lengths of 4 ft. each, and 3 in. diameter, for which the charge is 4*s.* 6*d.* each, they are also made in pottery from 4 in. to 12 in. diameter. It is not to the pipes only that Mr. Watson, directed his attention, but likewise to their insertion in the banks, without being obliged to cut a deep trench; this he contrives to do by a boring machine that he has invented for the purpose, and which we shall describe in our next number. By the aid of this machine, the pipes are easily and cheaply inserted in the clay or other soil, as shown in the annexed engraving of a cutting.

Another advantage offered by this patent is the ventilation that is procured in the works to which it is applied, and which will preserve building materials and consolidate earthwork. The borings are to extend not merely through the masonry, but some distance in the solid earth. As mortar will not harden if kept from the air, the importance of admitting air within masses of brickwork will be readily acknowledged. It may here be remarked, that holes bored for drainage, without the insertion of pipes, soon become choked and useless.

These pipes have lately been introduced for draining the back of the retaining wall in the cutting of the London and Birmingham Railway, between Euston Square and Camden Town, and also on the Croydon Railway.

Mr. Hughes of Bunhill Row will be happy to give any explanation as to the cost of inserting the pipes either by his own men, or he will instruct others.

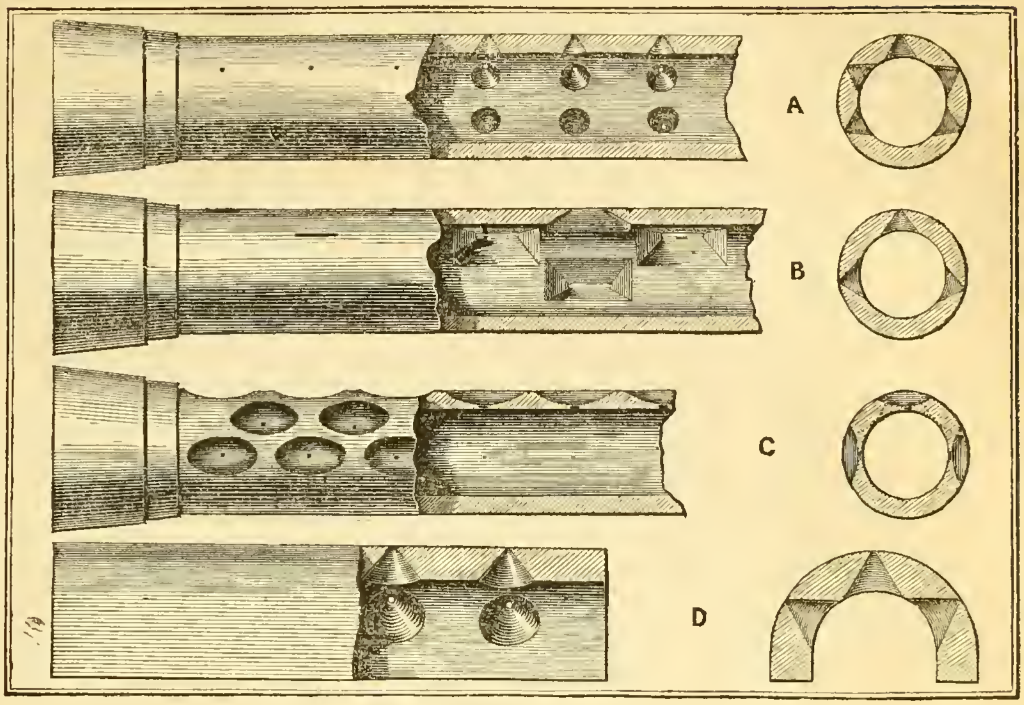


Fig. 1.—A, B, C, Sketches of the Pipes. D, a Drain Pipe.

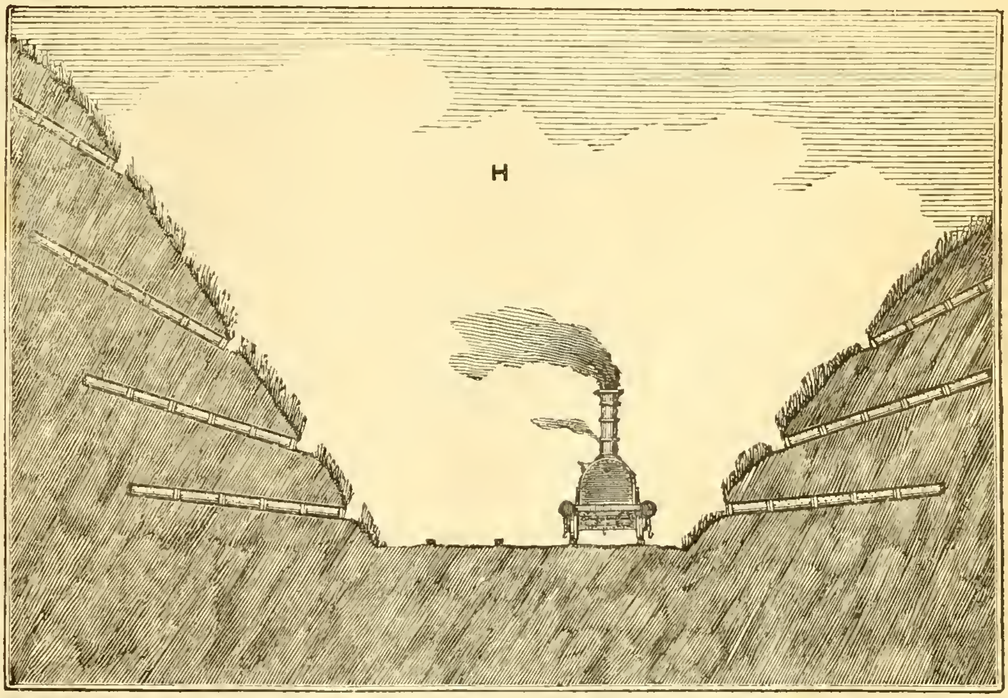


Fig. 2.—Drain Pipes in Open Cutting.

THE DRAINAGE OF THE COUNTRY.

By W. Mullingar Higgins, Esq., C.E., &c., formerly Professor of Experimental Philosophy at Guy's Hospital.

During the next three or four years there will probably be such an opportunity of improving the internal resources of the country, as has never before occurred. It is generally understood that the Government intends to introduce, during the next session of Parliament, a general measure, which will, probably, embrace the sewage of towns and the drainage of the land. That such a measure, wisely planned and carried out with skill, will be an invaluable boon to the nation, every one admits; but it may be doubted whether the public is at all aware of the extent of its value, and perhaps not many of its most sanguine promoters. The health of the population in towns, and the improvement of cultivated lands, are the two results which are generally acknowledged; but the effect of a good system of drainage will be scarcely less beneficial to the internal navigation of the country, than to the agricultural condition of the lands which are now, or may be brought into a state of cultivation. This view of the subject is so important, that a few remarks may not be inappropriate in the present state of the question.

There are numerous rivers in this country which would be of immense value to the districts through which they flow if they were navigable, and would become competitors with the railways for the carriage of merchandize, and the transit of passengers. Many of these have been at former periods large and deep rivers, and have carried vessels of considerable burthen. By great ignorance, or want of attention, and small temporary expenditures, natural causes, which man ought not only to control but to render subservient to the accomplishment of his objects, have, in various ways, so changed their former condition, that they are not only altogether useless for navigation, but are scarcely sufficient channels for the drainage of the country through which they lazily flow. As soon as the commercial wants of some town situated on or near their banks demand a rapid and commodious transit by sea, an engineer is required to give his opinion as to the method of improving the river; dredgings and embankments are immediately commenced, and the streams which had before only tended to the destruction of the channels, are made to assist in their excavation. The difficulty and expense which attend these local improvements, are only known to those who have been engaged in conducting or performing them. And after the expenditure of millions in various parts of this country, during the present century, the good which has been effected is confined to a few districts, and is not appreciated, if in any degree felt, by the country at large.

Should a general plan of drainage be adopted, there will be an opportunity of improving, and perhaps rendering sufficiently navigable, every river in the kingdom. They are the natural and proper channels by which all the waters that fall on the surface of the island should be conducted to the sea. In the present state of the country, these waters are allowed to lie upon cultivated lands, to be evaporated by the heat of the sun, or to collect in low lands, forming bogs and marshes. But, carry them by a perfect system of drains into the rivers, and with a little assistance they will deepen the channels, and improve the outfalls.

It is not my intention, at present, to enlarge upon this subject, as I may, at some future time, offer a few suggestions upon the manner in which this drainage, as a national measure, should be performed, and take a more enlarged view of the benefits that may be obtained. The importance of the measure, however, will entirely depend upon well devised plans and careful execution. The subject is one almost unknown to a large number of engineers, and there is no work in the language which treats the subject systematically. My attention has been many years directed to this and similar pursuits, but although I could mention many admirable reports delivered by British engineers during the last two centuries, in which the great principles of drainage are fully enforced for particular localities, I do not know of any paper containing so excellent a practical view of the subject as is given in one chapter of Gughelmini's work on rivers. I have, therefore, been induced to offer a translation of it. The Italians still look to the writings of this great man as authorities on all questions relating to the motion of water, and although in some particulars he has erred in judgment, the credit given to him by his countrymen can scarcely be denied by us, notwithstanding the advance that has been made in both the theory and practice of hydraulic engineering. It is at present uncertain to whom may be intrusted the works necessary for carrying out the intentions of the Government, but I have no hesitation in saying that a careful study of the following paper, considered in connexion with the works which have been performed in this country, particularly in the Fens, may be the means of preventing many errors that would be fatal to the success of the plans, in the ever varying conditions of the districts in which the improvements are to be made. It is with the view of assisting those who may be thus employed, and the agriculturists who are attempting to secure the effectual drainage of their particular districts, that I have made the following translation.

Beside the large rivers, which have their origin in high mountains, and the torrents which, although they are not fed by springs, have also their birth in mountainous districts, there are channels which carry rain water only, and these commence in the plains. They have seldom if ever been formed by nature alone, but by the art of man, who, to drain his fields and render his ground fit for cultivation, has excavated ditches, into which the rain water immediately flows, and these uniting with others, are finally discharged into a common bed, formed by manual labour, and called a drain,[1] or by other names, according to the custom of the country, and such drains have their own proper names, in the same manner as rivers. Most of these drains are public property, because the right of introducing the rain water into them is common to many, and by their channels the united waters flow towards their outlet. It happens, however, that some fields have no need of the public drain to keep them dry, and these are they which are contiguous to rivers properly embanked, into which, by means of private ditches, their waters are introduced; but these do not need any explanation, as they are but few, and nature herself teaches the mode of managing them.

The declivity of plains is generally so small, and the surface so unequal, that it is not possible for the rain water, unless it moves with great impetuosity, to run off from the high to the low lands, and leave the fields in a state of perfect cultivation, particularly in the time of spring and summer, when the grasses greatly impede its discharge. It is true that the waters are ultimately united in low places, and leave the higher free, but it is also true that for this end a long time is necessary, during which the earth, imbibing an excess of moisture, becomes barren; and as there are in the plains, low places shut up on all sides by more lofty grounds, the water is collected in them, and not being able to escape, necessarily forms a marsh or bog, as frequently occurs in countries unoccupied or neglected by man. This has made it necessary for civilized nations to cause all the plains to be connected by excavated ditches, and to direct the outlet of these ditches to the places where experience has proved they may find basins or continued low grounds, and along these to excavate a capacious canal to receive the atmospheric water from the drains of the country. From this artifice arose the drainage of all the provinces, which have been brought into a fertile state, but they can only be kept in that condition by the preservation of the first excavations.

These drains have their termination, either in neighbouring rivers, in marshes, in ponds, or in the sea. Those that discharge themselves into rivers can serve only those fields that are at least higher than their beds, if temporary, or than the lowest surface of their waters if permanent. The mouths of drains, where they discharge themselves into a river, may be either open or closed. Those only can have their mouths free, that is open at all times, which have their beds higher, or at least as high, as the greatest flood of the river, for otherwise, if the river be turbid, regurgitation through the drain would stop it with deposits, and close the outfall; hence it is that only higher grounds can be drained by open conduits in rivers. But if these channels are embanked, (a certain evidence that the flood rises over the surface of the country,) it will not be possible to have the mouth always open, but some mechanical arrangements will be necessary to prevent the floods of the river from being introduced into them, and that the rain waters, if there are any, should be retained either in them, or in the ditches of the fields, until after the flood has subsided, when the impediments at the mouth may be removed, and the water discharged.

Many artifices have been adopted to prevent the regurgitation of rivers in drains; but this is not the place to speak of them: they may be seen in Baratteri's "Architettura dell'Acque," part 1, lib. 8, cap. 19. The most common are the before mentioned. We should, however, in these cases, carefully observe the conditions of the districts, which give occasion for as many rules.

1. If the lands which are to be drained by a channel, furnished with a gate, are on the same horizontal plane, it is not necessary that the sides of the conduit should be embanked; because when the gate is closed the water is unable to overflow any one part, or if through too great an abundance it should overflow a part, it will distribute itself equally over all the country, an effect embankments could not prevent, which are therefore of no utility; but if the inundation of the country should not be prevented, (in case the gate should break, an accident very rare,) other cautions will be demanded.

[1] Scolo, fossa di scolo, condotto, tratturo, discursorio, o in altra maniera.

2. If the country should decline towards the mouth, as it commonly does, it will be necessary that the banks of the drain towards the outlet should be so much elevated as to equal the height of the highest part, or the water that flows down will overflow and cause inundations. Hence it is

3. That the districts which have a great declivity on the surface cannot have drains with gates, without overflowing the low lands when they are closed; and therefore in such a case we ought

4. To separate the drains of the high lands (as far, at least, as the highest flood of the river) from those of the lower grounds, and to make the former discharge by an open mouth, enclosed with banks sufficiently high to support the regurgitation of the river, while the latter may be provided with a gate and banks if necessary, in the manner above named. It is true that if the water of the open drain should not run in such abundance as to prevent the regurgitation of the high waters, during the freshes, a deposit will be formed, and there may be so small a quantity of water in the drain, that it has not sufficient power to remove the impediments when they are formed: in this case new and repeated excavations will be required.

5. The flood gate may be closed when the river is swollen, until the water in the drain shall be raised to the same level, and then it may be opened to discharge such additional water as may flow into the drain; in this way the regurgitation of the flood will be prevented, and the water that comes afterwards into the drain, will be discharged without inundating the country.

6. The low grounds may be drained by the use of flood-gates either in rivers or in the channel above named, but more easily by the former than by the latter, because the water of the river is lower than that of the drain, and also because the deposit which is formed in the channel cannot be produced in the river, in which the fall must consequently be greater.

The drains which fall into marshes, stagnant waters, and similar places, have generally an open discharge, and the reason is, because the difference between the highest and lowest surface of the water in the marshes is, for the most part, not so great as to require the application of a flood-gate (which is difficult to manage) to prevent regurgitation; and especially as the fields which are to be drained into them are higher than the surface of the marshes, and it is from the fields that the water comes which swells them; besides which, on deposit is to be feared from the regurgitation of the waters. Sometimes, however, the country has so little declivity in those parts contiguous to the marsh, that remaining dry, the great part of the year, in consequence of its elevation, it only spreads the waters at the time of floods. Under such circumstances it may be useful to defend the higher ground by surrounding it with banks, so that the water of the marshes increasing, may not overflow it, and at such times to arrest the rain-water in the fields, which, when the surface of the water in the marshes begins to fall, may be discharged into it by one or more cuttings in the bank. Such localities cannot be brought into a state of perfect cultivation, being by nature marshy, but they must be kept for pasture or meadows to which the dampness of the soil is useful. When marshes are occasionally much flooded, as, for example, when rivers enter them, or when rivers overflow their banks, flood-gates may be used at the mouth of the drains, but before they are introduced, it is necessary to consider the duration of the floods, the state of the country, and other similar questions, for upon these their usefulness depends.

Those channels which have an immediate discharge into the sea, must be differently treated according to their circumstances. The rise and fall of the tides, and the swell produced by winds, is sometimes productive of damage, and sometimes of advantage to the mouths of the drains. Every one knows that the sea forms its own banks, and throws up mounds of gravel upon the shore. The height of these defends the interior low grounds from inundation, which would otherwise be the result in time of storm, and sometimes also at the time of the usual high tides. These beaches must be cut to form an outlet, but the openings must, at the same time, be protected by strong banks, in order that when the water of a stormy sea introduces itself into the drain, it may not spread into the back country, and overflow it for ever, as has sometimes happened in low grounds. Therefore not to run such a risk, they are usually provided with strong gates, which being shut when the sea is high, keep it within its ordinary limits, and being opened when it is low, give a free discharge to the water that was retained during their closure. In some drains, however, which, on account of their length, or for some other reason, carry a large quantity of water at all times, and are equal to small rivers, it may happen that gates are not necessary, the continued flow of the water of the drain being sufficient to keep back the water of the sea; nor are they necessary in those places where the country rises as it recedes from the shore. By comparing the elevation of the sea when tempestuous with the level of the country, it is easy to determine what drains require gates, and what kind of banks should be employed. There are some drains which have outlets so large and deep that they form small harbours, and give shelter to vessels of moderate size. This may be occasioned by the natural depth of the sea in that situation, by the abundance of the water in the drain, or by the position of the shore; it may arise from the direction of the mouth being such that it is not exposed to those impetuous winds which, in tempest, drive sand or beach to the coast, or from the great rise and fall of the sea; or it may be occasioned by the operation of other causes, which prevent the formation of a deposit, and promote excavation, but which cannot be described without a particular examination of the place. On the contrary, the outlets of some other drains are closed when certain winds blow, and these drains must either be diverted and discharged in other places, or the water must be penned up so that it may enter the sea with velocity, and remove the deposit formed at its mouth.

In drains not large enough to have a good outlet, it is especially necessary that they should be sufficient to carry all the surface water of the country, and that they should not overflow their banks. It must, therefore, be borne in mind, that as they have, under ordinary circumstances, a comparatively small quantity of water, they must, when the stream is turbid, have a considerable fall before they can establish their beds. In a plain of little declivity the bed would be elevated above the level of the country, and the drain be rendered incapable of receiving the surface waters. In streams of this kind it is useless to expect any excavation, but it is, on the other hand, necessary to form the channel by manual labour, and prepare the course the waters should have to their discharge.

We must then be careful that the channels shall be excavated sufficiently deep to receive the water in great abundance, so that it may not be raised above the plane of the country, and, if possible, not within the drains that run into them. In addition to this, every excavation is superfluous, as, for the drainage of the land, it is enough that the private drains should remain dry after the fall of rain. Such benefits, however, cannot be obtained in low places with any amount of excavation; for, the bed being horizontal at a lower level than the place of its reception, where the mouth of the conduit ought to be, if greater excavations were made, they would only serve to produce a greater regurgitation, or to cause an eddy; besides which, when the excavations are deeper, a greater width is required, which would, in such a case, be a waste of ground, without a corresponding utility. It is true, that in the excavation of these channels it is better that they should be made too large than too small, for, although the drains of the country carry only limpid waters, they must always hold some earthy compounds brought from the surface of the cultivated land, particularly at the time of heavy rains, or, if from nothing else, from the washing and breaking down of the banks of the conduit, and therefore, the water having but little velocity, in consequence of the little declivity of the bed, as well as the small quantity of water, the earthy matters being deposited, must raise the channel. The water of the drain being raised by the elevation of the bed, the surface waters of the country can no longer have a free discharge: hence it is, that the greater the excavation, so much the longer will it be before the bed is raised to that height at which further deposition will become injurious; but, on the contrary, if the first excavation be too small, the defect will be immediately felt, and will continually increase. Hence it is, that the drains not being able to maintain a free discharge, and being necessarily obstructed by the inevitable accidents above mentioned (besides many others which ignorance permits, and malice creates) repeated excavations are required, which must, as the occasion demands, be done according to established rules."

OCEAN STEAM NAVIGATION.

Mr. Macqueen's *Reply to the Chairman and Directors of the Royal Mail Steam Packet Company.* London: Blackwood, 1844.

On a recent occasion, we expressed our regret that the condition of oceanic steam navigation is so unfavourable, and that dissensions exist which so seriously impede the extension of this important branch of commerce, and deteriorate the property of shareholders. Considered in a commercial point of view, ocean steam navigation affords the means of acquiring for this country, an extensive transit trade, if not the monopoly of it. We well know for how long a period the supremacy of Dutch commerce was maintained from such sources, and how, in the present day, we are deprived of any share of the transit trade, and beaten out of the market by the Americans, and other rivals; this, too, must necessarily continue, so long as the cost of materials for a vessel, and the cost of her stores, are so dear in this country, and cheap and abundant elsewhere. If we have not only to bring timber from the Baltic, but to pay a heavy duty on it, it is evident that shipowners on the Baltic can undersell us, so too, if our shipbuilders and mariners are paid higher wages, and if the stores of the ship are more costly here than in America or elsewhere. If, however, we can change these conditions, it is evident that the preponderance must be on our side, and steam navigation affords us the means of doing this. Iron for ship building and machinery is indigenous, not imported, and is cheapest here; the skill of our workmen is able to defy foreign competition; we are exporters of steamers, and machinery; this country is rich in the possession of the best coal, with which we largely supply other countries; our enginemen receive higher wages abroad than they do here. Thus we are able to build and to work steam ships cheaper than any other people, while the cultivation of this branch of trade will develop our own resources, largely increase the workings of our iron and coal mines, invigorate our manufacturing and mercantile industry, and give employment to large numbers of the population. On these grounds we feel the deeper interest in the subject, and we urge it on our readers as worthy of their most serious consideration and co-operation.

The present time is also most favourable for making a movement in advance; the part taken in the navigation of the wide seas by other countries, is very small. France is engaged in the Mediterranean and Levant lines, and also in the East Spanish; in the north, the Russian line is the only one of her connexions worth mentioning. Her most serious effort, however, is in connexion with the West Indies, though we do not anticipate such serious damage from a mercantile business carried on by naval officers, and, of all naval officers, Frenchmen. Austria has taken part in the Levant and Black Sea trades, and requires watching. The operations in the Baltic are comparatively of little importance. The Anglo-Americans are principally occupied with the navigation of their own rivers and coasts, and would still be so, had not the neglect of the Royal Mail Steam Navigation Company invited them into the West Indies. While little has been done by others, we have done much. We hold the chief part of the steam navigation in the northern seas from Christiania to St. Malo; also on the Iberian coasts, and in the line to Egypt. We have the Transatlantic routes to Boston, New York, and the West Indies, the traffic of the coasts of Brazil, Chili and Peru, and that of the East Indies.

If, however, such are our opportunities, we have been far from profiting by them as we might have done; though large profits have attended good management, the most serious depression has been the general result. Misconduct and rashness have been among the causes tending to this catastrophe, while many unfavourable circumstances have aggravated the casualties naturally attendant upon new enterprises, neither have there been wanting the distractions which cabals, rivalry, enmity, and revenge, infallibly produce. The loss of property and the loss of confidence have been very great, but we believe the period of adversity has now passed by, and that such evils as remain, readily admit of correction. The Liverpool and Boston line of packets has done its duty regularly, and given good proofs of what may be done by careful and well intentioned administration. The Great Western Steam Navigation Company have suffered most severely, both by their own misfortunes, and the success of their rivals. The unhappy loss of the President, and the unfavourable state of the money market, impeded them in their endeavours to recruit their force, while the line to Boston, supported by a government grant, has been able to cut down their prices, without any efficient means of competition. It is very evident that the traffic to the United States admits of unlimited extension, when rapidity of transit, frequency of communication, and lowness of price, are brought to bear, as in time they will be and must be. The Great Britain is a powerful means to this end, but when the time comes that the passage can be made weekly, with a duration of only ten or twelve days, and a cost of as many pounds, the traffic must be immense. Hitherto, neither to the United States, nor to the East or West Indies, has any adequate accommodation been afforded for second class passengers who, of course, form the bulk of the contributable population. Of the fatality which has attended steam navigation in the West Indies, we will speak presently, and the subject of Pacific steam navigation we have already fully discussed. In no case, however, can we see any grounds for despondency; adversity tends to increase its own evils, as good fortune ministers to its own further success. With the extension of steam navigation, and its conduct on enlightened principles, all the evils that now afflict it will cease, and it will, we hope, become as it ought to be, one of the great arms of national strength, and a powerful contributor to the national wealth.

The scheme for West India steam navigation was undoubtedly one of the most magnificent ever submitted to the English public, its very vastness appalled common minds; like the creation of a Frankenstein, it struck terror into those to whom its movements were entrusted. The original plan has been freely blamed—its projector has been assailed, and all the evils and mischiefs which have blasted the concern have been charged upon his head; yet surely that can have been no insane project, which the most cautious merchants pledged themselves to support with their wealth, which the experience and scrutinizing examinations of the Admiralty and its officers approved, and towards which, with small objection, the several bodies of the legislature voted a large and burthensome grant. The plan was great, it is true, but it was simple—entailing large outlay, but economical, because comprehensive—and ensuring a great profit, by leaving no source of traffic untouched. The long connexion of Mr. Macqueen, its projector, with the West Indies, and the prominent part which he had taken for the advocacy of particular interests, did not blind him in the views he adopted, but both he and the government of the day considered the plan as the means of binding together our own colonial interests, and securing the trade of the other West India possessions; while a route opened across the Isthmus of Panama, gave us access to new markets in the Pacific, the intercourse with our chief customers in the southern slave states of America was made more direct, and our communication with the Brazils, a great consumer of our produce, efficiently provided for by a branch line. This plan has received not merely the momentary approval of the Admiralty functionaries of the day, but it has been stamped with the approbation of the French government, who appreciating the immense advantages which it would give to this country, have started a rival line of their own, arranged on the same principle, and calculated, if well conducted, seriously to injure our interests in that quarter. We do not think, then, that Mr. Macqueen is to be rashly condemned for consequences which deviation from his plan has mainly contributed to produce.

It so happened, as it too often does, that the very support which the plan met with, was a fertile cause of misfortune; nothing apparently could be more fortunate than the strong support of the Admiralty and the West Indian interest, nothing, in fact, was more prejudicial. At an early period, intrigues took place among the members of the direction, to limit the operations to our colonies, by which the communication with the Havannah, and Mexico, New Orleans, and the countries on the Mexican Gulf, was to be sacrificed for petty islands, many of them more burthensome than they are productive. This was very specious, and colonial men readily adopted it, but a subsection also declared itself for sacrificing even the colonies genera ly to Barbadoes, and this party ultimately succeeded in carrying the day, so that Barbadoes has the advantage of several days post before the other colonies. This alone would have been sufficient to unhinge the plan, but out of compliment to the Admiralty, naval officers were generally appointed to the vessels, and a naval system of uniform and administration adopted, and as navy men were bitterly opposed to giving up the packet system, and have been constantly endeavouring to get the company knocked up, and the whole matter taken into the hands of Government, it was not to be wondered at that the scheme was burked by the parties engaged in carrying it out. Insolence towards passengers, neglect of duty, refusal to comply with customs and quarantine regulations, or to receive goods and passengers, were common occurrences, while the loss and grounding of vessels, intoxication and insubordinations were not rare. Intrigues were also set afloat by some of the leading officers of the Company, to supplant others, and there can be little doubt, that not the least among the misfortunes of the company, have resulted from the success of these cabals. Thus with an incompetent staff at home, treachery among the officers and agents abroad, a new administration at the Admiralty, the intrigues of the colonial party, the attempts of the naval party to knock up the concern, and of a colonial party to depreciate its value, and buy it into their own hands at a low price, operations began, and such a series of disasters has been the result as no common ability could stem, and which the exertions of the Directors, men of large capital and great talent, could not prevent. As a consequence of the intrigues Mr. Macqueen resigned his appointment in the company, and all the misfortunes being attributed to him, he has been obliged, in his own defence, to enter upon explanations of his conduct, while he has also become an assailant, whose incessant attacks have greatly depreciated the concern. This we regret, as he is himself largely interested in the company, both morally and pecuniarily, and his co-operation with the directors would go far to arrest the downward course of the concern. What is wanted is peace, and a gradual return to the original plan, the correctness of which every day's experience tends to establish.

The pamphlet now before us goes largely into the controversy between Mr. Macqueen and his opponents, but into the minutiæ of that it is not our province to enter. On the engineering department he charges many instances of neglect.

On the 30th of April, last year, it is said :—

"The account you heard about the *Teviot*, one of the Royal Mail Steam packets, having nearly sunk in the Southampton water, is perfectly correct. It is a well known fact here. The circumstances were these :—the engineers, on leaving work, left one of the sea cocks open, and some hours after, it was discovered that the ship was settling by the head from 1ft. 6in. to 2ft. On examination the cause was discovered, but so difficult was it to get at the cock, that one of the engineers got a bed or bag, or something of the kind, to stop the water until she was pumped out, and the ensign was hoisted union down, which is a signal of distress, or to indicate a want of assistance, which was sent from the *Severn*, and one of the Havre steam vessels stopped to render assistance."

Also that the *Severn* took fire on the voyage from Bristol to Southampton, owing to the construction of her boilers and furnaces. These have been strongly denied by the secretary of the company, but the evidence adduced by Mr. Macqueen has not been disproved. To the mismanagement, Captain Chappell, the Secretary, bears testimony in a circular addressed to the captains :—

"One ship proceeded from St. Thomas to Havana, through the old Bahama channel, finding no difficulty whatever in the navigation, whilst another passed to the south of Cuba, thereby extending her voyage unnecessarily between 300 and 400 miles, burning away above 60 tons of coals that could have been saved, and creating two days' delay on the passage, as well as further detention at Havana to replace the fuel thus unnecessarily consumed.

"Coals have in many cases been taken on board at a most objectionable expense, in places where the company have no depôts, and where no absolute necessity existed to ship coals, such as at Tobago, Charleston, and Curaçoa. In other instances more coal was taken from the depôts than was required, such as at St. Thomas, where the stock being short, one ship took much more than she wanted, leaving none for the next ship."

Also Mr. Macqueen says :—

"Several of the officers and crews at the outset would, however, lend no assistance to coal, and the manner in which the steamers had been constructed, with spar decks, is unfavourable for coaling rapidly, and the delay thus occasioned is increased by the coal-funnels being too narrow to admit the coals quickly. At the coal depôts these defects were much complained of, and which are attributable to the ignorance or carelessness of Captain Chappell, Marine Superintendent, when these were originally constructed. The existence of all these defects tended to produce delay, delay to produce confusion, and both to bring the great undertaking at the very outset into disrepute."

CONDUCTING AND ABSORBING POWER OF BUILDING MATERIALS.

New Experiments on Building Materials. By John Hutchinson, M.R.C.S. London: Taylor & Walton.

This small work embodies the results of the writer's long and laborious researches communicated to the Chemical Society. His attention was directed to the subject in connexion with the relative conducting power of building materials, as influencing the construction of penitentiaries, hospitals, union houses, &c. The compositions used for the purpose of experiment were obtained by permission from the Model Prison. From the degree of labour bestowed on this work, and with the knowledge that it is about as easy to make a right experiment as a wrong one, we are bound to presume that Mr. Hutchinson is right in his conclusions. It should be also observed, that he has most fully and carefully described the materials used, and the methods of experiment resorted to, so that any source of error, if existing, can be immediately detected. Of the labour, as we have said, there is abundant evidence. Such a work rests entirely on its own merits, and it is difficult to give an idea of the value of that which depends upon its merits as a whole, without republishing the entire work. We have, however, availed ourselves of two tables with Mr. Hutchinson's remarks and observations which by professional readers will be viewed with great interest, as they clearly show, at a glance, the conducting and absorbing power of most of the materials used in building.

There are in the work nine tables. The first gives the whole matters necessary to work out the calculation of specific heats of equal bulks and equal weights. The second table shows the times of passage as to velocity, through the various substances. The third exhibits the time consumed in the passage of heat. The fourth the resistance to the passage of heat outwards. The fifth the conducting power or velocity for the transmission of heat, corrected for specific heat, referred to the conducting power of fir wood as 100, and slate as 100. The sixth exhibits the conducting power during four different intensities of heat. The seventh the times of cooling in air. The eighth the quantity of heat conveyed outwards in air by different substances, compared with fir wood as 100, and with slate as 100. The ninth (shown below as No. 1) illustrates the gradation of conducting power. The tenth is also extracted as No. 2.

Table I.

Gradation of Conducting Power referred to Fir Wood as 100, *and to Slate as* 100, *in heating, and the rate of Cooling in air referred to Fir Wood as* 100, *to Slate as* 100, *the lowest Conducting Power, the lowest rate of Cooling, the lowest Specific Heat by Weight and Bulk, and lowest Specific Gravity placed first in each column.*

Conducting Power. Substances.	Referred to Fir Wood.	Referred to Slate.	Cooling. Substances.	Fir as 100.	Slate as 100.	Specific Heat. Substances.	Equal Weights.	Specific Heat. Substances.	Equal Bulks.	Substances.	Specific Gravity.
Plaster and Sand	67.72	18.70	Hair and Lime	54.60	37.93	Lead	.0292	Hair and Lime	.1530	Fir Wood	.4262
Keen's Cement	68.85	19.01	Keen's Cement	79.81	55.36	Hair and Lime	.0905	Fir Wond	.2205	Oak ditto	.5697
Plaster of Paris	73.36	20.26	Oak Wood	80.31	55.79	Malm Brick	.1720	Keen's Cement	.2281	Beech ditto	.7442
Roman Cement	75.62	20.88	Plaster of Paris	87.52	60.81	Chalk	.1827	Oak Wood	.2302	Plaster of Paris	1.176
Beech Wood	81.26	22.44	Plaster and Sand	90.65	63.31	Painswick (H.C.)	.1839	Plaster of Paris	.2544	Keen's Cement	1.230
Lath and Plaster	92.55	25.55	Fir Wood	100.00	69.41	Keen's Cement	.1855	Malm Brick	.2755	Plaster and Sand	1.308
Fir Wood	100.00	27.61	Roman Cement	104.58	72.63	Napoleon Marble	.1879	Plaster and Sand	.2758	Lath and Plaster	1.542
Oak ditto	121.90	33.66	Lath and Plaster	107.48	74.66	Stock Brick	.1860	Chalk	.2830	Chalk	1.549
Asphalt	163.66	45.19	Chalk	107.52	74.58	Bath tone	.1891	Lead	.3082	Roman Cement	1.560
Chalk	203.37	56.38	Malm Brick	112.19	77.96	Fire Brick	.1917	Lath and Plaster	.3184	Malm Brick	1.602
Napoleon Marble	211.06	58.27	Bath stone	115.82	83.96	Slate	.1924	Roman Cement	.3274	Hair and Lime	1.691
Stock Brick	217.83	60.14	Beech Wood	122.26	84.71	Portland Stone	.1928	Beech Wood	.3297	Stock Brick	1.831
Bath Stone	221.22	61.08	Portland Stone	134.19	95.07	Yorkshire Flag	.1930	Stock Brick	.3405	Bath Stone	1.858
Fire Brick	223.48	61.70	Painswick (H.C.)	134.55	95.32	Norfal (H. C.)	.1975	Bath Stone	.3512	Portland ditto	2.157
Painswick (H.C.)	258.47	71.36	Lead	137.73	95.67	Leunelle Marble	.2020	Painswick (H.C.)	.4115	Bolsover (H. C.)	2.164
Malm Brick	264.11	72.92	Bolsover (H. C.)	138.63	96.14	Bolsover (H. C.)	.2058	Portland Stone	.4158	Fire Brick	2.201
Portland Stone	272.01	75.10	Norfal (H. C.)	139.22	96.71	Lath and Plaster	.2065	Fire Brick	.4219	Norfal (H. C.)	2.219
Leunelle Marble	273.14	75.41	Stock Brick	139.63	96.97	Roman Cement	.2099	Norfal (H. C.)	.4382	Painswick (H.C.)	2.238
Bolsover (H. C.)	276.52	76.35	Slate	143.94	100.00	Plaster and Sand	.2109	Bolsover (H. C.)	.4453	Yorkshire Flag	2.360
Norfal (H. C.)	345.37	95.36	Leunelle Marble	145.75	101.26	Asphalt	.2150	Yorkshire Flag	.4554	Asphalt	2.572
Slate	362.30	100.00	Yorkshire Flag	146.48	102.29	Plaster of Paris	.2163	Slate	.5364	Leunelle Marble	2.678
Hair and Lime	396.16	109.38	Fire Brick	149.07	103.13	Oak Wood	.4042	Leunelle Marble	.5409	Slate	2.788
Yorkshire Flag	401.81	110.94	Asphalt	151.95	105.57	Beech ditto	.4431	Asphalt	.5529	Napoleon Marble	3.284
Lead	1888.3	521.35	Napoleon Marble	169.61	117.63	Fir ditto	.5174	Napoleon Marble	.6170	Lead	10.56

Table II. *Absorption of Moisture by Weight.*

Name of Substance.	Absorption of moisture by weight.	Absorption of moisture by bulk.	Specific gravity.
Aberdeen Granite	2.00	5.416	2.708
Napoleon Marble	3.00	9.85	3.284
Corrara White Marble	3.10	8.42	2.717
Shetland Flag Stone	3.25	8.74	2.691
Caithness ditto	3.27	8.62	2.638
Slate	3.50	97.58	2.788
Leunelle Marble	4.00	10.71	2.678
Asphalt	5.00	12.86	2.572
Carrara Hard Marble	8.50	23.09	2.717
Mann & Co's Stucco	16.00	35.56	2.223
Arbroath Flag Stone	20.50	50.77	2.477
Hewithburn ditto	23.00	56.85	2.472
Fire Brick	32.00	70.43	2.201
Norfal	33.50	74.33	2.219
Portland	34.25	73.87	2.157
Yorkshire Flag	40.00	94.40	2.360
Bolsover	40.10	86.77	2.164
Painswick	58.00	129.80	2.238
Bath Stone	78.00	144.12	1.858
Maulmien Teak	82.50	61.85	.7498
Stock Brick	109.00	199.57	1.831
Hair and Lime	109.12	184.52	1.691
Malm Brick	116.50	186.63	1.602
Keen's Cement	126.50	155.59	1.230
Chalk	133.50	206.79	1.542
Roman Cement	133.56	208.35	1.560
Plaster and Sand	147.00	192.27	1.308
Beech Wood	185.50	138.04	.7442
Plaster of Paris	187.50	220.50	1.176
Oak	224.75	128.04	.5697
Fir Wood	622.75	265.41	.4262

PRACTICAL DEDUCTIONS.

Want of space will not allow me to point out the numerous subjects of practical utility to be derived from the whole series of experiments hitherto detailed for the benefit of architects, engineers, and builders, but I will venture to fill up the remaining sheet with a few deductions that appear most prominent.

Asphalte stands as the best composition for resisting moisture; it is a slow conductor of heat, and hence is well adapted for flooring, as in cells of prisons, where economy of heat and dryness, the most important advantages are obtained. Slate will be seen to stand as a very dry substance, but from its quick conducting power (Table I.) it is very unfavourable to flooring where warmth is required; but when the one property is sought for and not the other, as preventing the ascent of moisture up the walls of houses, it is well calculated to be useful by forming a layer in the wall a few inches above the ground. The absorbing power of common brick appears very great, being more than one-fifth of its own weight; whereas Mann and Co.'s Stucco paint cement is not greater than $\frac{1}{31}$ of its own weight, and hence more than six times better adapted to resist moisture than brick, therefore the advantage to be derived by covering brick houses in exposed situations with this substance is considerable, while Roman cement resists moisture even worse than brick. I wish it to be borne in mind that I only speak of this stucco as regards its power of resisting the transmission of water, being the only property of it which I have examined.

Keene's cement and plaster of Paris stand as the warmest substances, therefore are well adapted to line rooms with, while hair and lime is a remarkably quick conductor, and therefore a cold substance for that purpose. I would also draw attention to the fact, that plaster and sand and plaster of Paris (particularly the latter) are admirably calculated to resist the action of fire, while we know, on the other hand, that lath and plaster is about the most combustible material in a house. I can most confidently recommend plaster of Paris and plaster and sand to be employed in surrounding iron chests, or other places which contain valuable property, intended to be protected from fire. If an iron chest be surrounded with six or eight inches in thickness of this substance, I believe it will perfectly preserve papers, &c., from any destroying heat in the midst of the burning of our ordinary dwelling houses. I may also point out that Yorkshire flag stone is a very quick conductor, and therefore ill adapted for warm flooring; also that lead which forms the covering of roofs is a remarkably quick conductor, and therefore a great waste of heat is experienced where such covering exists; hence the third back rooms on ground floors in our London houses are found to be so cold; a vast quantity of heat escapes through the leaden roof, and through three of the surrounding walls, which are generally external, and so thin as to allow of a free escape of heat. Such places should be lined with slow conductors if warmth is sought for. Touching the practical utility of the specific heat experiments, I may point out, that fire brick absorbs a great quantity of heat, and therefore is well adapted to form the backs of our fire grates, whereas, with iron backs, there is an enormous waste of fuel and heat, at the same time the fire requires constant stirring, and a quick supply of coal to keep it in; yet, curious to remark, we never enter a house, even of the highest order, where iron backs to fire grates are not universally to be seen, while, a back formed of a composition, as that of fire brick, which can be as easily moulded into any desirable shape, would both save fuel, thoroughly warm any apartment, require less stirring, and not go out so soon.

With regard to the specimens of wood I have examined, it is worth observing that Maulmein teak absorbs much less water than oak wood, in the proportion of 82 to 224, being nearly one-third less; and as the density of woods in their ordinary state bears a strict relation to their porosity or proportion of air within their pores, connecting with this, the fact that iron, protected from contact with the atmosphere and water (being compounds of oxygen) the better it is preserved, may very possibly be the reason assignable for the truth why iron is preserved considerably longer in Maulmien teak than in oak; the relation of absorption of water with the teak and oak (omitting the decimals) is as 82 of the former to 224 of the latter. The density of all these specimens of wood is here calculated from the state in which they naturally exist, that is, as dry as could be obtained, yet containing an unknown quantity of air and moisture. Mr. Parnell observes "when wood, rendered perfectly dry by the aid of heat, is exposed at common temperatures to the atmosphere in its ordinary state of humidity, it re-absorbs a certain proportion of water, varying accordingly to the compactness of the wood, and to the quantity of deliquescent saline matters present." In reference to these two assigned reasons that govern the absorption of water by woods, I would draw attention again to the Maulmien teak in comparison with the beech wood; the relative specific gravity or density of the former to the latter is as 7442 to 7498, being very nearly equal, yet the absorbing power of the two is very different, being in the proportion of 82 to 185. These facts render it incumbent on me to recommend it to the attention of ship-builders.

By Table II. it will be observed that the two kinds of flag stone, termed Shetland and Caithness, absorb very little moisture; having been previously informed of this property, I was desirous of examining them, and certainly they maintain the character determined from the observation of practical men. Their conducting power for heat I had not an opportunity of calculating, but if I might venture an opinion, I suspect they would range like Yorkshire flag stone; if so, they are quick conductors, or cold materials for flaging rooms were warmth is required; nevertheless, they will be found as valuable materials for arresting the ascent of moisture in the walls of houses, and speaking from memory I believe the Caithness flag has thus been employed in the north of England with great success.

The Carrara marbles mentioned are those generally employed in constructing mantle-pieces; it is curious to observe, though their density is the same, yet the harder specimen absorbed more than twice as much water as the softer marble.

Portland stone, Bath stone, and the stones employed in erecting the new Houses of Parliament, may be considered as spongy materials for absorbing water; their relative conducting power may be referred to in the first column in Table I. It will also be seen that Napoleon marble is a warmer material than common brick. I mention this to correct the general opinion that brick is a slow conductor, and therefore a greater thickness of that material should be used in forming the walls of our houses; hence it is that the brick walls so often neither afford protection from the cold of winter nor the heat of summer.

It will be observed that the specific heats have been compared with water as 1, therefore, if we reflect upon the capacity of water for absorbing heat, it very much exceeds all the substances with which it is compared. Water, therefore, becomes a reservoir for heat upon the surface of the globe; islands being surrounded by this reservoir, are preserved of a more equable temperature than main lands.

In reference to the conducting power of malm and stock brick, it will be seen that stock brick is placed twelfth in the scale, and malm brick the sixteenth; it is, therefore, so much colder as a shield from the weather. From this circumstance I would remark, that when this brick (malm) is used to case a building (as is now commonly done) the walls should be constructed proportionably thicker, or we render the house so much colder. The absorbing power also of this brick for heat is very low, being placed third in the scale in Table I. (third column), therefore we may conclude that malm brick is more a substance to please the eye for building than useful as a protection against the escape of heat, and what applies to the escape of heat will bear a similar relation to the protection against the cold of our climate.

It is curious to observe how low in the scale hair and lime is placed, both as to conduction and capacity for heat. If lead were omitted from the Table it would stand nearly as the quickest conductor and the lowest specific heat, proving that the compound is ill-adapted to line our rooms as far as concerns the preservation of heat. The best property of Roman cement, from these tables, certainly appears to be that of its slow conducting power, and therefore it is much better adapted to encase brick houses than malm brick, and as far as regards their relative absorbing power for moisture, the difference is not very great, being in the relation of (omitting the decimals) 133 of the former to 116 of the latter.

AN IMPROVED WATER METER.

Invented by Mr. ALEXANDER MITCHELL, Watch & Clock Maker, Glasgow; described by JAMES THOMSON, Esq., F.R.S.E., M.R.I.A., F.R.S.S.A., Civil Engineer, Glasgow.

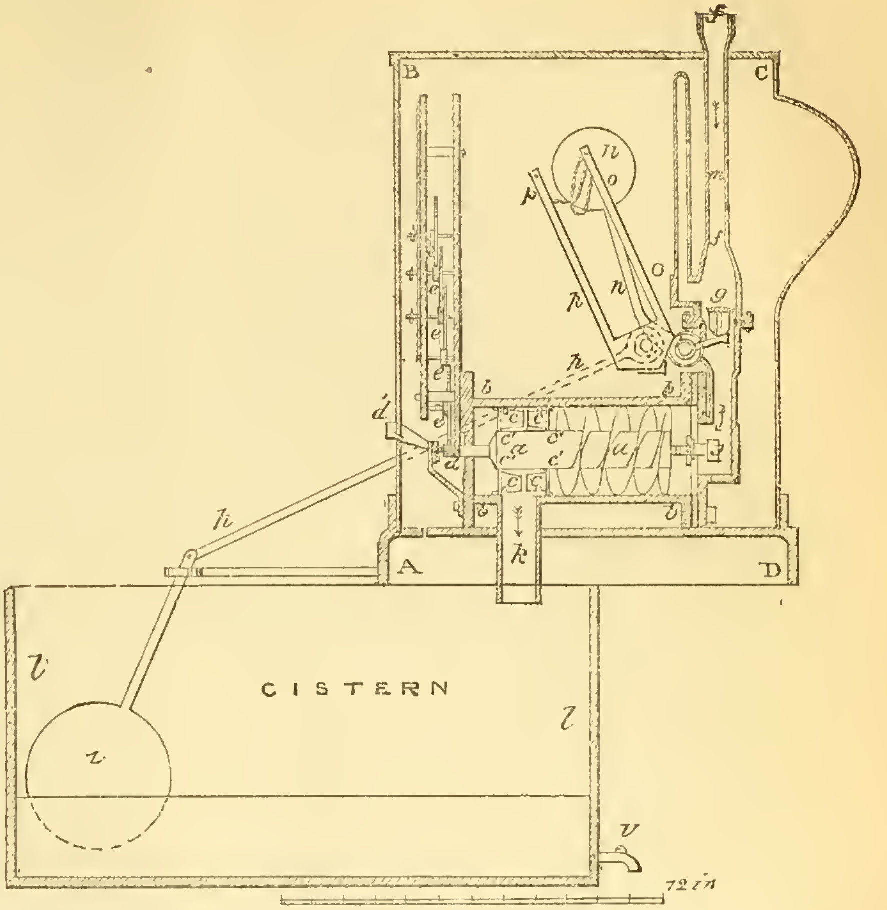
(Read before the Royal Scottish Society, 12th December, 1842, and reported in their Transactions.)

THE action of the meter, referring to the annexed figure, may be described as follows:—

The supply-pipe *f f* being connected to the water main by a coupling, &c., in the usual way, the water flows through the valve *g*, and passing into the cylinder *h h h h* at *j*, is discharged by the pipe *k* into the receiving cistern *l l*, from which the water is drawn off by a stop-cock *l'*.

Upon one end of the axis or spindle of the screw *a a* is fitted a pinion *d*, working into the train of wheels *e e e*, so arranged as to indicate the quantities of water discharged either in gallons or cubic feet, similar to the index of gas meters—the whole being set in motion by the flow of water through the cylinder acting upon and causing to revolve the Archimedean screw enclosed within it. To prevent the screw from being driven forward by the water, and in order to reduce the friction to a minimum, the end of the axis at *d* has a hard steel point inserted, which works in a cock or pottance fitted outside, and enclosed in an oil box, supplied with oil through the filter *d'*.

In order to render the indications of the meter uniformly correct, under different heads or pressures of water, the following very ingenious method of adjustment is adopted:—Upon the axis of the screw are fixed four thin brass wings or leaves *c c c c*, each moving upon a separate hinge or pivot *c'*, fixed at right angles to the axis, with screw nuts upon the end of each pivot, by means of which the wings can be maintained open or shut at pleasure, and so lessen or increase the discharge of water at each revolution of the screw. The lower pair of wings in the drawing are represented slightly open. With this power of adjustment, it is very easy to regulate the quantity of water discharged under different pressures, so as to correspond exactly with the index and train of wheels, which can best be ascertained by trial upon setting up the meter, say by a measurement of 20 gallons, and opening or closing the fly leaves, to bring the *quantity measured and the index to correspond.*



REFERENCE TO ENGRAVING.—A B C D, outer case of thin cast iron for enclosing the apparatus shown in section. *a a* Archimedean screw working in the cylinder *b b*. *c c* thin brass wings or flies, with adjusting screws for regulating the motion of the screw. *d* pinion upon the end of the screw-spindle or axis. *e e e* train of wheels set in motion by the pinion *d*, to indicate the quantity passed through the cylinder, closed in with a glass front. *f* supply pipe. *g* valve worked by the lever *h h*, connected to the ball-float at *i*. *h h* lever for opening and shutting the valve *g*. *k* discharge pipe flowing into the cistern *l l*. *m* air vessel to prevent injuring the pipe on opening and shutting of the valve. *n n* lever, with lead to retain the valve open or shut. *o o* and *p p* arms fixed upon the end of the lever *h h*, and attached with chains to the lead weight *n*.

It will be evident that the quantities of water passing through a metre, upon this principle, would be correctly indicated down to that quantity requisite to overcome the friction of the screw, below which amount, however, the water would pass through the cylinder without affecting the index, and consequently without being registered. Although the quantity thus passing would not be considerable in a well-constructed meter, Mr. Mitchell has recently introduced an improvement which completely obviates this objection, and renders the indications correct under any circumstances, and down to the smallest quantity.

This is accomplished by means of the conical valve cock *g*, which is so constructed as to act instantaneously, and so keep the supply either flowing at the full bore, or suddenly shut off, when the cistern is full. The opening and shutting of this valve is effected in the following manner:—To the end of the lever *h h*, which works upon a journal, and is raised or depressed by the ball-float *i*, are attached the two arms *p p* and *o o*. As the water in the cistern rises, these arms are carried forward without acting, however, upon the valve, until one of the chains, connecting them with the lever and lead-weight *n n*, is upon the stretch. At this point the lever and weight are upon a balance, so that the least further rise of water in the cistern carries it suddenly over, and allows the valve *g* to close. A reverse motion takes place on the fall of the cistern water, the action of the other arm and chain *p p* opening the valve, which a small catch retains in its place against the force of the supply water. To prevent any injury to the pipes from the sudden action of the valve, an air-vessel *m* is attached to the supply-pipe immediately above the position of the valve.

The introduction of this improvement, which prevents the possibility of water passing unregistered through the cylinder, renders this description of meter very perfect, and capable of indicating accurately the smallest as well as the largest quantities. From the small cost, too, at which they can be manufactured, it is to be hoped they will soon be brought into general use, *and substituted for the present unequal mode of water assessment upon house rent.*

REPORT OF COMMITTEE.—Your Committee having met with Mr. Mitchell, and having again heard his explanations, and carefully examined the water-meter submitted to them, came to the following conclusions:—1. That as far as they can judge, this meter may be considered sufficiently accurate to form a fair measure between water companies and their customers. 2. That its construction is simple, and well devised for permanent practical use, being little subject to derangement from the wear of its parts. 3. That its rate of registration being susceptible of easy adjustment, either in plus or minus degree, and its actual delivery, during certain portions of time, being always ascertainable by the consumer, its use may be adopted with confidence, as being alike equitable to the suppliers and the consumers.

GEOLOGY IN CONNEXION WITH ARCHITECTURE.

On the importance of geological studies in connexion with the practice of architecture, with notice of experiments on the resistance to crushing and fracture, and on the absorbent qualities of the principal building stones of Ireland. By George Wilkinson, Esq. Read at the Geological Society of Dublin, 10th of January, 1844.

In bringing before the Geological Society the results of some experiments made on the principal building stones of Ireland, it is, I conceive, necessary to offer some general remarks on the advantages to be derived therefrom; advantages, in my opinion, so very general, that to look at the result of experiments in a merely mechanical and professional point of view, would be confining the subject within too narrow limits. It ought to be a just matter of surprise that, at this advanced age of scientific investigation, the subject of practical geology in all its important bearings should have occupied so little attention; and that where there appears a desire for ameliorating the condition of the people of this country, particularly by promoting employment in ways calculated to develop its natural resources, persons should overlook what is capable of being accomplished through the medium of well directed experiments in this interesting and valuable science. To present the importance of practical geology in a familiar way, I would call your attention to the large proportion of people who are daily engaged in operations on the rocks in the country, either in dislodging or separating from their native beds those portions required for the varied purposes of building operations, or in conveying to the localities where they are required, and in shaping them for the different purposes to which they are to be applied, and thus calling to aid all the useful arts of the country, giving extensive employment to labourers, mechanics, and tradesmen, as well as to the scientific and learned professions of engineers, architects, artists, and others.

Most persons are more or less interested in the construction of their habitations, and I may say, all see the advantages of public structures, and appreciate the importance of bridges, canals, and other public and private buildings, and probably see in them the progress of civilization, and the benefit and dignity they confer on a country; but few, and very few, know anything of the materials employed in their construction, which too often present themselves to their minds only as a heap of stones and mortar. If we look to the early history of the most ancient nations, we find that the art of building has attended the first advance of civilization; and the use of worked stone has succeeded to caves in rocks, and the rude wicker or earth work of their common and early structures; but the conversion of stone to the increasing artificial wants of society was necessarily consequent on the advance of the mechanical arts before it could be shaped and applied. How interesting are the first though rude efforts displaying practical geology! The bold and noble monuments of the early ages show the natural vigour of the human mind, untutored in the mechanical skill and art of later times. The stupendous monolithal structures, and those early sepulchral monuments, known as cromlechs, cairns, and moats, which abound throughout Western Europe, were doubtless the work of a people, who, taking nature for their guide, by prodigious labour, raised and put together, and frequently conveyed to great distances, for the erection of their monuments, the immense stones which, detached from their native beds, were distributed over the surface of the country. Most of those stones are of the primary and crystalline class of rocks, which, from their hardness, have resisted the violence of that disturbing power which removed them from their mass, and afford us a good knowledge of their enduring quality. Moreover, the originality and boldness of their application, resulted from minds familiar with nature's works and untaught in the arts, which in after ages, accomplished by skill and the use of smaller sized materials, what the early ages, unskilled in building, could alone express by the magnitude of the stones.

Let us consider the more advanced history of the principal nations of the earth, and we shall find that geology, which term I may here use to express the converted rocks, has received great consideration. The architects and sculptors of Greece and Rome knew the qualities of their materials, and if we may judge from ancient writers and existing remains, gave considerable attention to them, abounding as those countries did in good materials. In the writings of Vitruvius on Roman architecture, the most particular rules are laid down with regard to the selection and use of building stones, and the cements employed with them. How important are the results of their influence on society! If Egypt, Greece, and Rome, had had their principal structures of a perishable material, what would we not have lost? What interest would we now feel in those countries; or how could we have derived the great advantages which have flowed from them? Good materials, and a right knowledge in using them, have, however, produced a different result; and again, what do not those countries owe to the durability of their structures, conceived, as they have been, in a noble spirit. Without them, Rome of the present day would be unvisited by the countless thousands whose wealth now enriches her; without her buildings the classic shores of Greece would less of European sympathy; nor would the dusky inhabitants of Egypt occupy such interesting ground but from the remains of the stupendous and imperishable monuments of her past history. Our own kingdom also possesses proud memorials in the enduring monuments of the middle ages, Those connecting links with the past and present, afford us noble examples of the religious zeal and skill of our forefathers; whilst the perseverance which has been displayed in accomplishing their erection, is much calculated to stimulate us to bold designs. These indelible landmarks of his early home, the traveller finds deeply implanted in his mind, and it is difficult for us to estimate their effect on society, in the attachment they cause to our laws and institutions. Nor do those venerated and bold structures fail to excite a powerful feeling in the inhabitants of the new world, who, though born in a distant land, contemplate with pride and fervent admiration the works of their progenitors. But the edifices of centuries past, many of which, even in their dismantled state, have withstood the destructive violence of the elements, will yet outlive very many of the most costly structures of the present day; and until a very recent period, so comparatively few were the buildings calculated to endure to any distant period, that future ages, judging by our public structures, will look upon the people of the present time as a degenerated race, and in the erections of centuries back will contemplate the finest and most durable monuments of architectural skill.

Many persons may say that a durability sufficient for the age is all that is necessary, and that posterity, which has done nothing for them, may act for itself. This, however, even in a narrow practical and economic point of view is most erroneous, for the constructive arrangement of the ancient buildings is less costly than in those of the modern period, and from their simplicity and the right use of the materials employed, they are more sound and durable edifices. In the buildings of the present day the simplicity of early structures has been lost sight of; a laboured mass of cut stone being more appreciated by the public than outline of design, and harmony of effect. We see in the ancient structures a homogeneous construction—the use of timber as supports under masonry is avoided; where openings or projections occur stone arches or other stone supports are employed, and a much more general use of stone, for various purposes, prevails, than at the present day; and in them we have models of constructive arrangement which we may profitably imitate. Many of the old buildings are so constructed that when dismantled of their roofs and their floors, they return almost to the state of the original rock, perhaps as a mass of limestone, for the stones may be lime, the sand may be that of limestone, and the lime burnt from the same rock. Such is frequently the case; thus, the mortar being good, becomes hardened by age, and more approaches the nature of stone; for it is said by an intelligent and scientific Frenchman who has given much attention to cements, that it requires 1,000 years to make mortar really good. Without doubting that a few years are sufficient to produce good mortar, it might be stated that the mortar of the Egyptian Pyramids, now supposed to be nearly 4,000 years old, is still in a good state of preservation. Structures so constructed become like a solid mass of rock; and that this is the case, the explosions made by Cromwell, in the 17th century, have very well shown, for the remains of some of the old castles, of which portions have been disturbed, appear almost imperishable. The sound and enduring state of some of the ruins, the original forms of which are still perfect, enable us fairly to state that a right use of the rocks of the earth has been capable of producing such a solid mass, that many may now, in their skeleton shapes, fairly be called architectural fossils; and they afford to the practical, as organic remains do to the scientific geologist, valuable studies in determining the character of the rocks to which they belong.

To the antiquarian, also, the study of geology affords much information, for the use of certain rocks, and the mode of working them, determine, to a considerable extent, the chronological date of the building in which they occur. It was a peculiar custom of the Normans and Anglo-Normans, to make use of none but the sandstones or oolites, similar to those with which they had become familiar in their own country, and in the round towers, and early ecclesiastical structures, erected under the influence of the Christians familiar with the Norman or Lombardic architecture, we rarely find anything but sandstones employed in the dressed masonry. With the Normans or Lombards (under which name I may include the northern nations who established themselves on the decline of the Roman power, and perfected from the last and worst models of the eastern and western Roman empires that peculiar architecture known to us as Norman, in which circular arches are the peculiar characteristic,) it was the practice to make their doorways the most enriched portions of their structures, and from being more elaborated or worked than any other part, they are commonly executed in a different kind of material, sandstones of variable quality having been generally used; and it is a peculiar fact, that an instance in which limestone occurs for dressed work or for doorways is very rare. Being familiar with the kind of materials employed in most of these structures, I do not recollect one in which the ordinary limestone rock has been so used.

It is not until a late period of the Norman architecture in Ireland that limestone has been employed. In the large limestone tract of the west of Galway and Mayo, where are the ruins of Cong and Ballintubber, in the later

Norman and transition styles of architecture, a light coloured easy-working limestone has been obtained from some distance, while the lime-stone of the locality, which is now preferred to any other material, and is conveyed to distant places for use, has been avoided excepting for the erection of the unwrought faces of the common walls. After the period in which these buildings were erected, limestone appears gradually to have come into general use in all parts, and now the directly opposite custom prevails, limestone being commonly used in sandstone districts; and I have known masons when employed in working sandstone to which they have been unaccustomed, to complain of stiffness and swelling of the arms for some days occasioned by the toughness of the stone, so different to the brittle rebounding effect of the limestone. It is most probable that the brittle nature of the limestone, in the working of which the Normans were not skilled, rendering it difficult to shape into mouldings after the masonry was built, as was commonly their custom, may have operated against its use. Those interesting structures, the round towers, on which so much that is evidently erroneous has been written, appear from their architectural and constructive peculiarities to be decidedly after the early Norman style of architecture. These edifices, of which Ireland has just reason to be proud, display to the practical geologist most interesting models of simple constructive arrangement, erected as they are with various kinds of rocks, including granite, slate, sandstone, and limestone, and which are almost always the stones of the locality, excepting in the superior dressed work of the doorways. Many antiquarian works of a recent period show very mistaken ideas as to the nature of the materials with which these early buildings have been constructed, and, therefore, draw erroneous conclusions. A very slight acquaintance with practical geology, and nothing more than this society, from their collections, will be able to afford, will tend to correct such errors; and it is most likely that such statements as those of Colonel Morris, in his work on the round towers, (in which he determines the red sandstone of some of these structures in the south to be Roman brick, and deduces from this certain conclusions regarding their origin,) will not be repeated.

There is one more feature connected with antiquarian research, upon which I should wish to remark, viz., the peculiarity of some of the earliest Norman architecture of this country. The architecture of the Normans in every country in which it was introduced (though preserving all the general characteristics of its early originals,) differs in details. It clearly continued to be the style of architecture in Ireland much later than in England, and extended over a much longer period than in other countries, owing, doubtless, to the peculiar and remote position of Ireland, at the western limits of Europe. It also frequently differs considerably from the Norman architecture of England; but it is in the early examples that the most distinctive details occur: and here a peculiarity is devolved, for which practical geology affords a ready and satisfactory reason, for the very hard nature of the stone has induced a different kind of ornament, and in several of the early examples we find the most elaborate execution on almost square columns, or rather jambs and architraves, quite at variance with the bold and deep cuttings so common in the Norman style. Nor is such a result other than should be expected, for they must have been deprived in those early ages of the facility of obtaining softer stones. It was the practice of the Normans at an early period to supply stones even to England, where soft oolitic stones abounded in many parts; and when at a later period intercourse with Ireland improved, we find that the stones of Normandy were brought to this country, and are to be met with in many of the ecclesiastical buildings, more particularly on the eastern coast.

It may be said that the study of the different properties of the rocks of the country, as regards their fitness for building operations, relates more particularly to professional investigation—that matters of this kind should be confined to the meetings of civil engineers and architects; and that the Geological Society is constituted for scientific investigation of the theory of geological phenomena connected with the structure of the earth's surface, and for the study of the successive changes it has undergone in arriving at its present state. To such an objection I would remark that, however interesting the pursuit of such a science may be in its theory, and however calculated to elevate the mind by reflecting on the wonderful architecture of our earth, and the vast changes its surface has undergone in becoming suitable for the habitation of the human family, we shall yet stand far short of obtaining all the advantages to be derived from this noble study if we confine ourselves merely to the theory. Owing to the neglect of the study of this science, designs are often prepared by architects and engineers, to whom is intrusted the expenditure of very considerable sums, without sufficient regard to the geology of the locality, the inquiry being confined to the question of cost, as to the nearest place from whence materials required to carry out a particular design may be obtained. It has frequently happened that stone has been brought from a great distance at considerable expense, when rocks of an equal, or of superior quality abound in the vicinity, with regard to which an acquaintance with this science might have reasonably afforded information. Numerous instances of such occurrences have come under my own observation within these last few years, where, either from sinking wells, or in making excavations of other kinds, or by chance trials for stones, there have been unexpectedly discovered, at very great advantage in outlay and frequent benefit to the contractors, some very valuable quarries; in illustration of which I may mention a particular instance with which I am familiar, in the discovery of a valuable working limestone quarry in the vicinity of a nobleman's mansion, which, if earlier known would, I am informed by the contractor, have saved him upwards of £1000 in the expense of procuring stones, which he had to convey a distance of many miles, and which were of an inferior quality to those which could have been obtained on the spot. If the science of geology were made practically useful, such occurrences would be rare, and in time would be altogether avoided.

The professional man is often deterred from the study of geology by the difficulty of mastering the technicalities, if I may so term them, of the science; and the theoretical geologist on the other hand is unable to appreciate the wants of the other; but acting together, the result would be mutually beneficial. The practical man would acquire the theory of the science with much greater facility; the theoretical geologist defining the geographical outline of the principal rock formations, and by the existence of fossils, and by recorded facts, determining where similar formations may or may not be expected to prevail; the professional member would obtain specimens of the different stones for experiment and chemical analysis, which in the yet imperfect state of geological science would most probably induce new theories in regard to many rocks, where the gradation from one mineral character to another is almost imperceptible. The peculiar stratification or dividing joints of the rocks are also features for profitable investigation. If we examine the various kinds we find great differences to exist in the size and shape of the masses into which they are subdivided; and in the same kinds of rocks we discover a subdivision peculiar to certain depths or other influences. In all, however, we recognize the wonderful contrivance of the Almighty in adapting the surface rocks of the earth to the want of industrious man. The greater portion of these rocks (the result of sedimentary deposition in water, of which the traces are still evident) occur in layers or thin beds, so separated from each other as to admit of being easily raised; others, with beds of soft clay, or other matter interposed; and, in the rocks of the primary or igneous classes, among which are included granites, basalt, &c., and which, occurring in large masses, would otherwise frequently be unconvertible, we observe the wise provision of nature in traversing them with joints or cleavages influenced by some prevailing law of crystallization or polarization, not as yet, perhaps, sufficiently accounted for. In the more solid masses, in which are included some of the limestone as well as other rocks, from the effect of internal heat, great pressure and other causes, the stratified form has disappeared; while the same cause which has obliterated the earlier divisions has itself produced others; and in some instances so shattered is the upper portion of the rocks that the practical builder altogether avoids them, although the removal of some feet from the surface would frequently disclose a most valuable material. Hence the advantage of scientific investigation and recorded facts. At the present time the want of a society combining practical and theoretical inquiries cannot, I think, but be manifest to all who contemplate the ordinary edifices of the present day. A better acquaintance with geology, or what is the same thing, a better knowledge of the rocks of the country, is essential to the production of edifices which will vie with those of past ages in durability, and harmonious adaptation of design to the locality. And it is, I conceive, only by correcting the public mind, and by giving assurance from experimental results and established facts, that a beneficial change can be effected.

Nor is the pursuit of this science unimportant as regards the *commerce* of the country. Let us look to the article of slates. At the present time there are several good quarries working, among which I may mention Killaloe, Valentia, and one more recently opened with great spirit by Mr. Synge in the county of Wicklow (the slates from which resemble those from the Bangor quarries); yet, such is the state of public opinion with regard to the native slates as to preclude their general use; and because at one period, in their early working, the slates of this country were very inferior to those now produced, the prejudice arose, and still continues, and no effort has been made to show by experimental inquiry, that Ireland contains slate quarries more than sufficient to supply all her wants; and yet thousands of pounds are annually going out of the country *in a direction from which there is no reciprocal trade*. I feel persuaded that it only requires the assurance which would result from well directed efforts of the Geological Society to cause, in a very short period, the annual expenditure of several thousands of pounds in the country in raising a native material, by extending the use of it, which money now unnecessarily goes to Wales; and there is this circumstance attending an increased demand, that the quality and economy of raising the slates will be improved. I may speak from experience on this subject, having used native slates in many instances; but from the little encouragement given, and from the prejudice still remaining, though the cause is chiefly gone, the proprietors have to struggle with many disadvantages in effecting a sale against their long established competitors who have a trade in the Welch slates. In more than one instance the native slates have been partly placed on buildings, in which I was concerned, and to satisfy prejudiced objections, it was expedient to have them removed, although the same slates have been used elsewhere. At Killaloe, where a few years back there was a rude surfaced mountain in which only goats or very poor cattle browsed, there are now, owing to the slate rock which prevails there, many hundred men daily employed. At Valentia not less than 200 are in daily work, and probably half that number at Mr. Synge's in Wicklow. The importance of the encouragement of such a trade is therefore manifest; for a regular trade of this kind, with all its minor ramifications, is much more beneficial to a country than the mere temporary employment on public works, which, creating a temporary excitement, occasionally works more mischief in the end than otherwise. At present the proprietor of the Valentia quarries, who works them chiefly for sawn flags, finds his principal market in London, while articles of this kind required for Ireland are obtained out of the country.

A similar remark may be made with regard to bricks. Good clay is abundant in the country, and good bricks are made in some parts, and might be made in many others; but from the frequent indifference as to the purchase of good materials, there is, in many cases, great carelessness in their manufacture. If, however, samples of bricks, and particulars of the clay, were collected, and the result of experiments made known, the good articles would be encouraged, and the making of many of the perishable ones of the present day, which are dear at the cost of carriage, would greatly decrease, and the buildings of the country would thereby be improved. Again, there is a strong prejudice against native bricks, which are really good. In illustration of this, I may mention a case connected with the manufacture of fire bricks at Dungannon, which are of excellent quality, and remarkably well made from the clay of the coal district, like those of Staffordshire; but the public, not knowing if they were really good, prefer buying the English fire-brick. Their sale is, however, now, or was, some little time since, considerable; but it arose from an ingenious, and scarcely to be condemned trick of the maker, who stamped the word Stourbridge on his bricks, and they then had a ready sale as good Staffordshire brick.

Before entering into the details of the experiments on the stones now before you, I would beg to advert to the important light in which the study of practical, or economic geology, is now viewed in the sister country, in confirmation of the remarks which I have made. Previously to the building of the new houses of parliament, a commission consisting of geologists (accompanied by the architect of the building) was appointed to investigate the various qualities of the different convertible building stones of the country. The result of their experiments has now been published in the parliamentary papers, (and this *Journal*, Vol. IV.) and has been received with the greatest satisfaction. It has also had the important effect of originating a museum of economic geology, for displaying the properties of the different stones of the country, in order that practical information on the various materials, with the characters which experiment and observation of the present state of those materials used in ancient structures supply, may prevent the continuance of the very numerous failures which have attended the use of many stones employed in different parts of the country, and which, being of inferior quality, have brought to speedy ruin many noble and interesting buildings. The institution referred to is now supported at the expense of government, and is under the direction of the distinguished geologist Sir H. De la Beche: connected therewith is a curator, and a laboratory for an analytical chemist, by whom experiments are made on various rocks, and who affords, at a fixed charge, any information required relative to the various properties of rocks for building, mining, or agricultural operations. I recently had an opportunity of visiting this museum, but found less really useful information for the architect and practical builder than I expected. It, however, contains most valuable and interesting collections of models, illustrative of the strata of the earth, the working of mines, and the minerals themselves in their several progressive stages from the mine to the manufactured article. From the constitution of the institution, at present, however, in its infancy, it does not appear to me to represent the spirit of a department in which the minds of those most interested in building operations are engaged; and from the contrary opinion with reference to the Dublin Geological Society, combining as it does scientific and practical geologists under its most intelligent and zealous curator, I augur that with perseverance most useful and interesting results will flow from their labours.

Reverting to the more practical consideration of the subject, we find that the altered circumstances in the advanced civilisation of the present age, now occasion the much greater use of the more convertible building stones, and so variable are the different kinds of rocks in the degrees of hardness and facility of conversion, in their colour and their relative durability, that a knowledge of these properties is now almost indispensable to the economical erection of the structures of the present day, as well as for the designing any building, in which the bold simplicity and spirit of the ancient structures is to be embodied; and hence the value of experiments and recorded observation on the defective materials which ancient and more modern buildings present, and without which expensive practical experience, and frequent failures will alone teach. The importance of attention to the good quality of the building stones will be evident by reference to buildings in Dublin, and to the already decaying nature of much of the granite in the Four Courts, and portions of many other structures; and I may mention that it is but a few years since, the necessity arose for restoring with new masonry the walls of the extensive building of Trinity College Library and the walls of the cathedral structures of Christ Church, and St. Patrick, in the old buttresses of which latter buildings the effects of perishable stone may now be seen.

EXPERIMENTS.

The experiments which I have now to bring before the Society have been made on nearly 600 specimens of the principal stones of Ireland, which I have from time to time in various ways collected together, and obtained chiefly through the kindness of different parties, by whom they have been presented to me, and among others I may mention the managers or proprietors of the several slate quarries. I shall divide these experiments into three classes, viz.: —1st, Absortion when immersed; 2d, Resistance to fracture, or bearing strength; 3d, Weight necessary to crush these stones.—1st. The results of the weight of water imbibed on immersion are very interesting, and disclose some important facts. The size of the stones immersed was 14in. long by 3in. square, one half of which specimens are now in the possession of the society. There were placed on their ends in 16in. of water, and were uniformly immersed for 88 hours, having been brought to a dry state before immersion, by being kept some time in a room at the ordinary temperature of domestic apartments. They were carefully weighed before and after the immersion. (It would be impossible to give in detail the results of these very numerous and extremely valuable experiments, and it will only be in our power to notice the averages given by Mr. Wilkinson). Of the six principal varieties of rock, viz:—Limestone, sandstone, granite, basalt, and slates, the following are the results:—Ordinary limestone of Ireland—average weight per cubic foot in a dry state (53 different experiments) 170lb., least weight 159lb.; greatest 180lb.; average absorption ½lb.; least absorption nothing; greatest ditto ½lb. The chalk limestone of Antrim weighs 160lb. to the cubic foot, and absorbs 3lb. of water. The impure shaly calp limestone weighs 160lb., and absorbs from 1lb. to 4lb. of water per cubic foot. Sandstone average weight per cubic foot (from 38 specimens) 145lb.; least weight 123lb.; greatest ditto 170lb. The absorption varies from nothing to upwards of 10lb., being exceedingly variable; the average being 5½lb. Granite average weight per cubic foot 170lb.; extreme weight 176lb.; least weight 143lb. The Newry and Kingstown granite absorb ¾lb.; Carlow from 1½ to 2lb.; Glenties (Donegal, between granite and gneiss) 4lb. Basalt average weight per cubic foot 178; extreme weight 181lb.; least ditto 171lb.; absorption is less than ¼lb. to the cubic foot. Clay roofing slate average weight of cubic foot 177lb.; extreme weight 179lb.; least ditto 174lb.; absorption from nothing to less than ¼lb. Soft clay slate from near Bantry absorbed about 2lb. In these experiments the weight of the stone and the absorption have been determined by direct weighing, and not by taking the specific gravity. The latter mode would probably give the most exact result; but from the small size of the specimens which would be operated on, and from the variation in density, which is evident in different parts of the stones here experimented on, and which is common to most rocks, I think that the result would frequently not approximate closer than that derived from direct weighing in larger masses. For particular scientific investigation the specific gravity is doubtless desirable, but for practical purposes the weight of the stone and its absorption ascertained in its ordinary state, is, I conceive, all that is useful or necessary for practical consideration. The limestones, it will be seen, are among the least absorbent of the rocks, and being the most abundantly used as a building material, it is obvious, that if good mortar be used in a proper manner in the external pointing, any weather may be resisted in almost any situation, without the use of perishable rough cast or costly cement. Buildings, however, carried up in wet seasons, in which the external mortar is not allowed to become hard, or where it becomes injured by frost, cannot resist the weather, but with good mortar pointing inserted between the stones from which the old joints have been raked out, I feel satisfied from experience and from the result of cases to which I could refer, that no material is more secure than these non-absorbent limestones. There is a popular error with regard to limestone, which is very generally considered to be a stone that will not keep out the weather; its very non-absorbent quality is, however, the cause of this idea, the stone condensing in the interior of the rooms the moisture of the air. Sandstone and limestone, when properly used together, owing to their different properties, make the best work; the absorbent quality of the sandstones keeping the interior face of the walls dry, and the exterior of limestone resisting the weather. I believe it is doubted if mortar will itself resist the weather; that it will, however, when it is carefully and properly applied, I feel a strong conviction, resulting from experiment, practice, and observation. And I may here remark what is calculated to strengthen the opinion, viz.: the state of some of the external mortar in the old castles and other ruins, where the plastered surface, after weeks of wet weather and heavy rain, if struck with a hammer, will commonly show a dry dust very close to the surface. It is therefore, not the fault of limestone that wet penetrates buildings, and it is frequently incurring unnecessary expense to avoid it on that account, for in most cases it is the fault of the mortar joints and not of the stone; and those portions of a building erected with the ordinary cut stone of the present day, are frequently likely to be the least dry part of the structure, owing to the generally imperfect mortar joints. The absorbent stones, such as the ordinary clay slates, and common earthy sandstones, are not likely to resist the severe weather in exposed aspects without some external protection.

The second series of experiments relate to the strength of the different kinds of stone employed to bear superincumbent weights, or applied in various ways, in which their resistance to fracture is the point to be considered. [Mr. Wilkinson here exhibited a diagram, which showed in a familiar way the results of the experiments. Slabs of the different classes of stones were represented of equal size and length, and a height of wall shown resting on them, varying with the bearing power of the different stones, the average, extreme, and least, bearing of all being given. The very great difference at once showed the importance which belonged to experiments of this kind, and how failures, which frequently result from their improper use, might be avoided, and how far their strength might be depended on, in applying them in any way different from that which they have been commonly and locally applied.] Mr. W. continued—I may here remark that the experiments have been very carefully made, and the test has been applied by a powerful but well-adjusted lever, the arrangement of our talented and scientific member, Mr. Mallet, by whose kindness I have been allowed to use it. The result of the average of many experiments is shown in the diagram, and the lines above and below represent the extreme weak stones, and the extreme strong stones of each class. From this it will be seen that the strongest stones in resisting fracture are the slate rocks. Some of these are stronger when the pressure is applied on the edges of the laminæ of cleavage than when applied on the faces. The basalts are next in strength, then the limestone, the granite, and the sandstones. Fortunately for construction, that stone which is the strongest is that which supplies the materials in the most useful forms for those portions of a building in which such strength is required. I have no doubt that the Valentia slate rock will ultimately come into very much more general use, and that the quarry will be of a considerable value; stones can be raised from it nearly 30 ft. long, 4 ft. or 5 ft. wide, and from 6 in. to 12 in. thick, and it is probable the use of this material will effect a considerable change in many parts of the interior constructive arrangement of buildings. Such are the convenient sizes and strength of the stone that it would without any intermediate bearings or support make the floor or ceiling of the room in which the Society is at present assembled, the ends merely resting on the side walls. It can also be easily wrought. The sandstones are the least satisfactory, and require great caution in using them in any important constructive arrangement. The only instance, among several hundred stone staircases, in which I have encountered any failure from the fracture of the stones has been at Lisburn, where several of the stone steps fractured close to the wall; being a geometrial staircase the failure of one broke the others. Now, in looking to the results of the experiments we find a satisfactory explanation, because the stone here used is the weakest of the whole; and though the stone quarries at Scrabo contain some really good and useful material, the quality of it varies so much as to make it necessary to exercise great caution in its use. By recording failures of this kind, however, much future inconvenience would be avoided.

The third series of experiments was to ascertain the pressure required to crush cubes of one inch sides. The second diagram represented by the difference in the heights of the walling over columns of the same size, but supposed to be of the different kinds of stone, their relative strength, the columns being considered as the stones on which the pressure was exerted. The order of strength in this case differs from that ascertained in the experiments on fracture, as shown in the first diagram. When subjected to crushing, the basalts proved the strongest, the limestones, and successively the slates and sandstones; the quality of the latter is exceeding variable, and show the great advantages to be derived from recorded facts. Of the different varieties of the limestones, some of the largely crystalline stones, and the compact hard calp, are the strongest. The light coloured crystalline stones of Ardbraccan, and those around Cork, are among the weakest. The Connemara white marble, or primary limestone, is the strongest of all the limestones I have yet met with. Among the strongest sandstones are the red rocks of the south, and the hard quartzy grits of the north-west of Ireland. Among the weakest are those of the county Down quarries, and the sandstones in Antrim and around Clonmel, and some of the coarse quartose sandstones of Donegal. Of the slates, those from Valentia, as proved by several experiments, resist less pressure than those of Killaloe, and those from Mr. Synge's quarries in Wicklow are about intermediate. Of the granites I have given no comparitive results, not having yet completed sufficient experiments to enable satisfactory conclusions to be drawn. I may mention, however, that, from several trials, the results do not give granite any superiority over many of the stones in ordinary use.

From the foregoing experiments, which I apprehend to be sufficiently numerous to allow of some general practical conclusions, it is clear that relation generally exist between the weight and degree of absorption of stones, the lightest being the most absorbent, and the heaviest the least so; but this relation is not constantly uniform, and in some varies considerably, as might reasonably be expected. Nor is it probable that, however carefully the stones might be weighed, either under an exhausted receiver of an air pump, or in any other way, that any results would be obtained, differing much from the conclusion here arrived at. Nor is there any uniform relation between the same kind of stones when used in different ways; for, used as a column, or in any other position where a weight would be exerted to crush it, the basalts, as shown by the foregoing experiments, may exceed all others, and yet occupy an inferior position in the scale when applied to support a weight over an opening, or as an architrave resting on columns (the peculiarity of mineral character rendering one stone better for one purpose than another) as the particles of the stone are differently acted on; and although this may be at variance with a commonly received opinion, I have full confidence in the general result of the present experiments which are very decided, and I believe much more numerous than any others of the kind which have been made. And however close the relation may be, which would appear from other experiments to exist between the crushing and fracturing strength of similar bodies, it is very clear to my mind that this law does not extend to stones, which, as aggregated or compound bodies, may be expected to differ much in experimental results from those which are simple. In conclusion, I trust that these experiments will be received by the Society as incipient attempts to establish some positive data in this neglected but important branch of their study, and hope that they may be the same means of inducing others, better qualified, to pursue the subject.

NOTES OF THE WEEK.

It was with great regret we learned that the Council of the School of Design had succumbed to the clamours of interested parties, and given up the class of wood engraving for females. The strong remonstrances of the press have, however, procured its restoration. The necessity of providing suitable employment for females would alone entitle any proposition for effecting this to favourable attention, from motives of common humanity. Then, too, it should be considered, that it is perfectly legitimate to give elementary instruction in any branch of the fine arts. We never heard of sculptors inveighing against the Royal Academy, or architects against any of the numerous public institutions for giving instruction in their art. The elementary processes may indeed be taught, but genius and refined taste cannot so well be communicated. Just imagine Landseer, Maclise and Westmacott applying to the Government for the prohibition of all public schools of art, what a lamentable spectacle would it present. If the School of Design can invent any process for making young girls first-rate engravers, we say so much the better, let them do it; but if, as we believe, they cannot communicate inspiration, but only create mechanical skill, we say again so much the better, for it will tend to reduce the price of inferior works, which now have to be paid for at high rates without any adequate cause. The remuneration of first-rate talent instead of being reduced by this measure is much more likely to be increased, while much good will be done by reducing the price of merely mechanical performances, and providing suitable employment for many females. It is ridiculous to assert that a common diagram engraved on wood is a work of art, and is to be paid for as an artistic production.

The Society of Arts has had a legacy left to it of £5000, and University College receives £14,000 under Mr. Brundrith's legacy.

We were amused to learn that a Theatre Royal has been erected in New Zealand, which although of slight materials, is illuminated with gas.

A fine statue of the Queen has been erected on the top of the grand portico of the Royal Institution at Edinburgh. It is from the chisel of Mr. Steele, and has attracted much admiration. The height of the pedestal and statue is 18ft., and the Queen is represented with a diadem, and in her robes of state, holding the orb in her right hand, and in a sitting posture. It is esteemed a very fine ornament to Edinburgh.

The 8th and 9th of April are the days named for sending in works of art to the Royal Academy for the ensuing exhibition.

M. Jacques, a French sculptor in Russia, has met with a great misfortune in the destruction by fire of his model for a colossal statue of the Neva, by which the labours of four years were lost.

Signor Lanzaruslo of Rome, has, it is said, discovered the means of fixing on lithographic stone, daguerréotype impressions. He has presented to the Pope several plates of the public buildings of Rome.

It is said, that Mr. Clegg is going to Berlin for the purpose of laying down an atmospheric railway from Berlin to Charlottenburg.

The monument raised by public subscription to the Prince of Condé, in France is finished. It is by M. Fauginet, sculptor, and M. Leveil, architect, and consists of a column and a cross of marble, 40ft. high. The base is decorated with statuary.

Overbeck is at Rome at work on a picture for one of the churches of Lubeck, his native place, and for which he is to receive 1000 ducats.

The palace at Baden is to be decorated with stained glass, by Dr. Stantz, of Berne, a celebrated artist, and with paintings by Gotzenberger, illustrative of the history of the district.

Among the engineering works recently published at Naples are the following:—"Monticelli, Sulla origine delle acque del Sebeto, 1840." "F. Abate, delle acque publiche della citta di Napoli, 1840." "L. Cangiano, sulle a. p. potabile di N. 1843," and also on artesian wells, 1842. It is now determined that a boring shall take place for an artesian well at Naples. The supply of water to that city is very bad, but the expense of obtaining it has hitherto prevented any effective measure.

The Emperor of Austria has determined on erecting a new Imperial Library at Vienna. The new building will also provide for the imperial collections of natural history and antiquities. It is hoped that this will give an occasion for the employment of Austrian painters in decoration on a large scale.

A great many new lines of railway have been brought forward during the week, and the best prospects of employment for engineers during the ensuing season are formed.

A very splendid new hotel has been built on the site of the ancient Ducal Palace of Bragnaza, in the centre of Lisbon, and is to be placed under the admirable management of Madame de Belem, who will immediately remove to it her entire establishment.

REGISTER OF NEW PATENTS.

Under this head we propose to give abstracts of the specifications of all the most important patents as they are enrolled, If any additional information be required as to any patent, the same may be obtained by applying to Mr. LAXTON at the Office of this JOURNAL.

IMPROVED WATER CLOSETS.

Henry Austin, of Hatton-garden, Middlesex, Civil Engineer, for "*Improvements in the construction of water closets.*"—Granted July 20, 1843; enrolled January 20, 1844.

The first part of these improvements relates to the machinery or apparatus for the discharge or supply of water; and, secondly, to the method of working and actuating the machinery; and, lastly, to a mode of forcing water into water closets, when there is little or no fall provided for the supply. The seat of this improved water closet is made to work on pivots, or centres, at the sides, so as to move up and down by the weight of a person using the water closet. Fig. 1 shows a sectional elevation of a water closet, constructed according to the first and second part of these improvements; *a* the supply pipe, leading from the supply cistern, *b* a water box, *c* the discharge pipe, which is made flat at the lower end, and so as to fit round the pan, *d* an air pipe, fixed upon the water box, *e* the seat, which moves upon centres or pivots fixed at the sides, *f* a valve, actuated by the lever *g*, and connecting rod *h*, one end of which is attached to the end of the lever *g*, and the other, or lower end, to the back part of the seat. When the water closet is not in use, the connecting rod, lever, and valve are in the position shown in the diagram, that is to say, the valve *f* in such case fits against the end of the supply

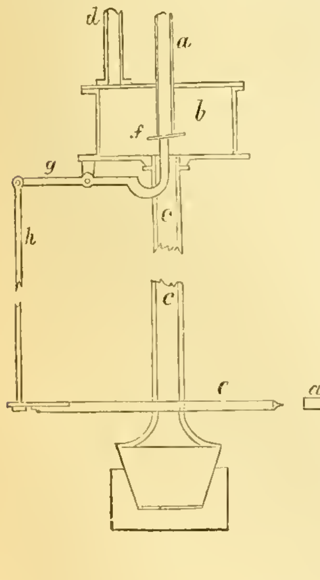


Fig. 1.

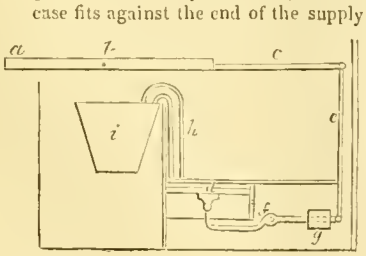


Fig. 2.

pipe *a*, (which may be about one inch in diameter); but when the closet is in use, the weight of the person on the seat causes the same, by means of the connecting rod, to raise one end of the lever *g*, and lower the opposite end, so as to bring the valve *f* upon the end of the pipe *c*; in this position the water will begin to flow from the supply cistern into the box *b*, but on the weight being removed from the seat, the valve, by means of the weight of the connecting rod, will ascend to the position shown, and the water contained in the box will rush down the pipe *c*, and into the pan or vessel. Fig. 2 shows the arrangement of parts for causing a force of water sufficient for the purpose, when there is little or no fall, provided *a* is the seat moving upon centres *b*, to the back part of the seat is attached an arm *c*, which actuates the piston *d*, by means of the connecting rod *e*, and lever *f*. When the seat is depressed, the piston *d* will be partially withdrawn from the box or cylinder. Just above the piston, when in this position, there are two or more small holes through the sides of the box or cylinder, through which the cylinder is filled with water. On the weight being removed from the seat, the piston will begin to ascend in the box by means of a counterbalance weight *g*, and the water contained in the box will be forced through the pipe *h*, and into the pan *i*, with sufficient impetus to remove any deposit; by this arrangement a force of water sufficient for the purpose is said to be obtained, when its level is below that of the pan.

A NEW MASTIC OR CEMENT.

Charles Bertram, Newcastle-upon-Tyne, for "*An improved mastic or cement which may also be employed as an artificial stone, and for coating stone and other substances.*"—Granted July 20, 1843; enrolled January 20, 1844.

This improved mastic or cement is made as follows:—About 70 parts of turf or peat, as it comes from the field, is subjected to pressure or heat, in order to free it from the greater portion of water which it contains, after which the turf is mixed with about 30 parts of pitch or tar from the gas-works (preferring the latter); this compound, after being allowed to rest for some hours, is put in a vessel and kept at a boiling heat for three hours; the product, after being well incorporated, is a mastic or cement, called by the inventor "*Sercollane*," and is of a very tenacious and adhesive quality. When this mastic or cement is to be employed for coating ships, the inventor employs to each 100 parts of peat or turf, two parts of yellow soap, and 10 parts of oxide of iron, or other like poisonous matter, the object of which is to prevent barnacles, sea-weed, and other matter, adhering to the sides and bottom of the vessel. When this cement is to be used as an artificial stone, the inventor mixes about 35 parts of peat or turf, and 35 parts of mud taken from the bottom of rivers, ponds, canals, or marshes, intermixed with dry sand or fine gravel; this mixture is treated in the same way precisely as above described, and then moulded into blocks or slabs, of the form required for paving or flagging. The above composition is the same in every respect as that for which a patent was obtained by Mr. William Mylam in June last, the inventor, therefore, only claims the application of the aforesaid cement to the purposes above described.

ROLLING IRON INTO SHEETS.

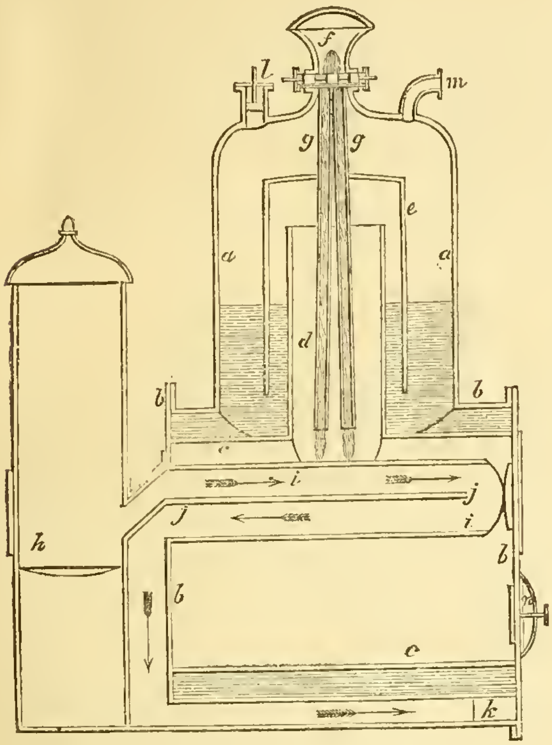
William Daniell, of Abercarn, near Newport, Monmouthshire, Tin-plate Manufacturer, for "*Improvements in rolling iron into plates or sheets.*"—Granted July 22, 1843; enrolled January 22, 1844.

The object of these improvements is to avoid the repeated processes hitherto necessary, in the manufacture of thin plates or sheets of iron, of piling and reheating, whereby a saving of fuel and iron is effected, and the repeated processes of piling, heating, hammering, and rolling is avoided. The process is as follows:—A ball of iron is taken from a puddling furnace or refinery, and submitted to the process of hammering, after which it is to be rolled into a bloom of about 6in. wide, and 5in. deep; this bloom is then cut by a saw, or other instrument, into lengths of from 4 to 6in.; after which the pieces are to be immediately rolled between rollers, taking care that the grain of such pieces is in a vertical direction, by which means the upper and under sides of the bars produced will be the clean cut surfaces; these pieces, if care be taken, can be rolled, without reheating, into bars of about 5in. wide, and 2in. thick. The process so far is stated to have been the subject of a patent granted to Mr. Daniell in April. 1822; but, instead of proceeding as therein described, the patentee commences at once to roll the pieces in a transverse or opposite direction, so that the bars, in place of being piled and hammered, are finished into thin plates or sheets, by rolling the pieces in the reverse direction to that in which the bars were rolled. The bars are then cut into lengths, according to the size of the plates to be made; these pieces are then heated in a suitable furnace, and rolled in grooved rollers, the grooves of which are the same length as the pieces of iron to be rolled, the rolling being effected at right angles to the previous rolling; the rolling is thus continued until the piece is about a quarter of an inch thick, after which it is to be rolled in plain rollers until such piece is reduced to one-eighth of an inch in thickness; in this state the piece of iron is technically called a "moulding," and is to be completed in a tin-plate mill. The patentee claims the mode of rolling iron into thin plates for the manufacture of tinned sheets, &c., by causing pieces of iron to be rolled out into sheets or plates, by rolling them at right angles to the direction to which they have been produced, when such pieces have been obtained by rolling cut iron with the grain in a vertical direction, the upper and under surfaces being the cut surfaces.

GAS POWER.

James Neville, of Walworth, Surrey, Civil Engineer, for "*Improvements in obtaining power by means of gases applicable to working machines.*"—Granted July 13, 1843; enrolled January 13, 1844.

For this purpose the patentee employs the rough nitrates of potass or soda, combined with charcoal, or bituminous coal, or other combustible matter, which will have the effect of decomposing the said nitrates. The coal or charcoal and nitrates are mixed together in such proportions as to completely effect the decomposition of the nitric acid of the said nitrates, and the compound or separate gases, and heat produced therefrom, are made available for producing motive power.



The annexed engraving is a sectional elevation of the apparatus employed for collecting and applying the gases to the purpose of generating steam, and is as follows:—*a a* and *b b* are two cylindrical vessels affixed at right angles to each other, as shown; *c c* is another cylindrical vessel, placed within the latter, or vessel *b b*, on the top of which is placed a pipe or tube *d*; *e* is a vessel suspended within the vessel *a* in an inverted position, with its lower end dipping into the water contained in the vessels *a* and *b*, which vessels form or constitute a boiler; *f* is a hopper, to which are attached two pipes *g*, *g*, which pass through the end of the vessel *c*, as shown; *h* is a furnace, and *i* a retort, divided by a plate or partition *j*. The action of this apparatus is as follows: the hopper *f* being filled with the above mixture or compound, a fire is lighted within the furnace *h*, the heat of which passes in the direction shown by the arrows, and escapes through an opening at *k*. When the retort *i* has become sufficiently heated, the compound or mixture contained in the hopper is allowed to fall down the pipes *g g* upon the heated retort, whereby the particles of the mixture become ignited, and the gases and caloric obtained therefrom pass up the tube *d*, and between the annular space formed by the vessel *e* and tube *d*, so that the gases and vapours are made to pass through water, in their passage to the boiler, and communicate their high temperature thereto, which will have the effect of producing a considerable quantity of steam, which, combined with the gases, may be applied for producing mechanical power; *l* is stated to be a contrivance for regulating the pressure in the boiler, and is the eduction pipe for the steam and other vapours. The patentee states that the residue of the nitrates employed may be removed through an opening formed at *n*; *videlicet*, the sub-nitrates of potass or soda will nearly repay the original cost of the raw material. The claim is for the application and use of gases and caloric obtained from the decomposition of the said nitrates, whether combined or not with aqueous vapour, as a means of producing mechanical power.

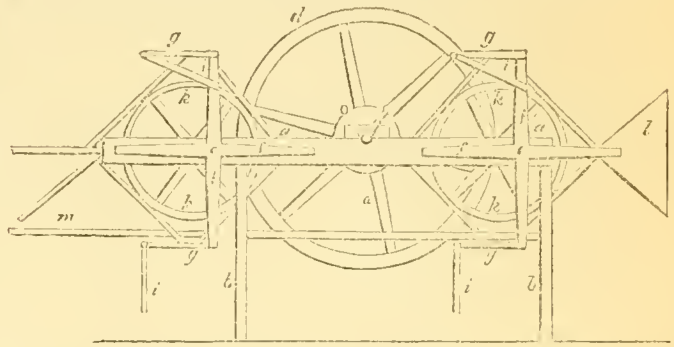
PRIMING OF BOILERS.

David Napier, of York Road, Lambeth, Surrey, Engineer, for "*Improvements applicable to boilers, or apparatus for generating steam.*"—Granted July 25, 1843; enrolled January 25, 1844.

These improvements in boilers or apparatus for generating steam are intended to prevent what is technically called priming or flushing, or, in other words, the water from passing off in conjunction with the steam, and is effected in the following simple manner. The surface of the water in the boiler is covered with one or more tiers of hollow metallic balls or other buoyant substance, or the same may be effected by substances that are not buoyant; such as perforated plates, supported in the boiler by any mechanical means, or wood may be advantageously employed; but the patentee prefers hollow metal balls of about 2 inches diameter; a tier of these balls being placed upon the surface of the water form a number of interstices, which will be greatly reduced by placing another layer or tier upon the first, and the same will prevent the water, when in a state of ebullition, from rising up and passing off in conjunction with the steam. The claim is for the method above described of preventing the priming and flushing, of whatsoever form or material the substances employed, and whether buoyant or supported by mechanical means.

AERIAL LOCOMOTION.

William Crofton Moat, of Upper Berkeley Street, Marylebone, Middlesex, Surgeon, for "*A method of obtaining aerial locomotion.*"—Granted July 26, 1843; enrolled January 26, 1844.



This machine or apparatus, intended for the purpose of aerial locomotion, consists of a rectangular or oblong frame of wood, or other material, supported, when on the ground, by four legs; to the upper part of the frame there is a transverse shaft with two double cranks, this shaft gives motion, by means of two other shafts, to 16 propelling flappers, which latter give motion to the machine. The following description and accompanying engraving, which is a longitudinal elevation, will serve to show the principle of the invention.—*a a* is the rectangular frame of wood, supported on legs *b b*; *c* is a transverse shaft, supported by centres, passing through the frame sides this shaft has two double cranks, one of which is shown in dotted lines; upon this shaft, and about the middle of the framing, there is keyed, or otherwise firmly fixed, a large wood wheel *d*, this wheel imparts motion by means of a rope or gut passing round its periphery, to two shafts, which are also supported by the framing at *e e*, upon the end of each of these shafts there is a frame consisting of two pieces of wood *f f*, at right angles to each other, in the form of a cross, to each of the ends of these cross pieces there is attached a wood frame *g*, and to each of these frames is attached, by means of a hinge joint, a propelling flapper *i*, consisting of a rectangular frame of wood, covered with parchment or other material; *k*, *k*, are wheels and square wood frames placed eccentrically with shafts that carry the crosses, the position of these eccentric wheels can be altered by means of ropes and tackle, but for what purpose is not clearly shown in the specification; *l* is the rudder, which is actuated by two ropes passing along the frame sides to opposite ends of the machine, and *m* a platform, which may be extended to any desired length, and is intended for the person to stand upon, whose office it should be to guide or govern the machine. On motion being given to the large wheel, which is effected by four men standing upon the platform *n*, a rotary motion is imparted to the cross pieces, which carry the frames and propelling flappers, which cause the latter to strike successively upon the air in a direction the opposite to that of the line of gravity; these combined effects, it is presumed by the inventor, will cause the machine to ascend and be propelled through the air. The claim is for the general arrangement and combination of parts, and the application of the same to obtain aerial locomotion.

GOVERNMENT CONTRACT FOR STEAMERS.

We have much pleasure in being able to give a copy of the specification issued by the Lords Commissioners of the Admiralty, on the 20th of January last, to the principal engineers, who are invited to contract for steam engines for two of Her Majesty's steam vessels of the first class and four of the second class. The tenders are to be delivered on the 5th March next. It will be perceived that the engineers are not limited to power, the object of Government being to obtain as great a power as possible within the limit assigned for the engine room, and within the limited weight.

Specification of certain particulars to be strictly observed in the construction of four pairs of marine steam engines, referred to in the Admiralty letter of the 20th of January, 1844.

For vessels of the Second Class.

The tenders are to be made (in triplicate) on the accompanying printed forms, every particular in which is to be strictly and carefully filled up; and all drawings, models, and boxes containing them, are to be distinctly marked with the names of the parties transmitting them. The whole weight of each pair of engines, including the boilers (with the water in them), the coal boxes, paddle wheels, spare gear, the floor plates, ladders, guard rails, and *all other articles*, to be supplied under the contract, is not to exceed 300 tons.

N.B. If this condition is not strictly complied with, the contractor is to forfeit £1000., or their Lordships are to be at liberty to reject the engines, the manufacturers paying £1000. for the disappointment.

The coal boxes (in the space of the engine room) are not to contain less than 350 tons, computed at 48 cubic feet to the ton, and more if possible. Sufficient details of the coal boxes are to be shown in the drawing, to enable a calculation of their contents to be made. In this computation, the space below the deck to the depth of 6 in. is to be excluded, to allow for the space occupied by the beams, and for the difficulty of completely filling the boxes with coals.

The consumption of coal per horse power, and the number of days' coals which the boxes will contain, are to be accurately stated in the tender. To avoid the possibility of mistake in the dimensions given in the drawings furnished to the respective parties, it is to be understood that

	feet.	inches.
The length of engine room in the clear is ..	50	0
Breadth of ditto	33	0
Depth of ditto	21	0
Centre of shaft above water line	8	9

The horizontal situation of ditto as per drawing, or as near as can be.

Those tenders, however, which place engines of sufficient power in a space less than 50 ft., and give the largest stowage of coals, will be preferred.

The holding down bolts are to be secured by nuts let into the lower sleepers, so as not to require the bolts to pass through the vessel's bottom, and the bolts are to have at the lower end of their points wrought iron washers about 8 in. square and 1 in. thick placed between the nuts and the wood. Should this mode of security be inapplicable to the particular kind of engine proposed, the engineer is fully to describe any other secure mode which he may think the most advisable to adopt.

The pistons are to be fitted with metallic packing. The blow off pipes are to be $3\frac{1}{2}$ in. in diameter, and not less than $\frac{1}{4}$ in. in thickness.

Discharge or escape valves are to be fitted at the top and bottom of each cylinder, for allowing the escape of water therefrom; the valves to have suitable metallic cases, to prevent danger of persons being scalded by escape of boiling water, reverse valves are to be fitted to the boilers, and stop valves at the ship's side to the waste water pipes.

Each cylinder is likewise to be fitted with a separate movement and valve, for the purpose of using the steam expansively in various degrees, as may from time to time be found eligible. The air pumps are to be lined with gun metal of $\frac{1}{2}$ in. in thickness when finished. The air pump buckets are to be of gun metal, with packing rings. The air pump rods are to be of gun metal or Muntz metal, or of wrought iron cased with gun metal.

The threads of all screwed bolts, nuts and pins used in engines and boilers, and in every other part of the work furnished by the contractor are to agree with the threads used in the steam department at Woolwich.

A small engine is to be fitted capable of working one of the pumps for feeding the boilers, in every case when the boilers are tubular. Pipes to be fitted for supplying, in the event of a leak in the vessel, the requisite quantity of water from the bilge to the condensers.

The hand pump to be made capable of being worked by the engine also, and to be arranged to pump into the boilers on deck or overboard, and to draw water from the boilers, from the bilge, or from the sea. The feed apparatus to be complete, independently of any feed from a cistern above the deck, should such be fitted.

The steam pipes and all other pipes to be of copper, and their respective thicknesses and diameters to be specified in the tender. A separate damper to be fitted to every boiler. Brine pumps, or some other equally efficient apparatus, with refrigerator, to be fitted to the boilers, and blow-off pipes so arranged, that any boiler may be blown off separately.

A small flat iron vessel to be fixed in one of the paddle boxes, with two pipes, one communicating with the stoke hole, and the other with the boiler, for obtaining a small supply of distilled water from the boiler.

Air tubes to be fixed in the coal boxes, for ascertaining their temperature. Particulars will be furnished to the contractors on application to the Captain Superintendant at Woolwich.

The Boilers are to be of the tubular construction, and the tender is to specify the cost with iron tubes, and with brass tubes respectively; and it is desirable that the upper part should not be a greater distance above the water line than circumstances render necessary. They are to be constructed in three or more separate parts, each of which may be used independently of the others. Sufficient details of the boilers are to be shown, to enable a calculation to be made of the area of fire grate and of the fire and flue surface.

A space of 13 in. wide is to be left clear between the boilers and the coal boxes in every part.

The paddle wheels are to be of the common construction, and to be fitted with suitable breaks.

The tenders are to specify the highest power of engines which may be compatible with the foregoing specification. The calculation is to be made, allowing the effective pressure on each square inch of the piston to be 7 lb., and the speed of the piston—

For 4 0 ft.	stroke not to exceed	196	feet per minute.
,, 4 6 ,,	,,	204	,,
,, 5 0 ,,	,,	210	,,
,, 5 6 ,,	,,	216	,,
,, 6 0 ,,	,,	222	,,
,, 6 6 ,,	,,	226	,,
,, 7 0 ,,	,,	231	,,
,, 7 6 ,,	,,	236	,,
,, 8 0 ,,	,,	240	,,

If any other than beam engines are proposed they must be described very minutely, with proper drawings or models.

All the necessary ladders for the engine room, together with fenders, guard rails, and floor plates, are to be included in the tender, and likewise the expense of trying and fitting the spare gear. It is to be understood that the practice of fixing new engines on board Her Majesty's vessels at Woolwich Dockyard is to be entirely discontinued. The ports to which their Lordships will for the convenience of manufacturers allow vessels to be taken, are those of London, Liverpool, Greenock, Glasgow and Dundee, provided the places at which the vessels are to be in those ports shall be named in the tender, and approved of by their Lordships.

In the case of vessels receiving their engines on board in the port of London, they will in the first instance be brought to Woolwich; and no subsequent charge will be allowed for transporting the vessel to the place where they are to be fixed on board; for coals in trying the engines until they are complete; for boats, anchors, men, lighters, pilotage, canal or dock dues, shipwright's work, or for any other expence whatever occasioned by the engines not being fixed on board at Woolwich. The "watching" of vessels is to be performed in future by officers and men in Her Majesty's service; but no shipwrights will be provided by Government.

In all cases of vessels receiving their engines on board at any other port than that of London, a deduction of 2 per cent. will be made from the price of the engines named in the tender, as a compensation for the expense, wear and tear, and risk thereby incurred.

The expense of clothing (in the following manner) the cylinders, steam pipes, and boilers, is also to be included in the tender.

The cylinders are to be covered with hair felt to the thickness of two inches, the felt is to be covered with thoroughly dried wood, well fitted, and bound together by iron or brass hoops.

The steam pipes are to be clothed with felt, which is to be moulded with spun yarn, and then to be covered with canvass, the whole to be of such thickness as to be even with the flanches.

After it has been ascertained by trial that every part of the boilers is perfectly tight, two good coats of red lead paint are to be put on them, and felt applied to the tops, sides, and ends, to the thickness of two inches, while the paint is moist.

For the more convenient application of the felt, it is to be previously stitched to canvass for the purpose of holding it together. The canvass is then to be well painted and carefully covered with thoroughly dried one inch deal boards, having rabetted or grooved and tongued joints, and bound up to the boilers with suitable iron stays.

The coating of felt and boards on the top of the boilers or steam chest is to be kept at least 18 in. from the funnel, and the circular space between the coating and the funnel is to be covered with a 3 in. course of bricks set in cement, and surrounded and held together by an iron hoop.

The boards and bricks on the upper parts of the boilers are to be covered with sheet lead, 4 lb. to the square foot, so as to prevent any leaks from the deck reaching the felt.

The specification for two pairs of engines for first class vessels, is exactly similar to the foregoing for the second class excepting the following—

	feet.	inches.
The engine room is to be in length ..	54	0
Breadth	34	4
Depth	23	0
Centre of shaft above water line ..	8	6

Coals to be stowed in the boxes, 400 tons (or more if possible.)

Weight of machinery, &c., complete as specification, 350 tons.

The blow-off pipes are to be four inches diameter and a quarter of an inch thick in metal.

GRAVESEND TERRACE PIER.

Considerable progress has now been made with the above work, for the carrying out of which an Act of Parliament was obtained during the session of 1842, the Royal Assent being given on the 18th June of that year; plans of the work were immediately afterwards prepared, in accordance with designs previously submitted to the Admiralty and to the Thames Navigation Committee, while the proposed undertaking was before Parliament, and which had been approved by those bodies. A contract was entered into on the 15th November following between the Commissioners, appointed by the Act for carrying it into execution, and Messrs. Fox, Henderson, & Co., of the London Works, Birmingham, for the execution of the whole of the works connected with the pier, and which were eventually commenced early in April last, from the designs and under the superintendence of Mr. John Balding Redman.

The site of the pier is, perhaps, as fine as that of any similar work in the kingdom, being immediately in front of the Terrace Gardens' embankment, the road of approach to the pier crossing those picturesque gardens, and rapidly descending from the end of Harmer Street, which, together with the terrace at right angles to it, are at an elevation of 30 feet above the level of high water of spring tides; to meet this, and to give ample room for the navigation of small craft along the shore of the river, in accordance with the wishes of the Thames Navigation Committee, the platform of the pier will be 12 ft. above the level of a high spring tide, and 32 ft. above the level of low water of similar tides, and will be nearly even with the crown of the arch which carries the road over the gardens, and the circular road of approach to the pier entrance, to be obtained by the embankment now in course of formation, will be level throughout, and of the same altitude as the platform of the pier: the precipitous descent from the archway to the present wooden pier, now so inconvenient, will thus be obviated, and the rapid descent of carriages from the town will be checked before arriving at the pier.

The entrance to the pier is flanked on either side, east and west, by two stone offices, of a substantial character, formed of Kentish wrag ashlar, with Derbyshire stone plinths, quoins, cornices, and dressings to windows and doors, the walls of which are now completed; the one will be surmounted by a clock turret, and the other by a belfry; the pier will project northwards 240 ft. beyond these offices, or 200 ft. into the river beyond the embankment, the walk along which will be continued uninterrupted underneath the pier, between the main abutment and the first tier of columns; immediately north of the offices there will be distinct approaches on each side to the vans and coaches, accommodation for which will be provided on the raised terrace formed by the retaining walls on each side of the abutment, and commodious flights of granite steps will be laid down on each side, from the platform of the pier to the terrace promenade, and to the gardens, parallel with the appruaches to the carriages.

The pier will be supported on 22 cast iron Doric columns; one-third of the number are fixed, and the whole of them cast; they are considered to be the largest and heaviest columns ever formed of cast iron; they are 28 ft. in length, and weigh from 9 to 10 tons each; their bases are, when fixed, level with low water of spring tides, and their capitals 8 ft. above the level of high water of the same tides. This will be the waterway throughout under the pier, as the girders supporting the platform and superstructure are horizontal. The width of the platform will be 30 ft., and there are three columns in the width of the pier, at each point of support. The first span or opening under the pier is of 22 ft. over the terrace promenade, and from thence two spans of 50 ft., and one of 51 ft. to the pier head, which is formed by a return at right angles to the main portion, 90 ft. long by 30 ft. wide, termed a T head from its resemblance to that letter, and formed by 13 columns, viz., seven at the junction and three at each extremity.

The approach from the river will be by a double staircase, formed of cast iron bearers, supported between the outer columns, carrying transverse oak steps, and spacious landings at various levels, to suit any state of tide: a transverse flight will lead from the upper landing to the summit of the pier.

The platform will be formed of fir planking on joists laid transversely upon the cast iron girders, the external ones of which will support a cast iron Doric entablature, enclosing the platform and forming the parapets; the entablature will be surmounted by coupled pilasters, filled in with a panelling of corrugated iron, supporting a light wrought or corrugated iron roof, which will cover the whole surface of the pier, and an ornamental cast iron cornice of the same level and meeting that of the offices, will run round the eaves of the roof and form a gutter, the pilasters forming rain water pipes to lead off the water: the pier may eventually be enclosed at will, on either side, by shutters to slide behind the panels, formed by the pilasters; from the platform to the ridge of the roof the height will be 16 ft.

The junction of the roofs at the T head will be surmounted by a lantern tower, from which will be exhibited a powerful and distinctive light for the benefit of shipping, to be erected subject to the approval and under the direction of the elder brethren of the Trinity House; this light will be at an elevation of 60 ft. above low water of spring tides, and 40 ft. above high water, and will be exhibited from a plate glass lantern, surmounted by a copper dome and vane, and supported upon an octagonal iron tower.

The whole area of the pier is at present enclosed by timber piles, braced together, forming a defence to the works and supporting horizontal longitudinal bearers, upon which rails are laid, which are traversed by a huge travelling machine *framed of timber on four railway wheels*, and supporting at top a powerful crab, which traverses upon rails laid upon the traveller at right angles to those below: the span of the traveller is 40 ft., and the machinery is at an elevation of 60 ft. above low water mark.

The foundations of the pier are now nearly finished up to the T head; and the abutment, wing walls, and offices nearly completed, one third of the main columns fixed, and some of the girders laid in their places. All the heavy castings are completed, and it is anticipated that the pier will be available to the public early in the ensuing summer.

The advantages gained by the construction here adopted, are an uninterrupted and free waterway at high water, very little impediment to the tidal currents, an easy approach from the shore, and an efficient protection to those frequenting the pier as a landing place or promenade from wind and weather.

The wooden pier now used will be removed upon the completion of the new pier.

METROPOLITAN IMPROVEMENTS.

A letter, headed as above, and of very unusual length, especially on such a subject lately appeared in the *Morning Chronicle*, which we should have noticed ere now had it not escaped our attention at the time. Be the writer, who affixes only his initials, E. P., professional or non-professional, there is a good deal of judicious remark in what he says, among other things, in regard to the consideration which ought to be bestowed beforehand on the style of architecture to be adopted for the new streets, now in the course of being formed from Leicester Square to Bloomsbury. If anything more than the dull regularity of uniform rows of plain-fronted houses is to be aimed at, it is highly desirable that the opportunity thus afforded should be made the most of, and turned to far better account than has been done in preceding "improvements" of the kind, whether at the west-end of the town or the east. With the writer of the letter in the *Chronicle*, we deprecate "a second edition of Regent Street," and its meretricious, tawdry compilation of downright architectural frippery; but of Moorgate Street we do not entertain quite so high an opinion as he seems to do. While it is a degree or two better than Regent Street, and free from most of the gross solecisms displayed there, it partakes of the defects of the same system of misplaced and overacted architectural pomposity. In as far as a mere order of columns or pilasters can bestow it, it possesses an air of magnificence, which though it may strike for a moment, too plainly betrays itself to be only in the "High life below stairs" taste. The shops on the ground-floor inevitably throw a degree of ridicule on the mock dignity of the upper part of the fronts: the effect thus produced is somewhat ludicrous—akin to that which must have attended Sarah Siddons' occasional starts in the tragic vein—as when she would ask a servant for beer at dinner time, in blank verse uttered in the tones of Lady Macbeth.

Besides the evident misapplication of a columnar style for such purposes, we generally find it, when so made use of, to have been adopted not so much from any particular affection for or relish of it, as from indolence, or else the inability to produce any sort of character or variety by any other means. Pomposity and mock dignity of a different kind are occasioned by these "joint-stock" façades being carried on to the extent they generally are;—whereby, instead of being increased, the sort of grandeur which is aimed at is lost. Were not more houses grouped together into one composition than would give nine, eleven, or thirteen windows in breadth, such fronts would carry with them a far stronger appearance of belonging to distinct houses on a large scale; and as such they would at the same time appear more lofty also. This is tolerably evident from the group of clubhouses in Pall Mall, which are infinitely more impressive than a uniform range of building of "respectable" common-place design would have been, even had it been extended along the whole street. Whatever may be the reason for it, it almost invariably happens that in wholesale masses of houses packed together to form one continuous front, study of design and effect is in inverse ratio to the ambitious pretension of the ensemble: hence not only poverty, but even paltriness, and sometimes vulgarity of expression. Such is the case with nearly every one of the "Terraces," "Places," "Squares"—or whatever other may be the polite designation bestowed upon them—which have sprung up of late years along the western outskirts of the metropolis. Considered as architecture, they are for the most part, sad rubbishly stuff, bedizened out with coarse finery, so essentially vulgar in taste, that the extreme of plainness is preferable to it, since at all events it does not court notice. It must be acknowledged that we have in many instances fallen into a sort of "swell mob" style of architecture in some of our "public improvements."

To return to the writer in the *Chronicle;* we are not a little puzzled by what he says on the subject of the British Museum. "Time and criticism would be wasted on it. The question is not an open one. The architect, by the style in which he has already finished two sides of the quadrangle, has already determined, within an ornament, more or less, the character of the front of the building. To him, without any meddling interference, should be left the completion of his design."

This is surely strange sort of argument: in the first place, *now* is the very "time" for "criticism" to interfere—to step in ere it be altogether too late, and demand that what remains to be done to the buildings should be made, as even now might be, to redeem its thorough unsatisfactoriness as far as it is advanced, It is *because* the quadrangle shows us pretty plainly what will be the quality of the external façade, that we protest against the original design being so carried into execution.

It is nonsense to say that the question is not an open one, when the matter itself is a public one, and it may be presumed, of some importance, unless the importance of our advancing in art, has been prodigiously exaggerated. In one sense, it certainly is not an "open question," because, instead of being made such, and public opinion being sounded by those who possess any authority or influence in the business, there is evidently an effort, although a silent one, to *gag* all questioning—a determination to weary out remonstrance, by turning a deaf ear to it, and to smother both inquiry and observation. But this must not be—dogged and unflinching sulkiness on one side must be met by unrelenting perseverance on the other. To suffer the matter to drop because all that has hitherto been said has produced very little if any apparent effect, would be very ill-advised, since it is the sudden silence which has succeeded to the loud and even stormy outcry raised at first in some quarters, which has thrown a damp upon the matter, as if it were found to be utterly hopeless and irremediable.

If nothing else, the ominous symptoms now manifesting themselves in Great Russell Street, would, we should have thought, elicited fresh remark. There is, indeed, one reason for their not having done so, though not of a kind very flattering either to the architect or the edifice; for many seem to have no suspicion that the row of "houses" a little to the west of the present buildings of the Museum, is intended to be connected with the "grand façade," as a wing to it. It was but the other day, that we ourselves were asked if a new street were going to be opened there—a very natural mistake, for that range of building certainly does look like a row of mere "street houses." Therefore, as soon as it comes to be seen what they are intended for, perhaps even those who have hitherto been silent may begin to express some disappointment and dissatisfaction, more especially as they have not been prepared for anything of the kind, by any of the so-called views professing to exhibit to us the new front of the Museum, but suppressing those very conspicuous appendages to it.

In the mean while, even those who would persuade us that Sir Robert Smirke ought to be left to go on entirely in his own way, do not expect more from him than a structure of "a pure, austere, cold, classical character, worthy of its object, though perhaps not a work which will inspire many persons with warm admiration and pleasure." That it will be cold and austere enough, we may rest assured; but that it will be "pure" and "classical," we very much doubt—or rather are not quite so fortunate as to have any doubts, for if we had, we might then have hopes also. If chilling bareness be purity—if the introduction of alien and disturbing features, and the rejection of classical treatment and classical embellishment, be classicality, why then we shall have both that and purity:—not otherwise. Still, "let no one" says the *Chronicle's* correspondent, "let no one hint at the substitution of any other architect. A total failure would bring disgrace on us for the rash and uncourteous interference. Against such an imprudent transfer, Buckingham House taken from Mr. Nash and committed to Mr. Blore, exhibits some things which should act as a warning. Mr. Hardwick might bestow on the Museum some splendid and ornamental conceptions, which might resemble the noble palace he has erected for the Goldsmiths' Company; and Mr. Barry might enrich the building with a façade in the style of his admirable clubhouses. Some persons would be found, I do not in the least doubt, who would suggest an Elizabethan front; and again Mr. Barry might be led in a retrograde path, and to please an inferior taste of a majority in parliament, or a majority of commissioners, he would be induced to suppress the beautiful forms of Greek or Italian architecture, and only reproduce Hatfield or a Town Hall of the Netherlands."

The precedent here produced for superseding the architect originally employed, by calling in another, says more for that course being now adopted, than all the rest does against it. Without stopping to inquire how far Mr. Blore altered for the better or for the worse, what had been done by Nash, we are hardly warranted in inferring, from want of better success in that particular instance, that a similar result must necessarily attend every other case of the kind. Besides, Buckingham Palace is still essentially what Nash made it, for his successor did not erect a *new façade*, and even the alterations were but inconsiderable. As to what is said of Mr. Barry, and the probability that he would adopt, or that any one else would think of recommending, the *domestic* palazzo Italian, or Elizabethan, is quite preposterous. In regard to the style or mode there could be but one opinion: Greek or Greco-Roman and columnar it would be as matter of course; and although he has not much practised it, we have very satisfactory evidence of what Barry is capable of achieving in that style, in the Royal Institution of Manchester—one of his earliest productions; and again in the masterly design exhibited some years ago for the Town Hall of Birmingham. After all, too, Mr. Barry is almost out of the question, he being engaged on another national structure upon a far more magnificent scale than the Museum. It were, besides, idle to mention any individual beforehand: full time enough will it be to look about for a successor to Sir Robert when he shall have been advised to feel the indispensable necessity of retiring from his very arduous and long protracted exertions in the service of—the public. His attachment to the public service is undoubtedly very great—far more so than his deference to public opinion, and his readiness to comply with what has been demanded of him by the public. Even his would-be apologist in the *Chronicle*, lectures him rather sharply for not complying with the call for the exhibition of the model for the façade of the Museum. "It is uncourteous, it is unwise, and it is unjust to withhold from the public the design which is determined upon." Yes; and it is not over wise or gracious either upon the part of those who have the power of enforcing compliance, not to do so.

To Sir Robert Smirke himself it may, probably, be matter of utter indifference should the building afterwards cause universal dissatisfaction, and heap disgrace upon its author. But it is not or ought not to be matter of indifference to us, the public, whether the Museum reflect credit or disgrace upon our national taste in architecture. Personal interest and party favour may, indeed, ward off censure from the architect in some quarters, and sycophancy may *award to* him its applause, but honest criticism and sound opinion will ultimately prevail, and then both that and all his other works will be estimated very differently from what they have been during the tide of a forced popularity. "Sir Robert Smirke," observes an intelligent contemporary, "has sailed with a fair wind and few impediments down the stream, and if he has not reached a peaceful haven, he has at least been embayed in a fertile and fragrant nook. Whether he has started fairly, and sailed in his own boat, we will not at present inquire; but if he values a repose which in his old age we would not disturb—if he wishes to be spared from the bitter criticisms which his works are calculated to call forth—whether regard be had to his *expensive constructions. and lifeless, frigid designs*, or to his *jobs, failures, and laborious puerilities*—we should desire him no longer to dare the public censure."

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By Henry Fulton, M.D.

No. 6.

The world, that is to say the architectural profession, is divided on the subject of competition designs; one moiety, and that not the least talented, stand aloof and leave the field to be occupied by the remainder; who, although they do not condescend to write in favour of competition, yet take every advantage of it in practice; and if competition goes on, this section will enjoy a monopoly.

Undoubtedly, if the practice of modern architecture had attained such a state of perfection as painting and sculpture have done under such master-minds as Buonorotti, Raphael, Da Vinci, Canova, &c., and that the public were as well qualified to judge of architecture as of the sister arts, the aristocracy of the profession would be quite right in standing on higher grounds, and treating the practice with contempt; nor do I imagine the public, if well informed, would require it; all that would be necessary for committees of selection to do, would be to fix on the style of the intended edifice, and then employ the architect within their reach, who was known to excel in that particular style.

But, alas, this is not the case, at least as far as the public are concerned; and as long as things so continue, and competitors are to be found to enter the lists, competition designs will be in request: and it is in vain that the anticompetitors, either by precept or example, endeavour to stem the current; better then to sail with it, than waste their strength in useless efforts to sail against it: better it would be to endeavour to turn it to their own advantage, and that of the art, by modifying, directing, and improving it, and not leave the harvest to be reaped and housed by others, less qualified, perhaps, than themselves for the undertaking.

I readily admit, that in very many instances competitions turn out badly; sometimes the architects do not know exactly what the advertising committees want, and it would be scarcely reasonable to expect that they should, as the committees seldom know it themselves. Not unfrequently the competition is all a farce got up to save appearances, the architect having been fixed on previously. I knew an instance of competition where the limit for the estimate was £20,000, and the prize was given for a design which the architect admitted would cost £80,000 (in fact he was not aware that there had been any limit.) It looked better on paper than any of the other plans, and the architect got 70*l.* prize, and what was better, he got £600 for altering it. On the parties being told that "the design never would have a firmer foundation than the paper on which it was drawn," their wrath was great, however, the event proved the correctness of the vaticination, for the design was thrown into the fire. Such adjudication as this brings its own punishment with it; for I believe it cost, together with a world of litigation, nearly £1,500 without any result.

Such misadventures, however, do not occur in every case, as I believe the nation generally is well satisfied with the result of the competition which placed the erection of the Houses of Parliament in the hands of Mr. Barry. As a contrast to this, Sir Robert Smirke (without competition) is to design the façade of the Museum. I much doubt if it will prove equally satisfactory. Where, as in the instance of the Museum, there is to be no competition, it appears to me that the architect, if not in honour, is at least in duty, bound to submit his design for the opinion of those who are, or even wish to be considered, judges of its merits: not indeed that I would have the architect, like the old man in the fable, make an ass of himself by endeavouring to please every body, but I would have him, as the old man ought to have done, listen to the objections, suggestions, and observations of others, and then use his own discretion as to whether he should lead, drive, carry, or be carried. It never can be injurious, either to the fame or interest of any well informed person, to hear and weigh the opinions of others, even although they may not be so wise as he is himself. So thought Edmund Burke, no mean authority in matters of taste; speaking generally, he says, "I have known, and according to my measure, have co-operated with great men; and I have never yet seen any plan which has not been mended by the observations of those who were much inferior in understanding to the persons who took the lead in the business."

It may be asked if architects in refusing to enter the lists as competitors, under existing circumstances do not begin at the wrong end. They ought to improve the public in taste before it can be supposed competent to appreciate individual merit; they ought also to be able to point out to the public such and such works on which to rest their claims for confidence. The establishment of an annual exhibition of designs and models, as pointed out in a former paper, No. V., would afford to every architect an opportunity of making himself known to the public.

Certainly the proposals for competition designs are very frequently absurd enough, and tend to place the profession on a very low scale indeed; for instance a joint stock company in connexion with the Dublin and Drogheda Railway have just advertised for plans for buildings, to cost £15,000, and the successful competitor, who shall furnish the most approved "plans, specifications and estimates," shall receive the munificent sum of ten guineas! There is on the advertising committee the name of one gentleman who could not have been aware of this insulting offer to the architectural profession. Architects competing *in any case* should not furnish or be required to furnish any working plan, specification, or detailed estimate: these with the supervision of the works ought to be subsequently paid for at a fair rate. This would simplify the thing and frustrate the mean intentions of advertising committees: indeed, as to the estimates, under the present system, they are generally most absurd, and quite on a level with the *designs*, though seldom in accordance with the interests and wishes of those committees, who speculate on having the plans carried into effect by a builder, without any farther aid from an architect.

II. It is almost as rare to find a failure in Gothic as it is success in the Greek style; which does away in a great measure with the necessity for competiton where the former style is the one selected. Would it be easy to find an architect who could design one part of a Gothic edifice equally respectable as the portico of the new Exchange, committing so great an error in any other part, as has been committed in polytrigliphing the interior, and exhibiting a base prostitution of a beautiful ornament. The reason of this success is, that fortunately we have no Palladian Gothic unless it be the exterior of the Duomo at Milan, and some reminiscences of Sir C. Wren and Jones at Westminster and Winchester.

It is true we often find in the same edifice a mixture of the details which more properly belong to different eras of the style. The style however, admits of great latitude in this respect; but it ought not to be carried too far, as for instance, the alternation of pointed and circular headed windows; or even their introduction in the same composition, which would be just as bad taste as the mixture of Ionic and Corinthian columns in a Greek composition; it would seem to be taking a leaf out of the Palladian "analysis of beauty," where it is considered a great perfection to exhibit an alternation of segmental and pyramidal headed window pediments.

III. One cause of the ignorance of the public on architectural subjects, is the criticisms of the miscellaneous press—almost every edifice spoken of in the newspapers is praised: those who know anything of the way in which newspapers in general are conducted, will be at no loss to account for this, as I believe those reports are for the most part written by the parties most interested; the editors in general being as ignorant of architecture as their readers; and it would be hard for the blind to lead the blind with safety and security. It is most essential, therefore, for the public not to be led away by representations of that description. Every person with any pretensions to good taste and correct judgment join in the condemnation of the National Gallery, both as regards fitness and beauty; and yet was it not praised beyond measure by the newspapers of the day? Oh! how it grieves me to think of the National Gallery of Berlin, in comparison with our own. When it shall be found, as I am confident it soon will be, that another and more suitable edifice is requisite, the palace at Kensington ought to be appropriated for that purpose. It would be sufficiently out of the smoke of London, and yet at a convenient distance for visitors. But I find myself digressing too much from the subject commenced with.

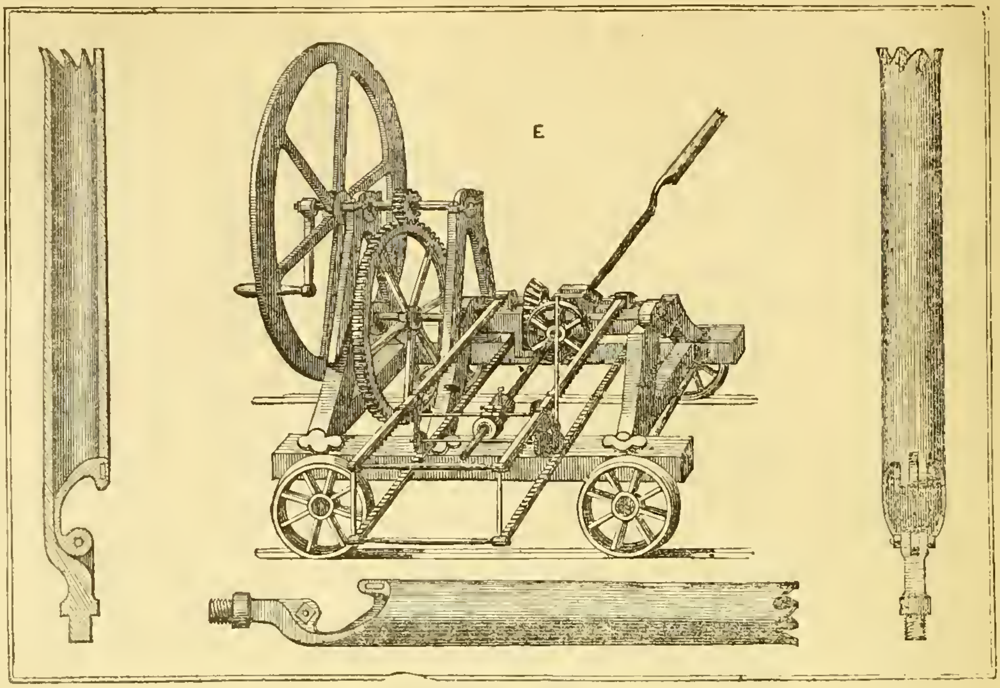
IV. At page 26 of this Volume C. D. of Milford, objects to the notice with which the Conciliation Hall, Dublin, is introduced to the readers of this Journal, as he considers the edifice below criticism. Is C. D. one of that school who object to "vilanous saltpetre" being dug from the harmless bowels of the earth? Does he not know that the end of a journal is in holding up the mirror to art, to shew deformity its own image, as well as beauty her own feature? In dissecting (which C. D. is pleased to remind me of,) pathology must be attended to as well as physiology, the diseased as well as the healthy functions. C. D. may be right as to there being no committee of selection in the case of the Conciliation Hall. The observations on that subject were intended to be general.

The Admiralty have purchased the working model of the Trafalgar Square Nelson with which to adorn their offices, which stand sadly in need of it.

WATSON'S PATENT IMPROVEMENTS IN DRAINING.

In our last Number, in describing the Patent Drain Pipe, we alluded to the Boring Machine, which is the most important part of the Patent, as it enables the drain pipes to be inserted with facility, which, without it, would be a very troublesome affair.

The Patent Boring Machine, shown in the annexed engraving, fig. 1, is worked by two men turning the handle which gives the rotary motion; the advancing motion is given by another man, who leans on a lever, which is represented in a perpendicular position; this when pressed downwards propels a pinion wheel, which advancing up the rack, impels a collar, and, by means of a thumb-screw, clips the boring rod passing through it. Double racks are used for the sake of obtaining a steady motion.



Fig, 1.—Patent Boring Machine and Augurs.

The action of the auger may be very advantageously used for brick work; it cuts out a complete cylinder of brick, and thus brings out a solid core. No other tool has been found to produce such a result. Augers and drills of every shape had been tried by the patentee before he hit upon this.

Fig. 2 is a front elevation and section of the retaining wall in the cutting of the London and Birmingham Railway between Euston Square and Camden Town; at the back of the wall is that difficult soil, the London clay, which has given so much trouble in consequence of being occasionally saturated with water; the clay has now yielded to the influence of the ventilation, by the introduction of the drain pipes, inserted at the back of the wall, as shown in engraving; they are inserted to the distance of 16ft. from the face of the brickwork. When the pipes were introduced, it was found that there were very few springs in it, but a considerable accumulation of rain water, and which now runs freely out after a heavy shower of rain from every pipe.

In a clay soil like the above, the borings must be made much closer than in a gravelly soil, or even a sandy one. An inspection of brickwork that has been thus placed for a few years, shows clearly that neither bricks nor mortar will endure long under such circumstances; and also it is proved that ventilation will harden softened bricks, though it cannot of course restore the washed out mortar.

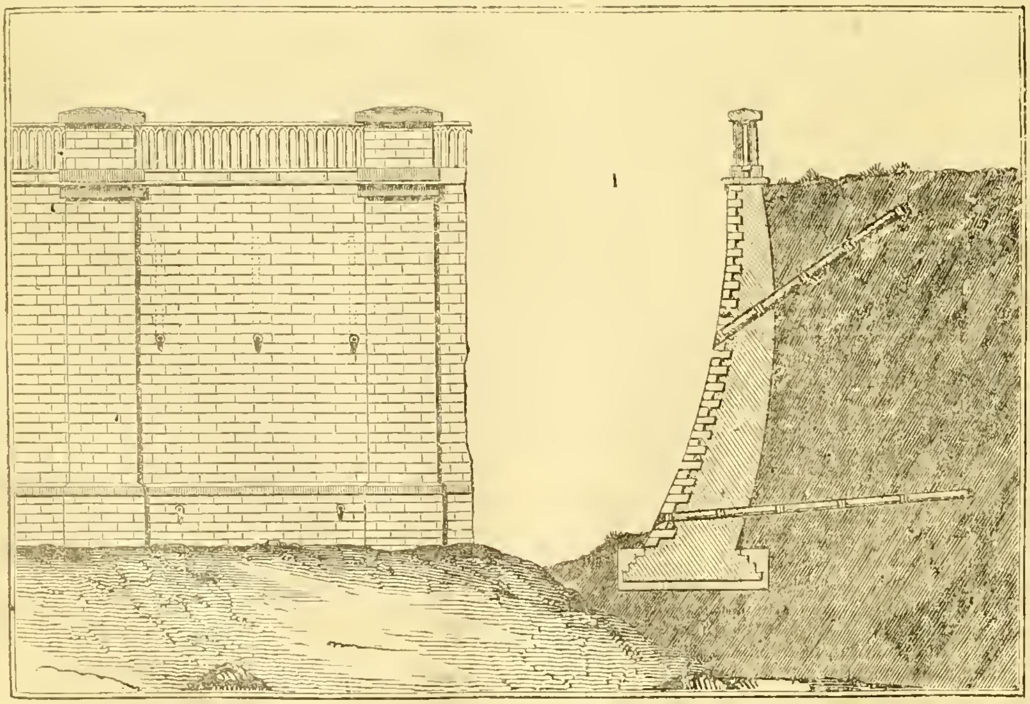


Fig. 2.—Front Elevation and Section of the Retaining Wall, London and Birmingham Railway.

WROUGHT IRON BEACON.

Description of a Wrought Iron Beacon erected at the harbour of Black Rock, in Long Island Sound, in the summer of 1843. By W. H. Swift, Capt. Corps Topl. Engs. (From the *American Journal of the Franklin Institute.*)

In March, 1843, an appropriation of 10,000 dollars having been made by Congress, for rebuilding the Black Rock Beacon, the Secretary of the Treasury applied to the Secretary of War to allow this beacon to be constructed under the direction of the Chief Topographical Engineer, and by the orders of Colonel J. J. Abert, the work was entrusted to the superintendence of Captain W. H. Swift.

The beacon stands 1½ mile south of the entrance to the harbour, and is exposed to all winds from E.N.E.; around by the south to W.S.W.; from the east it is open entirely to the rake of the sea for a distance of sixty miles.

When the first beacon was built in 1829, a large quantity of pebble stone was carried in vessels to the proposed site, and there thrown into the water around a single rock called the "Old Huncher," and upon which there had been an iron spindle in former years; this rock was conical in shape, about 4 ft. in diameter at top, and bare at very low water. Upon this loose stone, thus deposited, the superstructure was reared, and when the beacon was overthrown, the materials of which it was composed, were, of course, added to the rubble stone bed, and they, in turn, became the foundation for the beacon of 1835.

In the examination which I made of the site in June, preparatory to making the final plan for the iron work, I ascertained that the stone below low water, had, apparently, remained unmoved for a long time, and I subsequently found, by inquiring of Captain Wilson, the contractor, who had repaired the beacon in 1836, and who had maintained it in repair for five years, that such was the fact; while, as he stated, and it was evidently true, the stones between low and high water were thrown about by the force of the sea in every gale. This was fully exemplified too by the appearance which the injured part of the old beacon presented; the base, or that part below low water, was entirely undisturbed, the breach being between high and low water marks; all the stones below low water remaining, as stated by Capt. Wilson, as they were when the beacon was repaired in 1835.

There being no stone of sufficient size at the old beacon into which the iron shafts of the new structure could be secured, I found it necessary to procure elsewhere such as were suitable for the purpose, and to transport them to the site, and imbed them below the line of low water, in order that the sea might not disturb them after they should be laid.

Stone Foundation.—The beacon, according to the general plan which I had made, and submitted to Col. Abert on the 30th of April last, was to be elevated 36 ft., and for this height I decided to give the iron shafts a spread, or base, of 16 ft., with an inclination towards the centre of about 1 to 6. In order that there should be sufficient strength in the stone to resist any tendency there might be to fracture at the holes which were to receive the feet of the shafts, I adopted the dimension of 20 ft. as a suitable diameter for the stone bed designed for the shafts to be secured to; this dimension gave a distance of about 2½ ft. from the centre of the shaft holes to the edge of the stone at top, while at the bottom of the stone, where the strain is less, it would be 2 ft. The bed then is composed of 6 pieces of hammered granite, 2½ ft. thick; the middle stone is round, and is 8 ft. in diameter, the five outer stones are 6 ft. wide by about 12 ft. in length, each stone weighing nearly 12 tons; the stones are cramped and doweled together with 1½ in. round copper,[1] two at each joint, the cramps 2 ft. long, and the dowels 10 and 12 in. long.

The excavation which was made in what may be called the artificial island (for at low water an extent of 105 ft. from east to west, and 88 ft. from north to south is exposed,) for the reception of the stone bed is a few feet N.W. from the old beacon; it was 26 ft. in diameter, and 3 ft. below *ordinary* low water. When the excavation was completed, a layer of concrete composed of 5 parts of hydraulic lime, to 8 parts of sand, was spread over the bottom of the pit by means of a trough of wood for the foundation stone to rest upon. After the stones were laid, which was effected by means of a heavy pair of shears, and a "Lewis," the unoccupied space in the pit around the outside of the stone bed, was filled with concrete and rubble stone, flush with the top of the foundation stone. As it was only at, or near low water, that this part of the work could be carried on, that is to say ordinarily, about three hours per day in good weather, considerable time was necessarily consumed in getting in the foundation; from the day the shears were erected, to the day the stone work was completed, was just five weeks.

Iron Work.—The figure of the beacon is that of a truncated pyramid: it is formed of six wrought iron shafts, five of them 36 ft. 7 in. in length, standing in the periphery of a circle of 16 ft. diameter, and one 36 ft. long at the centre, the outer shafts incline towards the middle in such proportion, as to fall at the top within the circumference of a circle of 3 ft. diameter; each of these shafts is composed of two pieces of equal length, the diameter at the foot of the lower piece is 5¼ in., and at the top 4 in.; the diameter of the upper piece is 4 in. at the foot, and 3 in. at the top, they are united by a cast iron socket of 3 ft. in length, 2½ in. thick at the joint of the shafts, which is at the middle of the socket, 2 in. thick at the top and bottom, and 1 in. thick elsewhere; the top of the lower shaft is made concave, and the bottom of the upper shaft convex, fitting one into the other. At the distance of one foot from the joint of the shafts, a steel key, 2 in. deep by ¾ of an inch wide, passes through the socket and each shaft to secure them together; the sockets inside, and 18 in. of the ends of the shafts are turned and accurately fitted to each other. At a distance of 2½ ft. from the foot of the lower shafts, are four shoulders one foot long, and projecting, at the lower extremity, one inch from the shaft to form points of support for the same at the surface of the foundation stone. Above and below the joints of the shafts, and at distances of 9 ft. and 18 ft. respectively above the top of the stone, are two sets of braces extending from the middle shaft to each outer shaft, and from one outer shaft to another, making ten in each set; the braces are of wrought iron 2½ in. square, the extremities are secured by 1¼ in. screw bolts to cast iron collars, these collars are strengthened by two wrought iron bands, and are firmly attached to the shafts by steel keys; the space between the collar and shaft, and between the keys is filled with zinc; the braces are secured to the collars in such a manner that they serve for ties in case of any unforseen strain acting from the *interior* of the beacon, such as might possibly be occasioned by ice, or any other floating body.

The tops of the shafts are provided with shoulders to support a cast iron cap, composed of five arms, each 3 ft. in length, and 4 in. in width, strengthened by a rib, or flanch, of 3½ in. in depth; the shafts pass through this cap 18 in. from the centre of it, and are there keyed in place; a wrought iron band 3 in. wide, and ½ in. thick, is shrunk upon the extremity of these arms to add to its strength; from the ends of the arms of the cap, 3 ft. from the centre, braces of 2 in. round iron descend 4½ ft. to the main shafts, and are there secured by screw bolts passing through their extremities, and through the shafts also. At this junction of the braces with the shafts, a wrought iron band, similar to that which encircles the cast iron cap, is fitted and bolted at a distance of 4½ ft.; again below this second band is a third band similar to the two others, and similarly secured by screw bolts through the shafts; finally, there are 10 panels or gratings, 4½ ft. long, corresponding in shape and dimension with the wrought iron bands between the shafts, and the wrought iron bands; these gratings are made of boiler iron $\frac{3}{16}$ths of an inch thick, with eight horizontal and three vertical slats, or bars, 3 in. wide, riveted together; the horizontal slats are 3 in. apart, but at the distance of 500 yards, the top of the beacon presents the appearance of an opaque body 9½ ft. long by 6 ft. wide at the top and bottom, and 4½ ft. wide midway of the same.

The feet of the iron shafts penetrate the stone foundation 2½ ft., and are secured in their places by heavy iron wedges fitted to the unoccupied spaces between the sides of the holes in the stone and the shafts; the holes being inclined, and the braces between the shafts being immoveable. It is evident that the feet cannot be withdrawn from their places without rupture. Now, the braces are of 2½ in. square iron, and the thickness of the stone outside of the hole is 2½ ft. and this would seem to present sufficient strength to resist a shock from any ordinary cause.

In addition to the concrete around the outside of the stone, and the cramps and dowels to secure the same together, there are five iron ties of 1½ in. diameter, extending from a collar of two inch wrought iron, which surrounds the middle shaft, to each of the outer shafts to which they are firmly and securely attached by means of heavy iron stirrups; the ends of the ties are furnished with screws and nuts, and by this means can be kept in a constant state of tension. This arrangement was resorted to as an additional means of preventing any tendency there might be in the outer foundation stones to separate themselves from the middle stone.

The beacon, as finished, stands 34 ft. above low water, and 3 ft. higher than the old beacon; the cage, or grating, is painted black, and the shafts vermilion red.

The iron work was executed in Boston by Messrs. Cyrus Alger & Co., under the immediate superintendence of Mr. Lester; the entire weight is upwards of 19,000 lb. The foundation was prepared, and

[1] York stone or slate dowels and cramps are now generally adopted in England; they are far better and cheaper.—Ed. C. E. & A. Journal.

the beacon erected in place by Mr. Benjamin Pomeroy, of Stonington, Connecticut, under a contract made with him for that purpose. The entire cost of the iron work and foundation was about 4,600 dollars, and the time consumed in the construction was three months.

I had it in contemplation at one time to coat the iron work with zinc, by means of electro-galvanism, but I found that too much time would be required for preparing the necessary tanks and apparatus. I venture to hope, however, that another occasion may present itself, and that in the more important structure of the "screw pile light," which I trust I shall one day see executed upon our own shores, that the galvanizing process may be successfully applied.

In conclusion, I beg to call attention to one or two of the more important advantages which this application of one of the principles of Mitchell's Screw-pile, (see *Civil Engineer & Architect's Journal*, p. 182, vol. 3, 1840,) to the construction of light houses and beacons, presents.

In a very exposed situation, a light, or a beacon, if built of masonry, can only stand when the best description of work is introduced; this, of course, involves great expense, and much time. The mode of construction for such situations must, in principle, be similar to that adopted for the Eddystone and Bell Rock lights, and this, as all know who understand the subject, would, in the case of our own coast, present *an insuperable objection*: for example, the Bell Rock Light, on the coast of Scotland, cost £360,000, and four years were required to build it, this too in a situation where the rock upon which it is placed is bare at low water. The Eddystone was neither so costly, nor did it require so much time to complete it, still the amount would, with us, justly be considered out of the question for a single light.[2] There are many places upon our coast at which the screw pile light could be erected at a very moderate cost, far less, indeed, than that of a light ship; notwithstanding this, there are at this time several floating lights in Pamlico Sound, on the coast of North Carolina. The Middle Ground, in Long Island Sound, upon which there are only 3 feet at low water, and at which a light boat is now maintained, is, of all others, the most suitable point to make the first experiment upon with this description of light.

In reference to the *durability of wrought iron* exposed to the action of sea water, I have not a great deal of information to impart, still I have some which bears upon this question. Upon many of the reefs in Long Island Sound, and more particularly in Fisher's Island Sound, it has been the practice for many years to erect wrought iron spindles of about 4 in. diameter, and from 15 to 25 ft. in height; such spindles last from 15 to 20 years, unless carried away by ice. The contractor who placed several of these spindles, informed me that one upon a reef in Fisher's Island Sound had been up 20 years without being renewed; the wasting takes place principally between high and low water, and in this particular case, the size of the spindle is reduced from 4 to 2 inches in diameter. If, however, the zincing process, or if a precipitate of copper be resorted to, there is every reason for believing that the iron thus protected would last twice, or three times, 20 years. In short, economy in cost and in time, and the application of the principle of the screw pile in situations where masonry could not be resorted to without inordinate expense, would seem to be advantages in themselves sufficient to justify extensive experiments in a branch of the public service of such importance as that of our light-house system.

2 The Car Rock Beacon, on the coast of Scotland, cost £5,000; six years were required for the construction; it was intended to build it entirely of stone, but when half finished the upper part was constructed of cast iron. The cast iron beacon on York Ledge Maine, is an exact copy of the Car Rock Beacon: it cost £2,000.

PATENT SCREW-PILE BATTERY AND LIGHT-HOUSE.

Mr. Mitchell, the Patentee of the Screw-pile, previously described in our *Journal*, proposes to adapt them for the purposes of forming foundations for the erecting of batteries in the open sea, in such situations as the Goodwin Sands, and other sub-marine sand-banks.

The principle of such foundations has already been well tested both on the east and west coast of England—off the shores of which have been erected, screw-pile light-houses, that have now withstood the storms of several winters, without exhibiting the slightest symptom of insecurity or decay. The stability of such structures depends on two causes:—First, the firm hold which the broad screw takes of the ground, by being forced far beneath its surface. And, secondly, the solid part of the building being placed above the reach of the highest sea—no broad surface is opposed to the free passage of the waves—consequently, the structure is not affected by them.

The first foundation of this description was fixed in the Maplin Sands, by Mr. Mitchell in 1838, by order of the Trinity House, at the recommendation of their engineer, Mr. James Walker, for the Maplin Light-house; and, though it stands upon a bank of loose sand, many miles from the nearest coast, and exposed to the swell from the German Ocean, yet it is as stable and likely to endure, as if based upon a rock. But the first light-house of this description was erected by Mr. Mitchell in 1839, at the entrance of the sea reach, leading to the town of Fleetwood-on-Wyre; both these light-houses have been previously noticed in the 3rd & 5th volumes of the *Journal*. The stability of both these light-houses shows with what perfect security many descriptions of work may be placed on sub-marine sand-banks, by means of screw-piles; especially as Mr. Mitchell proposed for batteries, in consequence of some observations which fell incidentally from the Duke of Wellington, when giving evidence before the Shipwreck Committee of the House of Commons.

His Grace, while speaking on the subject of harbours of refuge, took occasion to observe, that the extensive application of steam, to maritime purposes, would effect an important change in naval warfare. That persons on the French coast, the sun being at their back, could see more distinctly what was passing in the channel, than could persons on the English side; which, by enabling steam cruisers to seize upon our merchant ships, at the most defenceless points, would, in times of war, seriously affect the trade of London itself; and, on this subject, his Grace concluded by alluding to the possibility of constructing places of defence on the Goodwin Sands, and other banks upon this coast, for the protection of our trade. For the necessity of such works, we have thus the highest military authority. For the purpose of a battery, Mr. Mitchell proposes to render his screw-piles available in the following manner, for a battery of 28 guns:—It is proposed to support it on forty-one malleable iron piles, placed in five parallel rows, the three interior ranges consisting of nine, and the two exterior, of seven piles each,—on the top of these piles an oblong platform is constructed, upon which the battery is formed, with a barrack and a light-house in the centre.

Among the many advantages to be derived from such places of defence, it may be mentioned the perfect practicability of placing them on sub-marine banks, adjacent to wide harbours, roadsteads, or estuaries of rivers, such as the Thames, where, from the absence of high and commanding positions, or even dry ground in their neighbourhood, ships of war constitute the only means of defending our trade, in time of war; the difficulty of which will now be much increased, in consequence of the introduction of steam in the navy. As compared with ships, the risk to such batteries, from hostile attacks, appears trifling; the narrow surface and rounded form of the piles, and each part of the frame-work, rendering it nearly ball proof; for, unless struck in the direct line of the centre, shot would glance off from their curved surface; and, even bar or chain shot could have no effect on the main supports of the building, owing to their great strength and weight.

OBITUARY OF MEMBERS OF THE INSTITUTITION OF CIVIL ENGINEERS.[1]

Professor Wallace.

William Wallace, LL.D., Hon. M. Inst. C. E., late Professor of Mathematics in the University of Edinburgh, was born at Dysart, in the county of Fife, in 1768. From birth, fortune, or education, he derived no advantages whatever, and the eminent station he eventually occupied as a mathematician, was achieved solely by his own industry and love of scientific knowledge, aided by natural talents of a high order. He was appointed, at the age of twenty-six, assistant teacher of mathematics in the academy of Perth. In 1803 he obtained a professorship in the Royal Military College at Great Marlow (afterwards removed to Sandhurst); and in 1819, upon the death of Mr. Playfair, and the removal of Mr. Leslie to the chair of Natural Philosophy, he was elected professor of mathematics in the University of Edinburgh. His pursuits and studies were chiefly connected with abstract mathematics, but some of the subjects to which he directed his attention may be here noticed, as having more immediate reference to the objects of this Institution.

The Eidograph, an instrument for making reduced copies of drawings, which he invented about the year 1821, and exhibited at a meeting of the Institution in 1839, is considered superior in many respects to the Pentogragh. It possesses greater smoothness and flexibility of motion, and while the copies may be reduced or enlarged in any proportion, their similarity to the original is preserved with geometrical precision. By a particular modification, the instrument is made not only to reduce, but to reverse the copies, whereby it is rendered peculiarly applicable to the purposes of the engraver.

Among the papers which he contributed to the "Transactions of the Royal Society of Edinburgh," there is one on the subject of curves of equilibration, which is interesting to us on account of its connexion with the theory of suspension bridges. From the development of a certain functional equation, he deduces series for computing the co-ordinates of the catenary, and gives tables of the corresponding values of the co-ordinates so computed; thus furnishing engineers with a ready means of constructing arches having the forms of equilibrated curves.

Professor Wallace obtained a high reputation, as a mathematician, at an early age, and during his whole life he laboured assiduously to extend and facilitate the study of his favourite science. Besides his contributions to the

1 From the Annual Report of the Institute.

memoirs of scientific societies (chiefly the Royal Society of Edinburgh), he was the author of nearly the whole of the articles on pure mathematics in the fourth and subsequent editions of the "Encyclopædia Britannica," and likewise of the greater part of those in Brewster's "Edinburgh Encyclopædia." His health having given way so far as to render him unable to discharge his duties in the University, he resigned his chair in 1838. During the remainder of his life, although an invalid, his scientific ardour suffered no abatement, for while confined to his chamber, he composed the memoir on equilibrated curves, as well as a work intituled "Geometrical Theorems and Analytical Formulæ," which was published in 1839. His disposition was amiable and benevolent; he was beloved by his friends, and respected by his fellow-citizens; and he died, universally regretted, at Edinburgh, on the 28th of April, 1843, in his seventy-fifth year.

Mr. Buddle.

Mr. John Buddle, M. Inst. C. E., was born at Kyo, near Lanchester, in the county of Durham, in 1773, and resided there nearly twenty years, when he removed to Wallseod with his father, who had then attained considerable eminence as a colliery viewer. The elder Mr. Buddle was a man of considerable attainments in mathematics; he was a correspondent of Hutton, Emerson, and other eminent men, and contributed many papers to the scientific publications of that period. He was remarkable for the systematic manner in which he conducted his professional avocations; and to him we are indebted for the introduction of iron tubbing for sinking shafts, which, it is believed, was first used at the Wallsend colliery.

At an early age Mr. John Buddle evinced an attachment for active occupation, and an eager pursuit of experimental knowledge. These studies and pursuits were encouraged by his father, from whom he derived nearly the whole of his education, having only been at school during one year when very young. He became very early the assistant of his father as a colliery viewer; and on one occasion, when, as usual in cases of emergency, the viewers of different collieries were called together, to consult on the means of stopping an extensive fire of gas in the Washington pits, he suggested the trial of a jet of water moved rapidly, alternately, across the flame, in the same manner as in his boyish experiments he had cut off the flame of gas with a knife: the plan was adopted, and being carried into effect by himself, was perfectly successful. After the death of the elder Mr. Buddle, his son succeeded him in the management of the Wallsend colliery, and there, in 1810, he introduced those extensive improvements in ventilation which have been so much imitated.[2] He was engaged as the viewer and consulting engineer of a number of the principal collieries in the North of England. His experience in all the details of the coal trade led to his being frequently examined as a witness in Parliamentary Committees; and he was also employed as consulting engineer on railways and general engineering questions. In 1838 he was appointed one of the Dean Forest Mining Commissioners, and his tact and experience materially aided in the successful completion of their labours. As he advanced in life he became the proprietor of coal mines, as well as of landed, shipping, and other property, which, under prudent management, produced a considerable income; indeed, when it is remembered that he was a bachelor, and that his habits were very simple, it is surprising that he did not accumulate greater wealth. He was very liberal, and his charities were extensive. He took great interest in the local scientific societies, and, even amidst his numerous engagements, found time to communicate to them some valuable papers. To all who have visited the coal-mines of the North of England, or have taken any interest in the history of coal-mining, the name of Mr. John Buddle is familiar. He was active, steady, and unremitting in the discharge of duties which were attended at all times with much personal fatigue, and frequently with imminent danger. He was extremely exact in his extensive correspondence, and kept a diary, which may probably furnish materials for a detailed and useful memoir. In private life he was distinguished by many excellent qualities and social virtues. Among other accomplishments he was a superior musician; and his retentive memory, and happy mode of explaining and illustrating his subject, rendered him as agreeable a companion as he was a valuable friend. His habits were extremely simple, but his house for nearly half a century was the resort of most of the scientific strangers who visited the North of England, and his hospitality was unbounded. Whether viewed in his professional or private character, he has left solid claims to admiration and esteem, and his death may justly be regarded as a public loss. He died on the 10th of October, 1843, at the age of seventy years, and was interred in the ground which he had given for a cemetery, and where a church had been erected, on his estate at Benwell, near Newcastle.

Mr. Penn.

Mr. John Penn, M. Inst. C. E., was born near Taunton, in Somersetshire, in the year 1770, and was apprenticed to a millwright at Bridgewater, whence he travelled to Bristol, and worked there as an operative; he soon became the foreman of an important work, when only twenty-two years of age, and was celebrated for his theoretical and practical knowledge of the forms of the teeth of wheels, which branch of construction was, at that period, only imperfectly understood by mechanics. He removed to London about the year 1793, and after working at and being a foreman in several works, he commenced business on his own account in 1801. His attention was at first chiefly directed to the construction of flour-mills, in which he made many improvements, particularly in the substitution of metal, for wood framing. In consequence of the injudicious proceedings of the Millwright's Union, he was induced to oppose a determined resistance to their demands, and by the introduction of self-acting tools, and the instructions given by him to another class of workmen, the millwrights lost many of the privileges they had previously enjoyed. The tread-mills for prisons[3] were first constructed at Mr. Penn's works, and latterly he (in conjunction with his son) manufactured many marine engines, particularly those with oscillating cylinders.[4] Mr. Penn was well versed in general science; he was an amateur astronomer, and possessed some valuable instruments; much of his leisure time was devoted to horticultural pursuits, which led to several improvements in the methods of heating conservatories and forcing houses. He died suddenly on the 6th June, 1843, in the 73rd year of his age, having enjoyed for many years the confidence and esteem of a large circle of friends.

Mr. Aher.

Mr. David Aher, M. Inst. C. E., was born in the year 1780; he attained very early a proficiency in physical science, and at fifteen years of age commenced his studies as a civil engineer. In 1803, he surveyed and superintended several of the works of the Grand Canal Company (Ireland), and subsequently directed the collieries in the County Kilkenny and Queen's County, an occupation for which he was well suited, from his knowledge of geology, a science at that time but little cultivated in Ireland. By his judicious direction of borings and other trials, discoveries were made which have proved very valuable to the neighbouring coal proprietors. His inventions and improvements in mining and boring machinery (which have been generally adopted), are remarkable for the mechanical ingenuity displayed in them, for the simplicity of their construction, and for their practical utility. In the years 1810, 1811, and 1812, he was engaged in making experiments and reports for the Commissioners appointed by Government, to inquire into the nature and extent of the "Bogs in Ireland, and their capability of being made available for cultivation, or other purposes." While engaged in the direction of the collieries, he laid out nearly all the new lines of road which have been made through the County Kilkenny and neighbourhood, and also the Great Leinster and Munster Railway, from Dublin to Cork, by Kilkenny, Clonmel, Cahir, &c. In 1840 he met with some disappointments and losses, which weighed heavily on his mind, and were the principal cause of the illness which terminated his life. He died in the 62nd year of his age, respected for his high professional attainments and strict integrity of character, and regretted by all who knew him.

Mr. Ranson.

Mr. Robert Gill Ranson, Assoc. Inst. C. E., was a manufacturer of paper at Ipswich in 1810 he introduced an improved mode of sizing and drying machine-made paper, substituting for the ordinary tedious process of tub-sizing (in which it was requisite that the paper should be previously cut into sheets), a method by which he was enabled to size and dry writing or drawing papers, in the lengths made by Fourdrinier's machine: by this process, the time occupied in the manufacture was reduced, and the uncertainty of the effect of the weather in drying was avoided. In consequence of a long illness, preceding his decease, this invention was not extensively carried out, but it appears now probable that it will be generally adopted. Mr. Ranson only became an Associate of the Institution in 1842, but he demonstrated the interest he felt in its welfare, by exhibiting at the President's conversazione a sheet of drawing paper 400 feet in length, which had been completed by his process from the state of rags, in the short space of 48 hours. He was highly respected by his friends, and his decease, at the age of 51 years, was much regretted.

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2 The Museum of Economic Geology, Craig's Court, contains a model which exemplifies this system of ventilation.

3 Designed by Mr. William Cubitt, V.P. in 1818.

4 First patented by Mr. Aaron Manby, in 1816.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

Feb. 6.—The President in the Chair.

The first paper read was by Mr. S. B. Moody; it described "*a water wheel,*" constructed by Mr. W. Fairbairn, from the designs of Mr. B. Albano, and erected at the Flax Mills in Lombardy. The chief peculiarities of this wheel consisted in the introduction of the tension principle for the arms and the ventilation principle for the buckets. The use of wrought iron bars as arms and braces on the tension principle, diminished the weight, as fewer centres and arms were required, and consequently a lighter shaft could also be employed; repairs were less frequent, and also were not so expensive as with cast iron arms. In the old form of the buckets, the air entering with the water prevented them from filling, but, by the introduction of an inner sheathing, forming a space between it and the sole plate, the air was permitted to pass off freely, and the buckets, being thus ventilated, were enabled to be more completely filled, and the effective power of the wheel was increased. Mr. Albano explained its construction, and stated its speed was about 6 ft. per second; and that the useful effect obtained was equal to $\frac{6}{10}$ths. of the power expended, which was higher than many of the best wheels had attained; he then described a very ingenious adaptation of the balance weight governor for the penstock, for regulating the flow of the water to the wheel.

A description of *a Water-meter*, by Mr. P. Carmichael was then read. The mode of operation of this meter, which was attached to the feed pumps of three steam boilers supplying an 80 horse engine, was thus described: as the water proceeds through the discharge valve, the float sinks until it comes in contact with a detent or catch attached to a rod, which is suspended from a lever, this moves round a spanner and pendulum, until it passes the centre of gravity, when the pendulum falls and strikes a spanner, which shuts the discharge valve and opens the inlet valve from the reservoir to the closed box which supplies the boiler; a dial, the hand of which was acted upon by the spanner, indicated the number of times of the emptying of the reservoir, and it was stated that the action of the reservoir was very correct.

Dr. Roth's *Automaton* calculator was exhibited, and its action explained by Mr. Wertheimber. He gave a short review of the various attempts at constructing calculating machines, noticing the Roman Abacus, the calculating boxes of the Chinese and Russians; the several classes of instruments invented by Napier in 1617, by Perrault and others in 1720, and subsequently; the slide rule invented by Michael Scheffelt of Ulm, in 1699; the more important machines attempted by Pascal in 1640, by Moreland in 1673, by Gersten and by Leibnitz, which were submitted to the Royal Society of London, and the Académie des Sciences in Paris: he then mentioned the machine of Mr. Babbage, upon which upwards of £20,000 had been expended before the project was abandoned, and the finished part, which formed tables of progression up to five figures, was consigned to the museum of King's College, London. Dr. Roth's machine appeared very simple, and its results, which were severally tested, were very accurate; it performed all the operations of arithmetic from simple addition, subtraction, multiplication, and division of numbers, or of pounds, shillings, and pence to vulgar and decimal fractions, involution and evolution, and arithmetical and geometrical progression: it appeared particularly adapted for checking long calculations of quantities, for contractors, for the merchant's counting house, or for government offices. The same principle had been adopted as counters for rotary or reciprocating machines, and they appeared from the compactness of their form and their regularity of action to be well adapted for the purpose.

ACADEMY OF SCIENCES, PARIS.

Jan. 2.—The first business of the evening was the election of officers. M. Charles Dupin was elected President, and M. Elie de Beaumont, Vice-President.

M. Hombron, surgeon to the last expedition of M. Dumont-d'Urville, read a paper "*On the Topography of the Austral Frozen Region.*"

M. Morren communicated the results of some experiments on the variations in the composition of air dissolved in sea-water at different hours of the day and in different seasons of the year.

The next paper read was a communication from M. Collegno, "*On the Character of the Italian Alps.*"

Jan. 8.—A paper, by M. Francois, was read, "*On Lights for Lighthouses.*" That gentleman has succeeded in manufacturing lenses of much greater power than any before known; so powerful is their illuminating property, that from an experiment made at the Observatory at Paris, it was proved that a revolving lamp of four wicks gave a light equal to 140 Carcel lamps, while the oil used was only 700 grammes ($1\frac{1}{2}$ lb.)—a single Carcel lamp consuming 42 grammes. M. Arago observed, in respect to this invention, that an order had been received for their application in England.

Jan. 15.—M. Arago made a further communication respecting the comet discovered by M. Faye, from which it appears that it is a periodical, having a revolution of six years and 200 days.

Papers were read from M. Milne Edwards relative to the organization of various non-vertebrated animals of the coasts of the Channel; by M. Bonjean, on the effects of the ergot in rye; and by M. Robinet, on the formation of silk by the silk-worm.

Jan. 22.—On this day were announced the rewards awarded by the committee of the Academy as follows—to MM. Stromeyer and Dieffenbach, for having conceived and performed the operation of strabism upon dead bodies, and for having been first to practise it with success on the living subject, 6000fr.; to MM. Bourgeray and Jacob, for their work on anatomy, 5000fr.; to Dr. Thibert, for his specimens of artificial anatomy, 4000fr.; to Dr. Longet, for his work on anatomy, 3000fr.; and to Dr. Valleix, for his treatise on neuralgia, 2000fr.—M. Frémy read a paper on metallic acids.

M. Biot presented to the Academy his articles in the *Journal des Savans* "*On the History of Observative Astronomy relative to the Theory of the Moon.*" He observes, that the Arab treatise of Abul Wefa, said to contain the discovery of the variation, has not the slightest reference to it, and that the supposed passage is nearly a literal translation from Ptolemy, relative to the second element of the crection.

M. De Gasparin read a paper "*On the Flooding of the Rhone,*" which he considered not as attributable to clearing the wood from the mountains and the elevation of the bed of the river, which he recognised as secondary causes, but to a meteorological phenomenon, arising from the deposition of rain by the south and south-east winds. This evil, he avers, is irremediable, but he recommends all engineering measures of defence to be adopted.

M. Chevandier read a paper "*On the Cultivation of Forest Timber.*"

Jan. 29.—M. Chaussenot's Safety Valves were again brought before the Academy, being now adopted in several places.

M. Morin made some observations on steam engines, from experiments made with Watt's steam pressure indicator. He considered from the examination of the curves made by the indicator—1st. That notwithstanding the various modes of communicating motion to the distributive valves, the pressure which takes place in the cylinder during the admission of the steam, is sensibly constant, and that to obtain this constant pressure from the beginning of the piston stroke, it is sufficient to give a little advance to the admission of the steam. 2nd. That in well-proportioned engines, in which the orifices, tubes, &c. have a sectional area of about $\frac{1}{25}$th of the piston in low-pressure engines, and $\frac{1}{18}$th to $\frac{1}{20}$th or less in high-pressure engines worked expansively, the pressure in the cylinder differs a little from that in the boiler. 3rd. That it is essential by regulation of the slide valves, to give a certain advance to the emission of the steam, in order to diminish the resisting pressure from the beginning of the stroke.

A paper was read by M. Eugène Chevandier, on the elements of the composition of the various woods grown in France, and the annual average produce of hectare ($2\frac{1}{2}$ English acres) of forest land.

M. Raulin, vice-secretary of the Geological Society of France, read a paper on the opinion of M. Marcel de Serres, that native mercury is not to be found in more recent strata than the red granite, and that there does not exist in the Aveyron any native mercury analogous to that of Idria.

A communication was read from M. Duchartre, on an *exhausted volcano* near Beziers, on the *Rocque-Haute*. He states that the crater is perfectly distinct, and can only account for its not having been mentioned in any of the recent works of geology by supposing that the wood with which the plateau of *Rocque-Haute* is crowned has caused it to escape notice.

A communication was read from M. Micallet, a physician of Malta, on the surprising effects of the sesquiodine of mercury in ulcerations of the cornea, particularly with scrofulous patients.

A communication was read from M. d'Hombres Firmas, on the electrometer of M. Majocci, of Milan. The writer states, that with this instrument the nature of every kind of electrical current may be fully ascertained.

NOTES OF THE WEEK.

It will be seen that it is in contemplation to hold a meeting at the Horticultural Society's Room in Regent Street, on Saturday, 17th inst., to adopt some measures for rewarding the public services of the late Mr. Loudon, and for securing the unincumbered possession of his works to his family. Upon his services to architecture by the foundation and conduct of the Architectural Magazine, during a number of years, it is unnecessary for us to enlarge, nor upon his valuable contributions to architectural literature by the publications of the Encyclopædia of Architecture, Repton's Landscape Gardening, Suburban Gardener, and his numerous works relative to architecture and landscape gardening. For careful observation. conscientious and laborious compilation, and minute completeness, no works have exceeded those to which we have just referred, and we beg to urge most strongly such of our readers as have not the whole of his works, to take the present opportunity of purchasing such as they may require, as indispensable to the formation of a truly useful professional library, while they will at the same time have the pleasure of knowing that they have paid a tribute due to a zealous and badly remunerated labourer for the public weal, and contributed to the comfort and welfare of a lady, scarce less deserving on her own account than as Mr. Loudon's representative.

The imposing façade of the Palais Saint Pierre, on the Place des Terreaux, at Lyons, is about to receive additions in the shape of a pavilion at each wing, similar to those in the centre. Each pavilion will be united to that of the centre by the erection of four colossal statues on the capitals of the pilasters which adorn the façade. This work is at the expence of a private person, a citizen of Lyons, and will prove a munificent public gift. A statue of the Virgin, by M. Auguste Préault, is about to be placed in the Ursuline Convent at Nogent sur Seine.—The French have sent 200 convicts to Stora to construct a wharf and road, and to restore the ancient Roman aqueducts.—The hotel Lambert, in the Isle of St. Louis, at Paris, a monument in the Louis Quatorze style, has been restored at the expence of the Princess Czartoriska. The ceilings are by Lebrun and Lesueur.

The parish church of Klosternburg at Vienna, and several houses have been destroyed by lightning.

The painter Margenstern, son of the perspective painter of that name, died at Frankfort on the 21st ult., aged 66.—The Goethe monument, at Frankfort, by Schwanthaler, is to be erected on the place of the theatre. This sculptor has also completed a colossal statue in brass, of the Margrave Frederick of Bayreuth, who founded Erlangen University.

Barberi, the mosaicist at Rome, has executed for Viscount Middleton, a restoration of the celebrated Pompeian mosaic, supposed to be a battle of Alexander and Darius.

The king of Prussia has restored the castle of Stolzenfels, on the Rhine.

St. Paul's church, at Auckland, in New Zealand, is completed, and a small church is to be erected at Windsor.

The lightning conductors for the Royal Exchange have been arranged under the direction of Mr. C. Walker, the able secrerary of the London Electrical Society, and author of the continuation of Dr. Lardner's work on electricity.

The Exposition of Arts and Manufactures at Berlin, was opened on the 24th ult. It belongs to the Trade Union, a society established four and twenty years, reckoning 972 subscribers, and now largely endowed.

The Cologne and Bonn railway is completed. This opens the communication with Antwerp and Ostend.

The General Steam Navigation Company have offered to establish a daily communication between Brighton and Dieppe, if the authorities of Dieppe will go to a little expence in dredging the channel.

The works in Trafalgar Square are, with the exception of the Nelson monument, fast coming to a completion. The stone is all down, the concrete is commenced as well as the bitumen of the Bastenne Company, and when the weather will admit the completion of the concreting, the bitumen paving, which is to cover the whole area around the fountains, will be finished. This will be the largest space so covered in this country, and will form a new feature in our public, as well as private walks. It appears by the works proceeding during the late frost, that there is no fear of any injurious effect from this description of material being laid in winter as well as summer. We hope to be able very shortly to give a plan of the square, describing the terrace and fountains, and also showing how the different stones, bitumen and cement have been used.

The South Eastern Railway was opened on Tuesday throughout to Dover.

AGRICULTURAL CHEMISTRY.

A Course of ten Lectures by Professor Braude, F.R.S., *at the Royal Institution, delivered January 27th. (Specially reported for this Journal.)*

Lecture I.

The Professor commenced by observing that he entered upon this course of lectures with great diffidence and anxiety, and at the same time with a great deal of pleasure—he was aware that the subject of Agricultural Chemistry is one that is attracting a great share of attention, and that it is in the hands of eminent chemists and skilful practical agriculturists; he was also aware that a great deal has been held out as to what chemistry may do, and can do, and will do in this very important subject; upon this subject he would endeavour to bring before his hearers, in plain and intelligent language, the main subject which the agricultural chemist ought to attend to—in fact, the practical agriculturist; because he did not hesitate to say that every farmer—every practical agriculturist, ought to be acquainted with at least the principles of agricultural chemistry.

He entered upon the subject with pleasure, because he was appointed by Sir Humphrey Davy. many years ago, to deliver a course of lectures to the then existing board of agriculture, at the time that he retired from the office of Professor of Agricultural Chemistry to that body. He had still the notes and memoranda which Sir Humphrey gave him upon that occasion, and he looked back to them with much pleasure as containing the germs of almost everything that has been done in agricultural chemistry since that period. The business of the practical farmer is in fact very simple. It is, to raise from a given extent of land the largest quantity of the most valuable produce, and to do that in the most economical way, both as regards time and money, and further in such a manner as permanently to impoverish the soil as little as possible. It is his business to show what aids are derivable from chemistry in reference to the accomplishment of this highly important object. The subject of agricultural chemistry, if we consider it as bearing upon the improvement of land, in its practical, rather than its theoretical, bearing—has now of course become a matter of the greatest importance. Our population increases rapidly upon our territory, and unless means be found to increase the produce of the land, emigration or other difficulties must occur to a great extent; and he thought it was perfectly obvious that a great deal of cultivated land in this country may be brought into a higher state of cultivation, and that a great deal of uncultivated land may be brought into a state of practical cultivation. There is something very extraordinary—though being every day before our eyes, we do not regard it as such, in the growth of a seed.—If we take for instance a seed of turnip, or rape, or wheat, we find that in the course of a certain time, and under particular circumstances, it produces a plant or a tree. Nothing, for example, can be more remarkable than that in the course of a few weeks, a small seed becomes a perfect plant; nothing can be more astonishing, if we look at it in all its details, than that a small acorn in a few years grows into the stately and majestic oak. The question we have to examine into is, "How is all this to be effected?" and to this end it is obvious that we should consider the changes in the seed itself, which is a matter of great importance. We find when the seed is placed in a congenial soil, that it soon expands, and then the germ begins to grow, it puts forth a rootlet, and after a time it makes its way downwards, and the stem makes its way upwards. During these changes there are very curious chemical alterations going on in the constitution of the seed itself, to which he will hereafter call your attention. Here we find that as soon as the young plant has taken such nourishment as it could get from the seed, it becomes dependent upon the soil which contains the root, and upon the atmosphere to which the branches are exposed. From the soil there is a considerable quantity of matter taken, and the leaves also imbibe a considerable quantity from the air. These agents therefore we have to create.

1st. As to the soil—we have to consider it as the mechanical support of the plant, and in this respect the texture of the soil is a matter of importance. Then we find that it derives nourishment from the soil in three ways:—1st. we have to examine the *inorganic* constituents which the soil gives to the plant—and if we take the stem, or the leaves, or any other portion of a plant, it will be found that it contains a quantity of saline, or earthy, or other particles which we call inorganic matter, which it cannot take from the air, and which therefore it must take from the soil. 2nd. There is also a quantity of *organic matter* taken up from the soil—and 3rd. It will be found to be undergoing changes through the influence of the air affecting both itself and the atmosphere.

These are some of the principles to which the learned Professor observed that he should have to revert in reference to the soil.—Next, in reference to the state of the air. Having determined what are the elements of the plant, and which it cannot get from the soil, we must search the air, and having ascertained its constituents, ascertain how far they contribute to the growth of the plant. It is extraordinary, but nevertheless true with regard to plants, that the nourishment they derive from the soil is very insignificant compared with what it obtains from the air. Take an oak for instance, in the course of a certain number of years it will contain perhaps several tons of wood. Now it is quite clear that the oak must have derived this either from the soil or the atmosphere. Has it impoverished the soil?—taken anything from it?—Certainly not; on the contrary, we find that the soil so far from having imparted organic substances, has in fact gained them, and there is an increase of the organic matter in the soil, arising from the shedding of the leaves, or the accidental fall of a branch, &c.—It is obvious then that this great acquisition of matter must have come from the atmosphere.—The atmosphere is a continual source of food to the plant; and as the plant cannot go about like an animal to search for its food, the atmosphere is continually wafting about the plant, and no sooner is the nourishment abstracted from one portion of atmosphere, than a fresh portion brings fresh nourishment which the plant greedily devours,

Without the soil it is true the plant could not get those inorganic constituents to which he has referred. If, for instance, we find in a plant lime, a phosphoric acid, it is clear they must come from the soil; but the carbon, hydrogen, and oxygen come from the atmosphere—not entirely, but principally—and in such quantities as not only enable the tree to grow, but, as he said before, by the shedding of the leaves, &c. to enrich the soil: and we do find actually that by the growth of trees the soil is considerably enriched, as far as organic matter is involved.

Having then examined how far the soil and the air are concerned in these matters, we are next to look at what will be brought before you as the ultimate and proximate elements of a vegetable. By ultimate elements, we mean those actual elementary substances which cannot be decomposed: by proximate elements, their secondary arrangements and results—sugar, starch, gum, &c., and the approximate elements of a vegetable.

Then there is another subject I must bring before you, viz., "What are the functions of the different class of plants?" And lastly, how far mechanical and chemical expedients may be resorted to, to render barren soils fertile, and fertile soils continuously so. We shall find that the roots and the leaves of plants affect peculiar functions—that the roots take up certain matters from the soil, and that the leaves and all the green parts of the plant are energetically employed in taking up an immense quantity of nourishment from the atmosphere, We are all aware of the beautiful provision by which the vegetable is made to take up, as it were, the refuse of animals. We may say that we are deteriorating the air as far as we ourselves are concerned, but we are impuring it for the growth of plants. We are like organs engaged in infusing into the air what is proper for plants, which they take up, thereby again rendering the atmosphere fit for our use.

Under the head of the mechanical and chemical expedients to be resorted to for rendering barren soils fertile, and fertile soils continuously, so we shall of course come to a number of facts connected with the influence of manures and the different operations of tillage. Looking at soils, in the first place they must of course originate in the action of the air, water, heat and light, or of those agents commonly designated under the term of "the weather" upon the earth; and as the different rocks or strata which form the crust of the earth, are some exposed in one place and some in another, giving thereby a different constitution to the soil, we see the important bearing of geological science upon agriculture.

Originally the surface of the earth consisted entirely of hard rocks, which by the influence of moisture and other agents, have gradually become disintegrated and fitted for the growth of plants. It is obvious. therefore, that the nature of the soil must greatly depend upon the character of the rock upon which the soil rests—though not always so. in consequence of the soil from one rock being sometimes carried to a rock of a different description. In examining a geological map we find immense tracts of chalk, red sandstone, limestone, clay, coal, and so on. all of which give rise to different soils; and it is important to consider this branch of the subject, for it explains to us how one system of amelioration which answers in one place, does not succeed in another.

The different strata give rise to what are usually called the different rocks, the term "rock" being usually applied in agriculture to the base on which the sub-soil immediately lies. The sub-soil is the matter supposed to be derived directly from the disintegration of the rock itself: then upon the top of the sub-soil comes the superficial soil, which in its mineral contents will agree with the rock and the subsoil, but which is nevertheless greatly different, in consequence of the animal matter which falls upon it, and the long exposure to the air, moisture, heat and light.

"I propose," says Mr. Brande, "1st. to lay before you a short account of the inorganic constituents of the soil, and endeavour to show how the preponderance of one or other of these constituents gives a different character to the soil—in other words, what is meant by a sandy soil, a clayey soil, a marly soil, a chalky soil, &c. And in reference to these matters, I shall endeavour to limit myself to such an account as presses immediately upon agriculture."

There are four substances usually called earthy bodies which are met with more or less in all fertile soils, and it is highly essential that an agriculturist should be acquainted with their particular characters and peculiarities. They are silica, or siliceous earth; alumina, or aluminous earth; lime, or calcareous earth; and magnesia; all of which are resolved by the chemist in their purest state to the form of a white powder. Chemically speaking, these substances are all metallic oxydes, and not as was formerly supposed, simple bodies. With regard to silica, that very important and abundant ingredient in almost every soil, it has this curious constitution, that it is composed of equal weights of a metallic body and oxygen.

He would have his hearers particularly to bear in mind the following proportions of the four earthy bodies which he had just referred to—all of them consisting of a metal and oxygen, viz.:—

8 parts of oxygen combine with 8 parts of the metal silicium, to form 16 parts of oxyde of silicium, or silica.

8 parts of oxygen combine with 9 of the metal aluminum, to form 17 parts of oxyde of aluminum, or alumina.

8 parts of oxygen combine with 20 of the metal calcium, to form 28 parts of lime.

And 8 parts of oxygen combine with 12 of the metal magnesium, to form 20 parts of magnesia.

The Professor then observed that he would pass through as quickly as he could an outline of the properties of these bodies. To commence with silica Silica exists in nature in a great variety of forms, absolutely, or very nearly pure. We find it in rock crystal quite pure, very nearly so in flint, which contains in addition some slight colouring matter, which we do not perfectly understand, and perhaps about 1 per cent. of foreign matter. If you heat flint, or rock crystal to a red heat, and then plunge it in water, it immediately becomes opaque, and can then be readily rubbed down to a fine powder. Another very abundant source of silica is to be found in the white pebbles which are so often met with in the beds of streams. And we also find a considerable quantity of silica in the form of sand, of which we cannot take a better specimen than the white sand from the western extremity of the Isle of Wight, or from Lynn, in Norfolk. It is a curious fact with regard to sand, if we examine it microscopically, we find it to consist partly of minute crystals, and partly of small rounded particles, so that a part may be regarded as the crystals of flints, and part as small pebbles. It would appear that crystallized sand arises from decomposed granite—granite consisting of three substances, quartz which is afterwards sand, felspar, and mica.

The extraordinary property which strikes us as being very important with regard to silica, is its utter insolubility in water and almost everything else. You may keep even the finest sand you can obtain in water for any length of time, and yet not the smallest portion will be dissolved. Silica, however, does find its way into plants, and into some in considerable quantities—in common straw, for instance, corn, and any grass, we find a great quantity of this insoluble substance; and it becomes a curious question to ascertain how silica is rendered soluble and finds its way into plants. Silica is indeed of the utmost importance to the texture of plants—if we take a stalk of wheat we shall find that it is silica which gives it firmness, enables it to bear the ear in due season, and imparts to it all those properties which belong to the more perfect and better kinds of straw. But though silica is insoluble in water, it is readily soluble in potass, soda, lime, and other alkalis. In some strata we observe silica presented to the roots of plants in a soluble form; but if we dissolve silica in an alkali, and then throw it down again, we find that in some cases it may be thrown down perfectly insoluble and sometimes quite soluble. Sometimes it is taken up in a soluble form and sometimes retained in an insoluble form. No doubt the silica in this wisp of straw *has been* soluble, *now* it is perfectly insoluble in water. Glass is a compound of silica and soda, yet glass is insoluble in water, for we know that it is employed as a vessel for holding water. This arises from the mechanical texture of the glass; for if we rub glass to a fine powder, we find that it does become soluble in water. This application of silica to the soil becomes a very important question; because there is no doubt that certain crops fail, not for the want of silica, because there shall be plenty, but for the want of it in a soluble state. Now some agriculturists actually mix pounded glass, or another substance, which I will show you presently, with their manure, and employ it with great success. If, instead of common glass, they take another compound of silica, viz., glass with more soda, they have a substance which readily dissolves in water. The Lecturer here exhibited a solution—called by the ancients "liquor of flints," and then proceeded to observe, "I can at pleasure separate the silica from it in a particularly soluble, or in a particularly insoluble state." He then proceeded with the following experiment. In a glass containing the "liquor of flints" he added a large quantity of water: and in another glass he had some of the liquor in a more concentrated state. To each of these solutions, he added a little of almost any acid; in the strong solution silica was thrown down in the form of a jelly, and by adding more water he showed that it would not re-dissolve the silica. In the weaker solution no such result was obtained, although he added as much acid as to the other, yet it remained perfectly clear. "In the first state," said Mr. Brande, "I need hardly tell you silica would be perfectly inert in the growth of plants—in the other state it would be readily taken up. We find also, though common glass in its usual state does not appear to be acted upon by the air and water, that it does yield, when acted upon by those agents for a long time. Pieces of glass are often met with in a field of all kinds of colours, and so soft, that they will give way to the nail.

There is another curious agent, which has the power of acting upon silica, and of carrying it at once away, and when he comes to analyze soils, he must show this substance—it is fluoric acid. Now it would appear that we have to consider silica first as a mere mechanical ingredient of the soil—that is, giving to the soil a certain looseness of texture possessed by all sandy soils: and then, also, with reference to the component parts of the crops growing upon the soil.

Another substance to which he adverted, is the argillaceous earth or alumina. It is an ingredient in all fertile soils, and from it they derive some very important properties. In the first place, all clays contain alumina: and he need not advert to the importance of clay in soils, and to the functions which alumina performs in them. It is a very hydrometic substance, that is, it has a great attraction for water, which it absorbs and retains in great quantities. It is the only substance which gives plasticity when mixed with other bodies; and whenever we have a plastic substance, then we have alumina.

Alumina is a most useful ingredient in the soil, provided that it does not exist in excessive quantities; if there be too much of it, it forms that stiff, clayey, unmanageable soil, of which there is so much in England. I must take you to it in its pure state, and we get it out of alum. If we dissolve a quantity of alum in water and add an alkali, we shall throw down alumina in a pure state, or very nearly so.

If we only take 10 or 12 per cent. of alumina, and mix it with silica, we shall find that it will give to it the plastic nature of clay. Indeed, a very small portion of alumina gives plasticity and adhesiveness and other important properties, especially as relates to moisture, in any soil. Like silica, it also forms a component part of the growing crop. Some vegetables cannot grow without alumina; none, perhaps, can grow well without it in the soil: some few actually require it as food. There are certain vines which cannot be cultivated without alumina; in those vines we find alumina composing a certain part of the plant—nay, we find it even in the grape—and even in the wine. The Rhenish wines contain a considerable quantity of alumina; and it is a curious fact, that a quantity of wine was actually stopped at the Custom House some time ago, which it was thought had been adulterated with alum, when, in fact, it contained no more alumina than it had taken up from the soil. Alumina at once differs from silica, in that it is equally soluble in acid and alkali. Another character of alumina is, that it combines with sulphuric acid and potass, and crystallizes very readily; but we have to deal with alumina only in reference to the soil and its agricultural purposes.

AGRICULTURAL CHEMISTRY.

By Professor Brande, F.R.S., &c.

Lecture II.—February 3, 1844.

(Specially reported for this Journal.)

The next most important constituent of the soil is lime. Now lime is found in nature in various states of combinatinn, but principally either as carbonate, phosphate, or sulphate. As carbonate it exists in most fertile soils. It is added, also, largely to fields as a fertilizing agent. But for this purpose it is not used in combination, but in a free state, as caustic or quick lime, in which condition it is obtained by exposing limestone rocks, which are carbonate of lime, to a strong heat in properly constructed kilns; this drives off its carbonic acid, and reduces it to the state of pure lime. If chalk, for instance, is heated, water first escapes, then carbonic acid, and the heat should be continued till it ceases to lose weight. As the limestones are not all pure, but are mixed with other ingredients, so the resulting lime is of different qualities, and receives various names, such as hydraulic lime, fat lime, and meagre lime, each being adapted for some particular object, some being used largely in mortars and cements. In lime-burning there are several circumstances that must be attended to, or success will not be obtained; one is, that the proper degree of heat be maintained, another, that a good current of air be kept up. It has been found, by the experiments of Sir James Hall and others, that when carbonates of lime are heated to the most intense heat in closed vessels, only a part of the carbonic acid escapes; indeed, they have shown, that if heated under pressure, none of the gas escapes from it, but that it is converted into a semi-crystalline mass resembling marble; in fact, it is supposed that in this manner marble has been formed in nature, by the intense heat of streams of volcanic lava acting on the chalk whilst imbedded beneath other strata, the pressure not allowing the gas to escape, and during its slow cooling assuming a crystalline arrangement. Hence we see the importance of constructing the kiln so as to allow a good current of air to carry off the carbonic acid as fast as liberated; which is also assisted by the steam produced from the moisture in the chalk. Now the change of quality produced by this burning, was by the old chemists, and is even by many of the unscientific agriculturists of the present day, attributed to something that it abstracts from the fire, and hence, say they, its caustic quality. But Dr. Black showed, long ago, that such was not the case. He found that when 50 lb. of pure chalk were converted into lime, it only weighed 28 lb., hence 22 lb. had passed off as an invisible gas, which by further experiments was proved to be carbonic acid, and the remaining 28 lb. of lime has been shown by Sir H. Davy, to consist of 20 lb. of a metal which he named calcium, together with 8 lb. of oxygen gas, forming oxide of calcium, or lime. Hence the composition of pure carbonate of lime may be represented thus:—

$$50 \text{ carbonate of lime}\begin{cases}\text{carbonic acid}\begin{cases}\text{carbon} \ldots & 6\\ 2\ \text{oxygen} & 16\end{cases}\\ \text{lime} \ \ldots \ \ldots \begin{cases}\text{calcium} \ . & 20\\ \text{oxygen} \ldots & 8\end{cases}\end{cases}$$

$$\overline{\quad 50 \quad}$$

When lime is exposed to the air it crumbles down into a fine powder, and if then examined it will be found to have combined with water from the air and become what is termed slaked. The same effect may be produced by pouring water on to lime. By taking a portion of fresh lime and pouring water on it, it will be observed to swell considerably, and to become very hot, sufficiently so even to char wood and to fire gunpowder, at the same time falling into a dry powder, which weighs much more than it did originally, every 28 lb. of lime having combined with 9 lb. of water, forming 37 lb. of hydrate of lime or slaked lime. If left longer exposed, it is found then to combine with the carbonic acid always present in the air, parting again with the water, and returning to the state from which it set out, of carbonate of lime.

There are other methods of getting the carbonic acid from a carbonate than by heat. If to 1,000 grains of chalk, an acid be added which has a stronger attraction for the lime, the carbonic acid will be set free, and may be collected as gas in a glass vessel inverted over water. This is the ordinary method of obtaining carbonic acid for experiment. But the lime in this case is not obtained pure, as it combines with the acid employed. Then if an equal weight of chalk be heated so as to drive off, in that manner, all its carbonic acid, and then placed in the glass vessel full of gas, it will be found that after a time the water will rise in the glass, showing that the lime is absorbing the gas, and again becoming carbonate.

Lime is soluble in water, and although it requires 800 times its weight of water to dissolve it, the solution will exhibit most of the properties of lime. It strongly reddens turmeric test paper, showing that it is alkaline: it absorbs carbonic acid from the air, the surface becoming covered with a crust of chalk: added in excess to rain or river water, it produces a cloudiness, proving that they contain carbonic acid; but if the water containing the carbonic acid is in excess, the carbonate first formed is redissolved, on account of the formation of the very soluble bi-carbonate of lime. To this latter property is owing a beautiful appearance frequently met with in limestone districts; the rain, falling on the surface, becomes impregnated with carbonic acid from the soil, and then filtering through some crevice in the limestone, renders some of it soluble; it then, perhaps, finds an outlet at the roof of a cavern, and here, being exposed to the air, parts with the extra quantity of carbonic acid, depositing the insoluble carbonate of lime, which first encrusts the roof, then by constant dripping, forms a series of beautiful crystalline icicles termed stactalites, the remainder falling on the floor, forms large stony masses termed stalagmites.

The consideration of these properties of quick lime will explain its utility when added to the soil. Its first action when strewn on the field, is to absorb moisture, to swell considerably, thereby loosening the texture of the soil—then, when acted on by rain, to form a solution which is destructive to animal life, killing all grubs and worms—when brought in contact with organic matter, to decompose it, which may be illustrated by mixing sawdust, lime and water into a paste, when it becomes dark brown, evolving carbonic acid—to decompose salts of alumina and iron which might be pernicious to the young plant—and, ultimately, by uniting with carbonic acid, to diffuse carbonate of lime through the soil in a finer state of division than it can be obtained in by other processes. One of the uses of lime which has till lately been overlooked, because taking place more slowly, is the property it has of disintegrating several kinds of rock, such as felspar, clay slate, and mica slate, setting free their alkali, which is highly necessary for vegetation. This accounts for the power attributed to lime, by many agriculturists, of awakening the dormant energies of some soils, bringing them, in the course of four or five years, into excellent condition.

The tests for lime are few and simple. In limestones, the application of an acid causes effervescence, as it generally exists in the state of carbonate. In river water, such, for instance, as the Thames, it exists as carbonate, and on boiling, is deposited, as is evident by the fur which accumulates in kettles. In spring water, so that it is not too near the chalk, in our blue clay, for instance, it is found as sulphate. Oxalate of ammonia is a very delicate test for the presence of lime in solution, causing turbidness even when a very minute portion is present. Ammonia causes no precipitate in solutions of lime, and is therefore useful, in analysing soils, in order to remove first those substances which *are* precipitated by it, and then the addition of carbonate of ammonia will throw down the lime.

A fourth ingredient of the soil is magnesia, which though not in so great quantity as the former, is still important This is found as carbonate in some limestones, which are then termed dolomites, or magnesian limestones. They are very excellent for building purposes, being very strong and durable, and were highly recommended by the Commission appointed to select stones for the Houses of Parliament. A curious point in their history relates to their use as manure, in Yorkshire, where they abound. It was found that when burnt for lime, they killed the young plant. Now this is owing to the fact that the carbonate of magnesia, when burnt, is reduced to the caustic state, or pure magnesia, similar to the lime; also, where strewn on the soil, it absorbs carbonic acid, but so much more slowly than the lime, that when the young plant shoots up, it still retains its causticity, and destroys it. This difficulty is, by careful management, got over, and it is now much used. Magnesia is found as pure carbonate in some parts of Asia and America. It is also a constituent of the serpentine rocks of Cornwall, and forms a large part of steatite, augite, hornblende, and meerschaum. Many of these are characterised by a peculiar greasy feel, hence steatite is well known by the name of soap stone. It is also abundant in sea water; when the salt has been crystallized from it, it imparts a very bitter taste to the residue, which, on that account, is termed bittern. From this it is separated in large quantities and used in medicine as Epsom salts, or sulphate of magnesia. Pure magnesia is almost tasteless, but possesses a slight reddening power on test paper; it is therefore an alkaline earth From solutions of magnesian salts, carbonate of potash throws down the insoluble carbonate of magnesia, which bears the same relation to pure magnesia that chalk does to lime. Carbonate of ammonia does not produce any precipitate, which may therefore be used to separate lime from magnesia; but if to the mixture phosphoric acid be added, a precipitate is slowly deposited, which is therefore a very characteristic test for magnesia.

To these four earths, which are all metallic oxides, may be added, as a common ingredient of the soil, oxide of iron. There are two oxides of iron, the red, which is insoluble and consequently harmless, and the black, which is very noxious. Both of these frequently impart colour to soils. The one is commonly known as rust of iron, the other, as slag. Dissolved in acids, and lime or ammonia added, the respective oxides are precipitated combined with water, as hydrates. But the lower or black oxide has always a strong tendency to pass into the higher state of oxidation, even by exposure to air. This may often be seen in ferruginous springs, which at their source are quite clear, but as they flow along, the protoxide of iron is converted into the peroxide, and is deposited on the banks as an insoluble red powder. The best tests whereby to recognise iron are striking and delicate. One of the best is a solution of any astringent matter, green tea for instance, but a solution of galls is best, which changes it to a dark purple, forming, indeed, ink. It is on this account that spring water, which frequently contains iron, spoils tea. Prussiate of potash, also, may be used, which gives a dark blue, which is Prussian blue.

These are the principal constituents of the soil. But there are other substances also present, which, though only in minute quantity, and once overlooked as unimportant, are now considered to be of vital consequence to plants, and which will be considered in the next lecture.

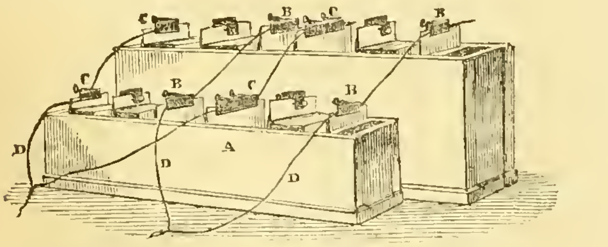
ELECTRO-METALLURGY.

The importance of the recent discoveries in electro-magnetism, have in no instance been more completely shown, than in their applications to metallic productions. The application of electro-magnetic power for plating, emanates from Mr. Spencer, of Liverpool, who was so shamefully used by the British Association. The Messrs. Elkington had, however, long before taken out patents for plating, although on other grounds. They subsequently made experiments with regard to the use of electro-magnetism in gilding and silvering, and the result has been several valuable processes of manufacture. From a very interesting little work, published by Messrs. Elkington, we extract the following descriptions:—

Galvanic Battery.—In speaking of the discovery of this Art, we have been led to describe what a Galvanic Battery is. Many different arrangements of battery have been suggested, all more or less valuable, according to the particular object for which the arrangement is required, but we do not think it important to notice them.

In Electro-Metallurgy there are two distinct states (if such an expression may be allowed) of galvanism or electricity, viz., electricity in its condition of *quantity*, and *intensity*, and as it will be necessary to quote these terms, we shall endeavour to explain them.

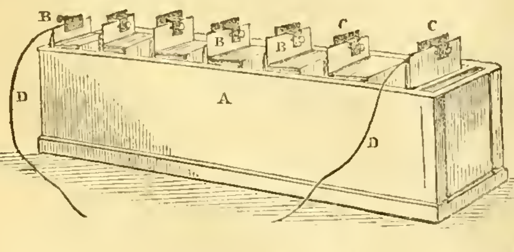
The *quantity* of electricity generated in a battery, is in proportion to the surface of zinc exposed to the exciting fluid, whether such consist of one or more pairs of plates; but if more than one pair be used, then the zinc of the first pair must be connected with the zinc of the second pair, and the copper with the copper; and thus the quantity may be increased as the numbers of pairs are augmented.



A, Battery Trough. B, Zinc Plates. C, Copper Plates. D, Connecting Wires.

Intensity is necessary when, from the nature of the solutions, or from any other cause, there is a resistance to be overcome; the electricity requiring *intensity* or power to force its way through, but the amount of metal deposited, depends wholly upon the *quantity* of the battery, and not upon the *intensity*.

Intensity is produced by arranging two or more pairs of plates, by connecting the zinc of the one pair with the *copper* of the next pair, and so on to any number of pairs—any number thus connected, forming a battery equal in *quantity* to one pair of plates only.



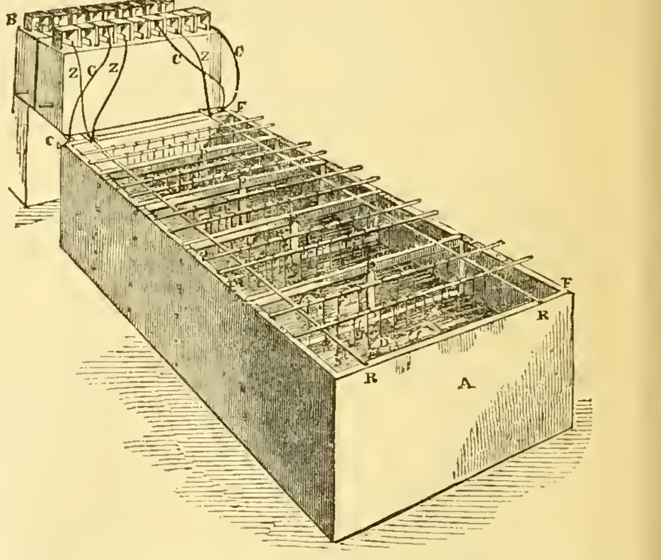
A, Battery Trough. B, Copper Plates. C, Zinc Plates. D, Connecting Wires,

With this knowledge a battery of several pairs of plates may be arranged so as to produce both the *quantity* and *intensity* required.

Metallic Salts.—All ordinary metals have the power of combining with other substances, forming compounds, capable of being dissolved, and held in solution by acids and certain alkalies; thus, for example:—When pure silver is put into pure nitric acid and heated, the metal is rapidly dissolved, forming the nitrate of the oxide of silver, or, as commonly designated, the nitrate of silver, and this may be held in solution in water. In forming a metallic salt for the purpose of electro-deposition, one general rule holds good in all cases, and may be considered a law (and if this law is attended to, no difficulty whatever *can* exist in electro-depositing); and this is, that the metal dissolved in acid or other solvent must have a *greater* affinity for such solvent, than the metallic article to be coated with the metal thus held in solution—for this simple reason, that if the article to be coated has a *greater* affinity for the solvent than the metal held in solution, a chemical substitution (preceding the galvanic action) takes place; the acid in preference combining with the metal, for which it has the greatest affinity, forming an oxide upon its surface, which oxide intervenes between the article and the metal deposited upon it. Such failures therefore as have taken place in electro-depositing have not been the result of any defect in the principle, but from want of knowledge in the operator, and principally from ignorance of the law just stated. For this reason the nitrate of silver cannot be used; the nitric acid having a stronger affinity for most *other* metals than for silver; another and better solvent therefore must be obtained, and this will be spoken of under the metal, silver.

Operation.—In proceeding to plate metals, it is necessary that the battery should be so arranged, that the *quantity* of electricity generated, should correspond with the surface of the articles to be coated, and the *intensity* should bear reference to the state of the solutions; that is, that the *quantity* should be sufficient to give the required coating of metal in a given time, and the *intensity* such as to drive the electricity through the solution to the articles. It is also essential that the plates of metal forming the positive pole in the solution, should be of corresponding surface to the articles to be coated, and face them on both sides.

Having procured the metallic salt best adapted for the purpose, the same is placed in an appropriate vessel, the articles to be coated are then suspended in the solution from wires attached to metallic rods, which cross the vessel at intervals, and which are connected with the zinc or negative terminal of the galvanic battery by means of long rods, placed longitudinally upon the vessel; plates of the same metal as that held in the solution are then placed therein upon either side of the articles; and connected with the positive or copper terminal of the same battery, by means of a slip of copper, fixed upon the edge of the vessel.



A, Vat or vessel containing the solution. B, Battery with Zinc pole Z, connected with rods RR; and Copper pole C, connected with the metallic sheets PP, in the solution; by means of the Copper slip F; DD, are articles suspended in the solution by wires from the rods RR; S, the solution.

The particular arrangement of battery shown in the above sketch we find the most useful in practice. The coppers being continued above the zincs instead of below, prevents their being affected by the mercury, which amalgamates the zinc. The plates also resting upon a shelf a few inches above the bottom of the trough, are always in contact with the least saturated portion of the exciting fluid, the sulphate of zinc formed, being specifically heavier, falls to the bottom.

So soon as the articles, which are connected with the negative pole of the battery, and the metallic sheets with the positive, are both immersed in the solution, the galvanic circuit is completed. The metal held in solution and the solvent combined originally from being in different electrical states, the metal being positive, and the solvent negative. When the galvanic circuit is completed, the solution becomes a part of that circuit: the electricity then passing through the solution decomposes it, the positive element—the metal going to the negative pole, which is the article ; and the negative element—the solvent—passing to the positive pole, which is the plate of metal suspended in the solution, with which it combines. So that for every atom of metal attracted to the negative pole, a corresponding atom is dissolved from the positive, and the solution is maintained in the same state.

In proceeding to plate an article by the electro-process, great care should be taken that it is free from all grease and oxide ; for this purpose the first operation is to boil it in a solution of caustic alkali, by which any grease is saponified; it is then scoured with sand and water, after which it is dipped into dilute acid, which removes any oxide that may be on the surface; after rincing in water, it may be placed in the solution. It is sometimes well, before placing the article in the solution, to dip it into a dilute solution of the nitrate or cyanide of mercury, and this may be found necessary when the metal to be operated upon has an affinity for the solvent of the solution used.

It is generally believed that metals deposited by electricity are necessarily *soft*, because pure, but this is not a consequent: from experiments we have frequently made, it appears that the hardness of the deposited metal varies with the intensity of the battery; a battery of three or four pairs intensity producing silver sufficiently hard to scratch ordinary sheet silver, whilst sheet silver will not scratch it. When the intensity of twelve or fourteen pairs of plates is used, the hardness is so great that burnishing with a steel tool fails in producing a polish upon it.

Metals deposited.—The following metals have been deposited by Messrs Elkington by the electro-process—gold, platinum, silver, copper, zinc, antimony, arsenic, bismuth, nickel, cobalt, palladium, titanium, cadmium, lead, and tin ; those which are principally adapted to manufacturing purposes are gold, silver, copper, and zinc : and upon these we shall make a few remarks, pointing out the peculiar adaptation of the electro-process to their use.

Gold.—Cyanide of potassium is the salt we prefer for dissolving this metal for electro-depositing, it is obtained by fusing eight parts of dry ferro-cyanide of potassium with three parts of carbonate of potash. The gilding solution may be prepared by placing sheets of gold in a solution of pure cyanide of potassium, and attaching to the negative pole of a galvanic battery a small plate of gold, and to the positive a much larger plate ; when but a small quantity of solution is required, this method answers very well, and makes a pure solution ; but when a large quantity is wanted, time will be saved by dissolving gold in nitro-muriatic acid, and precipitating it by magnesia, the oxide thus obtained being again dissolved in cyanide of potassium and water. This solution should be used at a temperature of 130 deg., the arrangement of the battery and articles being the same as already described.

Silver.—The salt of silver, best suited for electro-depositing, is also the cyanide.

Silver being allowed to remain in a solution of cyanide of potassium, is dissolved, or take the nitrate of silver, to which add a solution of cyanide of potassium, the silver combines with the cyanogen, and precipitates as a white powder ; the liquid is then decanted, and the precipitate well washed with pure water ; to this more cyanide of potassium is added, which dissolves the precipitate, forming the double salt of cyanide of potassium and silver ; this constitutes the plating solution.

The same general arrangement is to be observed for plating with silver as already described, the *quantity* of battery power, being in proportion to the surface of the articles to be plated, and the *intensity* agreeing with the density of the solution. In a few seconds after the articles are placed in the solution and connected with the battery, they are covered with silver, and are allowed to remain therein until the necessary coating is obtained, and this is effected in from four to six hours. In order to ascertain correctly that the required quantity of silver has been received, every article is weighed previously to being placed in the solution, and again after the process is completed, and the weight entered in a book against each. After the plating is finished, the articles are taken to a lathe, and brushed with brass brushes, when they are ready for burnishing. this process consists in rubbing the surface with great force, with a highly polished steel or blood-stone tool, until it is as bright as a mirror. This is a severe test for any plated article, by whatever process made, and if a most perfect cohesion did not exist, it would at once be detected in the burnishing.

Copper.—It was, as we have already noticed, the deposition of this metal from its sulphate, which suggested to Spencer, in England, and to Jacobi, in Russia, the application of the electric current to the multiplication of works of art.

For all purposes of solid deposit, for electrotyping, &c., the solution of the sulphate is found to answer best, and is the cheapest ; the method of operating with it is now generally well understood. A considerable improvement, however, may be made in this solution, (when used for the purpose of covering metals) by the addition of caustic potash or soda, which should be added by small quantities until the precipitate formed by it, is no longer re-dissolved by the solution. The ordinary sulphate of copper contains one atom of acid for one of copper, so that, in decomposing by the electric current one atom of this salt, we have *one* atom of copper only deposited ; but by the addition of caustic alkali, a part of the acid is taken up by the alkali, leaving *two* or *three* atoms of copper combined with the remaining acid, forming a different salt of copper. This we find superior to the ordinary sulphate, and in practice effects a saving of battery power, besides the deposit being obtained in a shorter time.

The arrangement of battery best adapted for solid deposits of copper is the single cell. A plate of amalgamated zinc is put into a vessel of unglazed earthenware, or any other porous substance, containing dilute acid, and placed in the copper solution, the articles to be coppered are attached to the zinc plate. In this arrangement crystals of sulphate of copper should be suspended in the solution, to compensate for the metal deposited : but when the neutralized solution above described is employed, it is necessary now and then to add caustic alkali to maintain the proper qualities of this salt.

But the simplest of all single cell arrangements, and which we find the best in practice, is to wrap the amalgamated zinc in a double sheet of ordinary brown paper, tied round with string, the joints being cemented with glue; care should be taken in this, as well as in every other single cell arrangement, that the surface of zinc be equal to the surface of the article or articles to be coated ; the better plan being to suspend before each article a corresponding surface of zinc.

From the qualities and cheapness of copper and its salts, it is generally used for all purposes of electrotyping and solid deposition ; and it may also be used as a coating for the protection of iron from rust, besides rendering it highly ornamental.

The alkaline salt of copper best suited to the coating of iron, is the double salt of cyanide of potassium and copper ; it is thus prepared :—Take pure dry crystals of sulphate of copper, dissolve them in water and precipitate with the ferro-cyanide of potassium, wash the precipitate and dissolve it in cyanide of potassium and water. After the iron has been properly cleaned, which is effected by allowing it to remain for a short period in dilute sulphuric acid heated, it is placed in the cyanide solution, heated to about 120 deg., and connected with the battery ; in from two to five minutes it will be found completely coated ; the iron should then be scoured with sand, and placed in the sulphate solution ; if any portion should have been imperfectly coated in the alkaline solution, it will immediately turn black in this, in which case it should be cleaned and returned to the alkaline solution for one or two minutes.

By this process every article of iron work, either cast or wrought, may be firmly coated with copper, and afterwards bronzed, the articles retaining all the strength of the iron, with the beauty and indestructible qualities of the copper ; and with the aid of our patents for the production of works of art before described, copies of the beautiful marbles and bronzes of the antique may be successfully produced.

Zinc.—All metals, in ordinary circumstances, possess a certain definite galvanic character, and when any two are together exposed to an exciting fluid, there is immediately generated a galvanic action ; the electro-positive metal is gradually destroyed, whilst the negative is protected by the action which destroys the positive. Thus zinc and copper placed in connexion, in an exciting fluid, form a galvanic battery ; the positive metal, zinc, being destroyed, and the negative, copper, protected. The effect of this action may be noticed upon iron railings which have been connected with the stone work of buildings by lead, a metal *negative* to iron ; after long exposure they will be found much more wasted upon the parts touching, or adjacent to the lead, than in any other ; this arises wholly from the galvanic action induced by the two metals in contact, and at the expense of the more positive. Zinc is galvanically *positive* to all ordinary metals, and, from this property, protects them when in contact with them ; whilst the zinc wastes away, but very slowly ; because " When exposed to air or placed in water, its surface becomes covered with a grey film of suboxide, which does not increase ; and this film is better calculated to resist the mechanical and chemical effects of other bodies than the metal itself." Thus, while zinc has the property of protecting other metals by its electro-positive state towards them, its own decay is prevented by its oxide, which exists only as a thin film, is insoluble in water, and is not easily removed. These properties of zinc have long been known ; but have not until now been practically taken advantage of for two reasons :—1st. The impossibility of procuring *pure* zinc, except at a cost so great as to prevent its use. And, 2ndly. The impossibility of applying pure zinc in a melted state to iron. Impure zinc is of *little* or no value as a protection to other metals, because the impurities it contains being all electro-negative to it, are by their galvanic action operating to its destruction ; and there is no method of procuring the metal pure, but by distillation or deposition. But supposing pure zinc to be obtained, the difficulty is still to be overcome, of applying it, except by deposition.

The best and cheapest solution of zinc is the sulphate, which may be safely used to coat articles of iron, the zinc having the greatest affinity for the solvent of the solution. One pound of dry crystallized sulphate of zinc, to one gallon of water, forms a very good solution; very little intensity of battery is necessary, indeed, if the *quantity* be well balanced with the surface of the articles in the solution, and the electricity has not too far to travel, *no* intensity is required. The electro process therefore offers a cheap and effectual mode of protecting iron from oxidation, by coating it with pure zinc.

Metallic Cloth is another adaptation of this art, for which article we have recently obtained patents, and which is valuable from its properties of resisting the effects of the atmosphere, as well as being water and fire proof, besides being so light that a surface of nine square feet may be made to weigh only 18 ounces. The mode of manufacturing is as follows:—On a surface of copper, attach very evenly stout linen, cotton, or woollen cloth, and connect it with the negative pole of a galvanic battery, immerse it in a solution of copper or other metal, connecting a piece of the same metal as that in solution, with the positive pole: decomposition takes place, and endeavouring to reach the copper plate, the metal insinuates itself into all the pores of the cloth, forming a perfect metallic sheet.

IMPROVEMENTS IN THE MANUFACTURE OF IRON.

Patented by Thomas W. Booker, Esq., of Melin Griffith, near Cardiff. (From the *Transactions of the Society of Arts.*)

The method usually, now and heretofore, adopted in the manufacture of bar iron (where the dangerous, and, as the author thinks, reprehensible practice of puddling the crude or raw pig iron, without the intervention of the refining process, is not adopted), is as follows:—The pig iron is thrown up on what is called the milling finery, or run into the finery in a fluid state, from the smelting or blast furnace, and after undergoing the process of refining, it is run out into cakes or moulds, and suffered to get cold; it is then broken up into lumps of a convenient size, and thrown into the puddling reverberatory furnace, which is usually constructed with one door, and at which only one man can work at a time. The author's improved method is detailed in his specification, plan, and model, and its effect is this—a saving of full 50 per cent. in fuel, and nearly 50 per cent. in metal, an immense saving of labour, and a greatly increased product of work in the puddling furnace—the usual product of a puddling furnace being from fourteen to eighteen tons in a week, while the author's will as easily produce from forty to fifty tons in a week. The author thus combines the processes of refining with puddling, and to show the importance of preserving, and the hazard of dispensing with the refining process, he subjoins the results of analysis by M. Berthier of three samples of cinder or scoria, in one of which the remarkable fact of the presence of phosphoric acid shows how important this operation is to the purification of the iron:—

	Silica.	Protoxide of Iron.	Alumina.	Phosphoric Acid.
A Staffordshire sample..	0·276	0·612	0·040	0·072
A South Wales sample..	0·368	06·10	0·015	none
Ditto do.	0·424	0·520	0·033	none

The object of Mr. Booker's invention is to simplify and accelerate the conversion of cast iron from its crude state into malleable or wrought iron, for which purpose the refinery or furnace is adapted to the various qualities or descriptions of cast or pig iron which it may be necessary to use, by surrounding or enclosing the hearth with blocks of cast iron, into and through which water is allowed to flow or not as may be expedient, and as is well understood in making refinery furnaces, the blast of air being introduced through one, two, or more apertures or tuyres, as usual.

The refinery is connected with the reverberatory or puddling furnace, which is constructed of the requisite form and dimensions. The bottom of the body of the furnace, and the grate bars, and binding plates and bars, are formed of iron; the other parts of the furnace are constructed with firebricks, sandstone, or fire clay, as is well understood. In the neck, or near the flue of the reverberatory furnace is an aperture through which the iron, when it has become decarburetted or refined in the refinery, is introduced or run in a fluid state direct from the refining hearth into the puddling or reverberatory furnace. On each side of which reverberatory furnace a door is constructed; the door in the one side being immediately opposite to the door in the other, through which two doors the workmen perform the process of puddling in the ordinary way in which puddling is done, when working only with one door, which is the general practice.

As respects the Refining.—Having thrown up the fuel, and having, by the application of fire and blast, produced the necessary heat, a charge of nine cwt. or thereabouts of pig or cast iron, of the description generally used for forge purposes, is thrown on and melted down and decarburetted or refined in the ordinary way; and when the refining process is completed, the whole charge of metal is run off in a fluid state direct into the reverberatory or puddling furnace previously prepared to receive it, by having been already heated to a proper degree of temperature, and by the bottom, sides, bridge, and opening to the flue being protected in the ordinary way, by the workmen having previously thrown in a sufficient quantity of limestone and iron cinder. The metal having been introduced into the reverberatory or puddling furnace in a fluid state, the workmen raise, apply, and regulate, and vary the heat in the ordinary way, by feeding and moving the fire in the grate, and raising or lowering the damper on the top of the stack or flue, as circumstances require, and as is well understood; they at the same time stir and agitate the iron with bars and puddles, while the escape of the oxide of carbon in a gaseous shape takes place, and until the whole mass of iron agglutinates. The workmen then divide it into lumps or balls of a convenient size, and draw the charge from the furnace, passing the lumps to the squeezer, hammer, or rolling cylinders, or such other contrivance or machinery as is used for forging or compressing the iron.

During the process of refining the iron, by the application of heat and blast, in the open refining hearth, a considerable quantity of scoria or cinder is produced, which is tapped and run off as heretofore, as circumstances require; but it is to be observed, that during the process which the iron undergoes in the reverberatory or puddling furnace, the author does not find that any cinder need be generated or produced, and cinders and limestones are thrown in, as already described, for the protection of the various parts of the furnace exposed to the action or agitation of the fluid metal, but no cinder need be tapped or drawn off.

Mr. Aikin's opinion.—The principal novelty in Mr. Booker's invention consists in placing the refining and the puddling furnace so near each other that the refined iron may be run in a liquid state into the puddling furnace, instead of allowing it (as is usual) to cool and become solid when let out of the refinery, previous to its being transferred to the puddling furnace. The heat lost by the iron is thus saved, as well as the time required to bring the solid refined iron to a state of fusion. Both the refining and puddling are to be performed, according to Mr. Booker, in the usual way; it was therefore incumbent on him to show how it happens that while the common process of puddling produces slag, his does not.

Mr. Booker's statement that by his process a saving of full 50 per cent. in fuel, and nearly 50 per cent. in metal, is effected, appears to be an enormous exaggeration; the saving in the former being only (as far as appears) the fuel required to melt the refined iron. In making iron of the best quality, 31·74 cwt. of pig iron give 26·45 refined, which is reduced to 23 in the puddling process. 8·74, therefore, is the loss which 31·74 pig suffers in becoming puddled iron. Half this loss, namely, 4·37, will represent 50 per cent. of saving, and this, added to 23, makes 27·37, which is 0·92 more than the entire quantity of refined iron.

Berthier's analysis of two samples of scoriæ from South Wales, and one from Staffordshire, showing the presence of phosphoric acid in the former and none in the latter, has no bearing on Mr. Booker's statement, that in the process of refining, the phosphoric acid is separated from the iron.

If the quality of the iron produced by Mr. Booker's process is not worse than that of iron refined and puddled in the usual method, Mr. B.'s process deserves the approbation of the Society. But I would recommend that Sir J. Guest, or some other practical iron master, should be consulted.

In answer to a communication from the Secretary, Mr. Booker writes:—

"I account for 'the production of slag in the common puddling furnace, and its non-production in mine, as follows:—The common puddling furnace is so constructed that the iron operated upon in it is exposed to a very rapid draught or current of air, which rushes in at the grate at the back of the furnace, and passes off through the body and into the flue and stack at the head thereof. This draught is so great as to oxidize the iron, and transform a great portion of it into slag or scoria during the process of puddling, which process, moreover, is effected so slowly, that the charge of iron, consisting of from 3½ cwt. to 4½ cwt. is exposed to the heat and draughts in the puddling furnace during the space of full an hour and a half.

"My puddling furnace is so constructed, that the draught or current of air admitted at the grate is broken, and its oxidizing effects upon the surface of the iron while fluid, and upon the fibrous particles as they cohere, after the oxide of carbon has been expelled, are entirely neutralised. That portion, therefore, of the charge which in the common puddling furnace is converted into slag or cinder, in mine is not wasted or oxidised, but remains, and is converted into pure malleable iron.

"'The saving of fuel' is accounted for thus:—In the common puddling furnace not more than 4½ cwt. of metal is admitted at one time, and this in a solid cold state. In mine, double the quantity is admitted, and that in a melted and fluid state. It is obvious that the time, fuel, and labour necessary for melting the iron are saved, and that double the quantity of iron is converted from a cast into a malleable state within half the same space of time.'

THE PHILOSOPHY OF DESERT FORMATIONS.

(Continued from page 42.)

In vain, in this grand and universal wreck of by-gone existences, will the geologist look for the mixed material composing many of the older soils of Europe: the fossils of the one and of the other speak alike of a common origin, of causes similating to causes, effects to effects; but the mineral kingdom is still in its infancy, is still but partially developed: it has naphtha, bitumen, mineral pitch, and bituminous rocks, but no coal: it has the metalloyds in their uncombined, and even in their combined state; but it has neither iron, copper, silver, tin, or other mines of metallic substance; and, where the metals are developed, as M. Guielin truly observes, they are but superficially disposed upon or near the surface of the earth: it has no lacustrine or terrestrial deposits, no aluminous clays, no formations analogous to the lias, no fossils which tell of its previous occupation by terrestrial forms of life; the beds of its lowest valleys and plains, as its most elevated tracks, denote the one common origin, and exhibit properties and fossil bodies common to both. Wherever the fresh waters descend from above, or percolate through the porous strata, there fertility appears; the soils of the desert, like the island in the midst of the ocean, when favourably disposed, teeming with vegetation, and demonstrating by its abundance and the sterility around it that nature operates by general laws. Every locality has its local phenomena, and from no one portion can we take a sample as illustrative of the one great whole: the groups and families of mollusca, the chains of reefs, and the beds of marl filled with reliquæ, are all peculiar to their respective regions, and confined to that geographical area within which alone they can exist. To whatever depth these soils have been explored the same phenomena is presented to observation, and in no one instance throughout these extensive tracks, on digging for water, have vegetable earths or other products generated by their presence been discovered; tbey are alike deficient of the gems and metals common to older soils, or lands more favourably situate for their development and increase. In these localities disposed within rainy regions, or watered by rivers, the mineral kingdom is largely developed, and many of the metals towards the eastern and southern regions of Africa are found in abundance; but the only metal generally disseminated over the virgin earth is iron in its oxidated state united with calx, or developed in saline beds in the form of iron glance; in this latter state it abounds in Mount Ormus in the Persian Gulf, which elevation is almost wholly composed of muriate of soda: beyond the state of sulphate, phosphate or carbonate, iron ore is rarely or never seen, and only where water is present. Again, in these soils, the stones continue for indefinite periods of time in the petrified state, similating in their general composition and character; and such is the case with desert sands, the one and the other becoming translucent and crystalline, as they are exposed to the conjoint action of heat and water: thus in the river Nile, many of the sands are exceedingly beautiful, and other of the stones are converted into varieties of quartz and mineral gems.

All the plains and elevations of the deserts are more or less impregnated with salt, and the greater part of the springs are so saline as to render the water wholly unfit for man or animal to drink. By the sea of Abyssinia, the salt exists in dry solid masses: the summit of the mountains which border the desert to the west of Grand Cairo present an immense plain, covered with a mass of salt extending over a surface of 30 or 40 square miles. In the Mesopotamian deserts there is an abundance of rock salt, much of it in very large transparent crystals. In the kingdom of Tunis, mount Had Delfu is entirely composed of rock salt, and in fact there are few parts of the desert where it is not to be found. The earths of soda and magnesia are also exceedingly abundant, entering into the composition of rocks, and decomposed masses of calcareous matter, and giving character to the marls.

The hills which form the boundaries of Upper Egypt are all of fossil composition, some of them have passed by gradual transition into compact limestone, and when within the reach of the waters have assumed a quartzose structure: others are in the state of soft carbonate of lime, indurating as they become exposed to the hot dry air, and the fossil shell fish contained therein are discovered in their various stages of conversion into chalk, from which state, on exposure to the atmosphere, they silicify, and eventually become Egyptian jasper. Many extensive formations are wholly composed of Cirrhipedes, pipe corals, ostræ, &c.; the upper plains exhibit a great variety of species in their fossilized state, particularly echini, ostræ, radiati, and other fish of a calcareous nature; in some places the limpets and rock oysters are seen fossilizing as the rocks indurate; in fact their changes and re-combinations are, generally speaking, indefinite. Many of the hill ranges in the very heart of the Nubian and Suez deserts have a striking similarity in character and composition, to the very recent formations bordering the Red Sea, being of a calcareous nature, and containing vast quantities of the same species of marine exuviæ: the perpendicular fronts of both mark the action of the waters as they have slowly decreased, and their upper surface terminating in considerable plains covered with salt and fossil bodies; and where the dry hot sands have covered in the fossils for a series of ages, they have been preserved from change, so that when taken therefrom, pearl oysters have exhibited all their native freshness, as though recently abstracted from the waters: they also contain aggregates of an indeterminate character between granite and sandstone, or limestone and sandstone, in which are numerous crystalline secretions of sulphate of iron: some of the beds gradually assuming a lamellated appearance, the fossils and chalk being in alternate layers, as is often exhibited by the chalk formations of this country. In some of the extensive valleys the whole of the fossil bodies spread over the surface are covered with a delicate bloom of sulphate of magnesia; in other places the eye is dazzled by the lustre reflected from crystalline salt or selinite.

Green marble (serpentine) is very prevalent in the Nubian and Egyptian deserts, rose jasper in its various stages of formation, from the slightly adhesive mass of silicifying pebbles and calcareous matter, until the whole of the aggregates become united by the silicious waters, jasper is exceedingly abundant, and Mr. Bruce mentions small pieces having green, white, and red spots, called in Italy Diaspo Sanguineo: the granites and porphyries sometimes form entire hills, and with marbles and limestone entire mountains; and the mountains bordering the sea, or those which receive the rains, have a reddish or brownish hue, the calcareous matter spreading over their surface having passed into various stages of change. Both Buchardt and Bruce speak of enormous masses of red granite, hornblende and rose quartz as being exceedingly abundant, particularly near the borders of the Nile, and in the rainy regions. It was from the heart of the desert, between Cosseir and the river Nile that the ancients quarried their fine granites, marbles, and porphyries.

Of the phenomena of the desert, the moving pillars of sand are not the least remarkable. Bruce says, "we were at once surprised and terrified by a sight, one of the most magnificent in the world. In that vast expanse of desert (Waadi el Habsud), from W. to N.W. of us, we saw a number of prodigious pillars of sand at different distances, at times moving with great celerity, at others stalking on with a majestic slowness; at intervals we thought they were coming in a very few minutes to overwhelm us, and small quantities of sand did actually more than once reach us; again they would retreat so as to be almost out of sight, their tops reaching to the very clouds. There the tops often separated from the bodies; and these once disjoined, and dispersed in the air, did not again appear. Sometimes they were broken near the middle, as if struck by a large cannon shot. About noon they began to advance with considerable swiftness upon us, the wind being very strong at north. Eleven of them ranged along side of us about the distance of three miles. The greatest diameter of the largest appeared to me at that distance as if it would measure 10 feet. They retired from us with a wind at S.E., leaving an impression upon the mind to which I can give no name, though surely one ingredient in it was fear." This phenomenon is common to the deserts of Nubia and Arabia, and generally occurs in plains surrounded by high mountains: it is produced in like manner as waterspouts, by contending currents in the atmosphere, the upper and prevailing current being opposed by the other, changes its force of direction towards the earth, descending in a spiral form, and rebounding from the earth passes upwards within the vortex it creates, until it reaches the prevailing current, when it is immediately broken to pieces; the sands are preserved in their pillar like form by the encircling current. I have often encountered them in the Arabian deserts, with a sensation of pleasure rather than fear, for it does not appear that any danger exists either of being carried up by the whirlwind, or being choked by the falling sands.

The Samiel (signifying angel of death), sometimes termed the Simoon, is in reality dangerous and deserving its name, and instances of entire caravans having been overwhelmed are related by many historians. While in the midst of an extensive plain where all retreat is cut off, it is seen advancing in a dull yellowish fog, extending from the surface of the earth to an inconsiderable height; its outer edge has the copper colour hue of clouds preceding a hurricane in the West Indies; its searching influence is felt long before it reaches you, and even the camel, shows symptoms of alarm, uttering loud cries; and every traveller falls prostrate with his face towards the earth to prevent suffocation. In one of the Waadis of Nubia I encountered this venomous blast, and as it passed over my prostrate form, every part of my body tingled as though innumerable sparks of fire had come in contact with the flesh. When blown over, which was in about ten minutes, I found my water skins dried up, and the sands on the wind-ward side reaching to the saddle-bow of my camel. This terrific blast consists of sulphuretted hydrogen and carburetted hydrogen, and other noxious exhalations of the earth, uniting within their volumes an enormous quantity of burning sands, so exceedingly minute, as to be invisible to the eye: it is said, and I believe truly, that no human being can fully inhale this vapour without having the lungs irreparably injured, and instant death is very often the consequence.

In some parts of the desert, towards the land of Abyssinia, about Narea and Caffa, there are immense marshes where the waters annually accumulate, until in the overflow they empty themselves into the beds of the rivers,—this gives a new character to the oceanic fossil soil, the grey marls are converted into a red bole, the sands in many places consolidate as sandstone, and much terrestrial matter or vegetable earth is blended with the various substances primarily composing these plains. Again a portion of these waters passes off by filtration into valleys disposed at a great distance from them, carrying with them the causes of effects manifest in the changes of fossil matters into minerals. The entire Delta of the Nile is spread over a marine formation, being generally of a calcareous nature, or consisting of sands silicified, marine exuviæ, and marls converted into clay in consequence of uniting with the overlying matters.

The deserts, in whatever parts of the globe they are disposed, even exhibit phenomena peculiar to themselves, and as such at variance with the geological notions of the day; in our researches, no remains of lacustrine fresh water or land species have hitherto been found beneath this marine strata, the organic character disappears the lower we descend, but, the lower beds, to the greatest extent known, consist of sands and ocean marls. We cannot therefore conclude that in the changes of this planetary body, the waters have experienced no diminution, but that the great preponderance of oceanic matter, composing in entirely ancient soils, as well as in recent formations, the phenomena of the deserts, and of newly formed islands and continents, all demonstrate priority of existence to the soils formed by the operations of nature on dry land, and it is palpably manifest to all men that the ocean earths form the basis of land vegetation, and of all things produced thereon by the influence of the atmosphere.

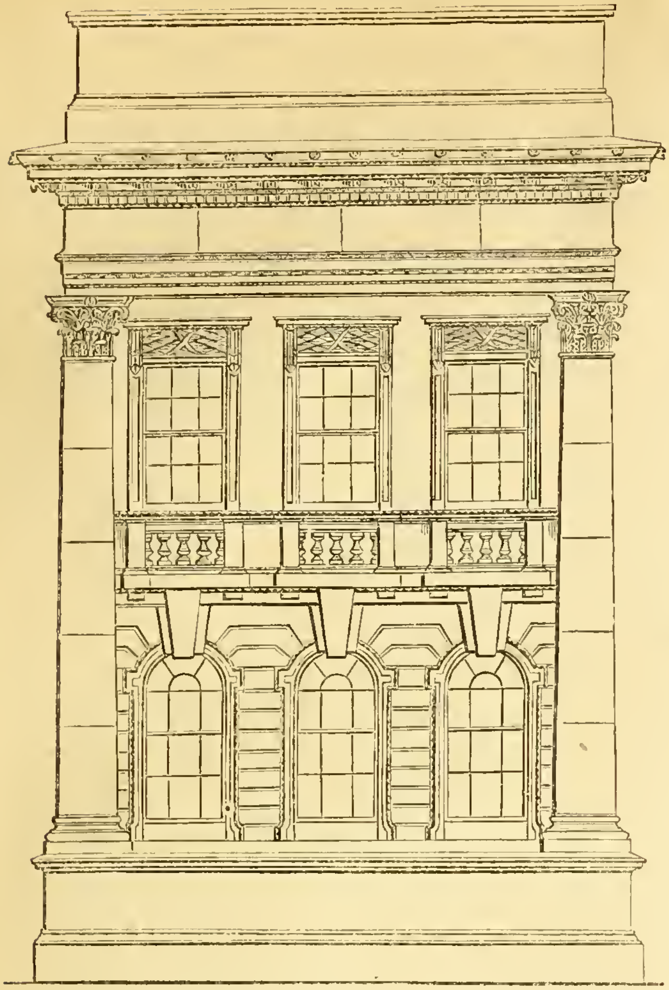
In one of the preceding articles, has already been explained the reason why the term "terrestrial" is used to designate the earth or dry land, in contradistinction to the term "oceanic." It is palpably manifest to men of even common sense, that there are organic species peculiar to the waters, and organic species peculiar to dry land: also that there are earths peculiar to the one, and to the other, as for instance *vegetable earth* and *ocean marl:* in reality the one and the other are the products of animal and vegetable organic bodies—ocean marl implies or embraces varieties, but vegetable earths do not, although much animal matter is blended therewith, they are in fact the earths of earths, species of dry land proceeding from oceanic earth; the term "terrestrial" in contradistinction to "oceanic," implies no contradiction. It has also been observed that gelatinous matter, whether generated by animal or vegetable species favours the conglomeration of silica, and there are few analytical chemists of the present day who will be found to dispute this acknowledged and palpable truth. I go a step beyond this and prove that gelatine favours the generation of silica. A correspondent holds it to be absurd to suppose that the comminuted particles of shell fish can be converted into sands. "The earthy matter in shells," being, as the correspondent says, "wholly *lime*;" truly this is some new discovery, the elementary constituents of living creatures of the deep are various, the most simple organization being purely gelatinous, others combine in their elements albumen and gelatine, with phosphorus; others with these, marine acid, the earths of sodium, &c.,—the abundance of these elementary compounds is manifest in the ocean slime, the phosphorescent light, and saline quality of the waters; the slime is the natural cement of the shells of mollusca, as it is the natural and sole constituent of many species, the elements of the gelatine generated by living organic action, and forming other combinations, become converted into albumen, and then again gelatine and albumen on the death of the animal, form other combinations, entering the mineral kingdom with *silica*, &c. Otherwise, whence comes the silica which constitutes full two-thirds of the entire bulk of the earth? it is not found in the waters oosing from the ocean beds, for the generation and increase of species, is invariably followed by the continuous increase of fossil beds. Mr. Lyell would supply calcium from internal reservoirs. Whence will he derive his supply of silica and other earths? It is said that silica is composed of definite elements, so is the living organic body; in death this mathematical union is sometimes wholly dissolved, and other mathematical and mechanical combinations take place, the results being definite; undecompounded bodies, defying the art of the chemist to separate the elements of their composition but being of necessity compound bodies, and therefore susceptible under some, though to us unknown circumstances, to change.

To the highly intellectual body to whom I address myself, no subject can be more interesting than "The Architecture of this Earth;" from the elementary works alluded to by *a Correspondent*, they derive ideas of the general building, but from me they learn the nature and composition of the material, and the circumstances under which it was and is produced: geologists see the building through geological spectacles clouded by crude i leas and contradictory opinions, and are told to rest satisfied with this general view, and not to look for foundations to the building or primary causes of its being, as that is not their province: I simply hold up the mirror of nature and permit men to judge for themselves. Twenty years travel and observation is worth at least double the quantity of closet philosophy. Geologists teach that crystalline rocks are produced from a previous heated liquid state. I maintain that aggregate masses are combined together by certain common bases or cements, and under the influence of long continuous atmospheric heat or chemical action. Geologists maintain that the material of crystalline rocks has been upraised from the interior of the earth; I am prepared to prove that the most elevated crystalline bodies are produced by atmospheric influences, and that they do not exist at any considerable depth within the earth; geologists term these rocks primary, and say that the causes of effects thus manifest have universally ceased: I prove that many of them are recent, and that the causes of their formation are even now more active than ever they were. It was only a short time since that much learned eloquence was put forth by geologists to prove that from the geological character of the soil no coal could possibly be found in the Falkland Islands, but the existence of coal in those islands was well known to individuals at that time, and it has since been proved that there is abundance of coal, and that the great beds pass by gradual transition into this mineralized form, specimens of which are now to be seen in the "Museum of Economic Geology." Again, bodies every year are added to the number of known undecompounded bodies. Who then shall presume that natural philosophy is now perfect? Geology at present is a very uncertain and fluctuating science.

The effects of heat and cold, water and atmospheric air, gases and vapours, upon bodies exposed to them, or chemically combining with each other, are palpably manifest to all men, however limited their sphere of action may be; the flowers of the garden, the grasses of the field, the creature which exists by the one or the other, all exist by sufferance of temperature and association. On the island wholly composed of marine exuviæ and sands, vegetable species, peculiar to that island, make their appearance, and as they generate and die off, or periodically shed their fruits, flowers, and leaves, so the formated soil becomes covered with a coating of mould gradually increasing in thickness; the plants yield potash; whence is the potash derived? It cannot be from the oceanic soil, because in this soil potash has no place; and, again, its quantities multiply as vegetable matter increases; if derived from the soil, and eventually returned to the soil, there would be no perceptible increase. It is not a constituent of ocean waters. If, then, it be an inorganic substance, whence can it be derived? Certainly not from the atmosphere. It cannot, therefore, be primary, not being antecedent but contemporaneous with, as necessarily appertaining to, the vegetable body: under other aspects the same plant yields soda and not potash. It is found as a constituent of many mineral bodies, and its presence truly denotes the presence of vegetable matter, lost in combinations with other compounds: affording demonstrable evidence that the rock, of which it forms a constituent part, assumed its consolidated form after this earthy matter was deposited, consequently that the rock is a secondary product.

On the Advantages of employing Large Specula and Elevated Situations for Astronomical Observations, by C. P. Smyth, Esq., in a paper lately read at the Astronomical Society, the author adverts to methods proposed by Mr. H. F. Talbot for the multiplication of copies of specula by means of the electrotype, and for observing astronomical objects with a telescope absolutely fixed, by means of a revolving plane mirror, which methods he considers might, if carried out, produce great improvements in astronomy. Amongst the advantages of the latter method he enumerates the following, arising chiefly from the unlimited focal length which it would be possible to give to the mirror: First, The obviation of the necessity of an accurate parabolic shape for the reflector; Secondly, The magnifying of the image without distortion or colour; Thirdly, The small effect which inaccuracies of the screw of the micrometer would produce, eye-pieces of low power being employed; Fourthly, The elimination of errors dependent on the contraction or expansion of the tubes of telescopes; and lastly, The advantage of having the eye in a fixed position. The author then enlarges on the advantages which would attend the use of such a fixed telescope if placed on the slope of a high mountain, with the object-mirror and the eye-piece fixed on piers, and separated by a considerable interval, the mirror being beneath.

GRESHAM COLLEGE.



Scale 12 feet to 1 inch.

In our last volume, p. 276, we gave a plate showing the Basinghall Street front of Gresham College, at which time we made some observations on the merits and demerits of the building. We now exhibit the minor front in Cateaton Street, which has less pretensions to display.

ON THE PYRAMIDS OF EGYPT.

By J. J. Scoles, Esq., Fellow.

(Read at the Royal Institute of British Architects.)

About three years since the two first parts of the magnificent work of Colonel Vyse on the Pyramids of Egypt, were presented to the Institute, and Mr. Scoles then read a paper on the subject of the discoveries made by Colonel Vyse, and described the pyramids at Ghizeh. On the presentation of the concluding number of the work, he took the opportunity, on the last meeting of the Institute, to resume the subject and to describe the further discoveries which have been made in the pyramids situated at Sakkarah, Dashhour, and other places in the "Faioum;" and which are delineated in the third number from drawings by Mr. Perring, the civil engineer, under whose direction the various excavations were made at the expense of the gallant Colonel.

There appear to be thirty-nine pyramids in Middle and Lower Egypt, all of which have been explored by Mr. Perring. They are situate on the western side of the Nile, chiefly on the desert hills, occupying a space measuring from north to south of fifty-three English miles.

The first pyramid described by Col. Vyse is known by the name of *Abou Roash*; the base is 320 ft. square. The bulk of it is built of the mountain rock, (a sort of hard chalk,) which has been reduced to a level around it, and the defective places have been made good with masonry. No part of the external casing is to be found; indeed the edifice was not probably ever completed or raised to a considerable height. A passage about 160 ft. long, commencing on the north and descending at an angle of 22° 35′ leads to an apartment about 40 ft. by 15 ft.; above it smaller chambers appear tho have been constructed similar to those in the king's chamber in the great pyramid of Ghizeh, called "Chambers of Construction," because they relieve the lower part from the superincumbent weight. Near to the pyramid are heaps of broken granite, which may be the chips of the blocks for the extreme casing; the blocks themselves probably have been re-used in modern times, as the pyramids have been a sort of quarry for ages past. The fragments, though granite, crumble to pieces upon being handled, and are much decomposed, either from great antiquity or from an exposure not merely to the corroding air of the desert, but also to the moist winds of the Delta. The common saying that it never rains in Egypt, only applies to the upper country. In the Delta, extending from the sea to the district of the pyramids, rain is frequent and copious, and it was noticed that persons have arrived at Alexandria and remained there some time, subject to continual rain, and have left with the impression that it always rained in Egypt, although their idea before visiting the country was, that there it never rained.

The next pyramid is situate at *Rhegah*. Mr. Scoles here remarked that the names given to the pyramids and by which they are known, are derived from the villages nearest these monuments, and have no reference to their ancient names, though frequently the site of an ancient city is to be traced in the modern name of the villages in the vicinity. This pyramid of Rhegah is curious, on account of being carried up in two inclines, like a pyramid at Dashhour. Mr. Perring did not succeed in discovering any entrance to it; but in the course of his excavation he discovered fragments of stone sculptured and coloured, and some marked with golden stars upon a dark blue ground, as if belonging to the ceiling of an apartment.

At *Abouseer* are five pyramids, some tolerably perfect; Mr. Perring experienced great difficulty in exploring the interiors, as large masses of rubble masonry constantly fell in and seriously injured some of the explorers. The interior of three of these pyramids are similar in their arrangement. The entrance passages leading from the centre of the northern fronts are at first inclined and afterwards horizontal. The apartments in the centre, range from east to west, and are covered by inclined roofs, formed of several courses of stones. The bulk of the northern building has been in the first instance carried up in degrees or steps, and afterwards completed in the pyramidal form. The masonry in general is very rude, consisting of rough blocks of various sizes put together like rubble work with *Nile earth* instead of mortar. The passages are lined with granite and were closed by portcullis of granite; this material was apparently introduced to give strength to the masonry where its solidity was weakened by passages, &c., and as an additional security there had been three tiers of roof blocks over the chamber, and the base of the upper tier had been carried beyond those of the lower, in order to distribute the pressure over as great a base as possible. These blocks were of immense size, some 45 ft. long, 9 ft. wide, and 12 ft. thick, and yet so completely had they been destroyed by the indefatigable exertions of the people who broke into these pyramids, that only two perfect blocks and fragments of two others remain. The marks of wedges were every way visible, but Mr. Perring observes, it is difficult to imagine any power but that of gunpowder could have effected so much destruction. A recess in the casing above the entrance appears to have been intended to receive an inscription like that, as we are informed by Diodorus, was placed over the entrance of the third pyramid of Ghizeh; and this circumstance may account for the inscription said by Herodotus and by other authors to have been seen upon the great pyramids. In one of the Abouseer pyramids blocks of granite filled up the entrance passage and remained in their original positions, clearly proving that the interior of the pyramids was not intended for any astronomical purposes. The pyramids of Ghizeh had the passages similarly filled up, and the violators of these monuments of the dead had in the first instances forced a way down to the chambers through the solid masonry.

The larger of these Abouseer pyramids was built in steps or degrees covered over with flat stones, and the space between these and the pyramidal casing was perhaps filled up with a rubble work of smaller stones. The mortar used in this pyramid was composed of Nile earth mixed with a small quantity of lime or pounded limestone. In this pyramid we have a specimen of the durability of wood, for a long piece of this material had been worked into the masonry, which though rather shaky, was completely sound, and must have been built in the masonry at the time of the original creation of the building, a considerable portion of the same still remaining inclosed among the stones that have not been disturbed, and the mortar adhering to its surface, which could only have taken place when it was first laid on. A portion of this very piece of wood is in the British Museum. In the smaller pyramid the apartment was 12 ft. 2 in. long, and 10 ft. 6 in. wide; the roof was covered with blocks laid horizontally, and which had given way.

At Sakkarah are eleven pyramids and a large building called the Throne of Pharaoh. They are built of stone, and are much decayed, except the large one, which is built in degrees, and this and another towards the north-east are the only two at present open. Mr. Perring has given a sketch of these pyramids, and that gentleman remarks that Bruce probably alluded to this view, when he observed that "the traveller is lost in the immense expanse of desert, which he sees full of pyramids before him—is struck with terror at the unusual scene of vastness, and shrinks from attempting any discovery among the moving sands of Sakkarah." In the second pyramid the regular inclined passage in the centre of the northern front remains closed up with masonry. The two apartments have pointed roofs, the blocks which form the sides are not laid in horizontal beds, but are laid on an inclined plane like the beds of the queen's chamber in the great pyramid of Ghizeh.

The great pyramid of Sakkarah is called by the Arabs, Haram el Modarrggeh, "The Pyramid of Degrees." It is evident that the exterior of the edifice originally consisted of six degrees or stories, varying in height and gradually diminishing in height towards the top, each of which had the shape of a truncated pyramid, and was successively smaller than that below it; but by the effect of time and violence, the whole of the eastern and nearly the whole of the northern and of the southern sides of the lowest tier have been removed. Two attempts have also been made to force an entrance on the southern side, and the French are said to have employed artillery for the purpose. The bulk of the masonry consists of loose rubble work, and is inclosed by walls about 9 ft. in thickness, and are composed of rudely squared stones set to the angle of the face; and the breadth of the building from north to south has apparently been increased by an additional wall on each of these sides. The walls of the lowest tier are 10 ft. thick. The mortar is of various kinds, but it is principally composed of the gravel of the desert and of lime, or of Nile earth, and of small pieces of calcareous stone. The face of each story has an angle of 73° 30′ with the horizon. The entrance is in a pit which opens into a passage partly horizontal and partly inclined, leading to the lower part of the large apartment. Near the entrance of the passage is a hole for the pivot of a door. Another passage from the northern front leads to the same apartment at 7 ft. 6 in. above the floor. A third entrance from the same front communicates with a recess in the upper part of the apartment. A fourth entrance proceeding from a pit on the southern side, communicates by a horizontal gallery with another recess 70 ft. above the floor of the apartment. The gallery is an excavation, but as the rock above it was not of sufficient thickness to sustain the weight of the superincumbent masonry, the ceiling is supported by a row of 22 short columns formed with blocks of compact limestone. The columns have been brought to their bearings by wedges of wood. The southern end of this gallery did not seem to have been previously visited, as nearly 30 mummies were found in it apparently undisturbed. They had neither coffins or sarcophagi, but three or four had painted decorations; they were enclosed in wrappers with pitch and bitumen: but as Mr. Perring did not meet with any of the objects usually deposited with mummies, excepting some of the common stone idols on the body of a female, he therefore concluded they were the bodies of persons employed on the building.

The large apartment (measuring 24 ft. by 23 ft., and 77 ft. high) is an excavation. The original ceiling was examined by the help of torches made of greased rags, and ascertained to have been formed with planks, supported by a platform of timber, consisting of cross bearers of oak, larch and cedar, and of two principal beams of oak about 18 by 12, and strutted from each side by angle pieces. The larch was in the soundest state. Beneath the floor of this large apartment, which consists of blocks of granite 3 ft. 6 in. to 4 ft. 6 in. thickness, a remarkable chamber 10 ft. long, 5 ft. 4 in. wide, and 5 ft. 4 in. high had been formed; the entrance to it had been closed by a conical block of granite shaped like the stopper of a bottle, above four tons weight.

The Baron von Minutoli supposes this chamber to have been the place of an oracle; but Mr. Perring is of opinion the place was intended for a treasury, because there did not appear any secret entrance by which a man could easily have got into it, and because the ponderous block by which it was closed did not seem fitted for mysterious purposes, as a number of men and machinery also would be required to raise it; because likewise no acoustic effect was perceived which would peculiarly qualify the place for an oracle.

The floor of the large apartment was supported by pillars of loose masonry wedged up with wood to an uniform height; broken pieces of wood, crooked branches, &c. have been inserted between the pillars to tie them together. The extensive employment of wood is peculiar to this pyramid. There are other smaller apartments in this pyramid. The doorway in one of them is bordered with hieroglyphics in relief, and small stars in relief are sculptured on the headings of this and another doorway.

The sides of some of the apartments are ornamented with rows of convex pieces of bluish-green porcelain about 6 in. by 4½ in., inscribed on the back with a hieroglyphic, the impression of which remained on the cement. The porcelain had been removed. At the back of each piece of porcelain was a projection pierced through with a hole, into which the moist stucco upon the wall entered (the stucco was composed principally of plaster of Paris); in some instances to increase the adhesion the wall was also perforated in the same manner. This pyramid differs from the rest in many respects. It is the only one in Egypt the sides of which do not exactly face the cardinal points, the northern front being 4° 35′ east of the true north. It differs in the form and mode of building, in the number and complexity of the passages and apartments, having four entrances, one being on the southern side; by the hieroglyphics and peculiar ornaments on the walls of the chambers, and also in containing a large apartment covered with timber. The remaining pyramids at Sakkarah are very much ruined, and have not any peculiar arrangements or construction to require particular notice. The throne of Pharaoh, so called, from an Arabian tradition that an ancient king of Egypt erected it for his seat, is a pyramidal building, composed of very large stones and constructed in two degrees or stories. The materials consist of coarse calcareous stones, in which are semi-petrified oyster shells. The building has no doubt been a tomb, but no entrance has been discovered.

At Dashhour are three pyramids of stone and two of crude brick. The north stone pyramid is the most perfect of any in this district. The stones are laid in horizontal courses, and the masonry is good; the angle at the apex is nearly a right angle, and the building has on that account a handsome and solid appearance. The usual inclined passage leads to the chambers about 12 ft. wide, which are covered over by the courses of the walls over sailing about 6 in. on each side, leaving the ceiling 1 ft. 2 in. in width.

The southern stone pyramid is built in two inclinations, so that the lower part has the form of a truncated and the upper that of a perfect pyramid, which mode of construction, according to Sir Gardner Wilkinson, was probably occasioned by a desire to complete the building more quickly than it was at first intended: this conjecture was in some degree confirmed by Mr. Perring's researches, by which it appeared that the upper part had been carried up with less care than the lower, and was also composed of smaller stones; but whatever may have been the cause, all architects must agree with Mr. Perring that the effect is unpleasant, and very inferior to that of the other regular formed pyramids. The beds of the casing stones are not horizontal; but incline downwards towards the interior of the edifice, in order probably to obtain greater solidity, as likewise to save the materials, as less of the external faces of the stones thus laid would require to be worked away to complete the exterior of the building. This inclination, however, is not uniform, nor at right angles to the exterior, but it seems to be regulated by the shape of the blocks. The usual inclined passage leads to several chambers, which are covered by the side courses approaching each other.

The northern brick pyramid is composed of crude bricks 16 in. long, 8 in. wide, and from 4½ in. to 5½ in. thick, some composed of alluvial soil, some of sandy loam mixed up with Nile earth and a little straw. All the bricks are remarkably solid, laid principally in courses from north to south, occasionally intersected by courses from east to west. The bricks were bedded in, and the interstices between them were filled in with fine dry sand. The bricks were marked on the upper surface, by means of the fingers, with different signs, apparently according to their quality and also according to their position. The most usual mark had been made by two fingers about 1 in. apart, having been drawn down the middle. This building was cased with stone, and it was supposed that stone might have been also employed in their interior for the construction of the apartments, or that the interior might afford additional proof of the antiquity of the arch, because ceilings to any extent could not have been formed with bricks in any other manner; but with all Mr. Perring's excavations and researches, he could not discover any entrance or apartments within, but he discovered a very curious and interesting mode of forming a foundation. It seems that the stony surface of the desert had been made level by a layer of fine sand, and confined on all sides by a stone platform 14 ft. 6 in. wide and 2 ft. 9 in. thick, which supported the external casing, and the pyramid was built upon the sand, which is firm and solid. Mr. Perring has met with many other instances in Egypt where sand had been thus used, and provided it be retained in its place it apparently may be depended upon. The blocks composing the platform were laid upon four courses of bricks. Several of the blocks of the casing were held together by stone cramps of the double wedge form.

According to Herodotus, Asychis, the successor of Myserinus, added lofty propylæa to the eastern front of the temple of Vulcan, and from a desire to surpass his predecessors, constructed a pyramid with bricks, upon which was this inscription—"Do not degrade me by comparing me with the pyramids built with stone, which I excel as much as Jupiter excels the other gods, for those who built me thrust poles into the lakes, and collecting together the mud which adhered to them, they made bricks, and thus they constructed me." The pyramid in question has been supposed by Mr. Hamilton and by other good authorities, to have been built by Asychis: and in support of that opinion it may be observed that it is the most considerable pyramid built with bricks, and that it is near the other pyramids built with stone, with which it might have been compared, and also that it is within a short distance of the Temple of Vulcan, which Asychis had so considerably embellished: the solidity of its construction is likewise remarkable, not a single brick appears to have settled from its place; and although the boasting terms of the inscription has excited much surprise, it is difficult to imagine a mass more solid and also more durable, as long as it was protected by an external casing of stone from the effects of the atmosphere. It is certainly, therefore, as superior to those built with common stone rubble, as Jupiter may have been supposed to the other gods. As the whole of the bricks are not composed of alluvial soil, the latter part of the inscription can only refer to those formed of the mud or clay drawn out of one of the sacred lakes. If it be urged that this pyramid could not have been built by Asychis, because from having been cased it must have had the appearance of stone, it may be remarked, that all the brick pyramids in Egypt (which are four) appear to have been covered with stone; and likewise that the above-mentioned inscription would have been unnecessary had the material of which the pyramid was formed been apparent.

The southern brick pyramid is much destroyed, and Mr. Perring did not discover any traces of the chamber, the roof of which is stated by Dr. Richardson and others, to have fallen in, nor did he perceive any considerable settlement. It is built in the same manner, but not so carefully, as the other brick pyramids. The bricks contain a greater quantity of straw, and vary from $15\frac{3}{4}$ in. to $13\frac{1}{2}$ in. long, and $7\frac{1}{2}$ in. to $6\frac{1}{2}$ in. wide, and $5\frac{1}{2}$ in. to $4\frac{1}{2}$ in. thick. The upper surfaces have been marked with the fingers.

The pyramid of Meydoom is called the false pyramid, because the base is supposed to have been formed out of a knoll of rock, and it certainly has that appearance. The base is about 530 ft. square, and 124 ft. 6 in. high. It is formed in three degrees, each having the form of a truncated pyramid, at an angle of 74° 10′. The blocks are of compact limestone 2 ft. thick; they are laid at right angles to the external face, and have been worked and put together with great skill. The entrance was not discovered. Mr. Perring thinks the whole has probably been covered with large unsquared blocks, so as to complete the shape of a regular pyramid. The appearance is very striking from the river, and particularly commanded the attention of Mr. Scoles and his fellow-travellers in passing up the Nile.

The Illahoon pyramid is built round the knoll of a rock, which is nearly 40 ft. higher than the base; the rock has been faced with crude bricks, and a superstructure has been erected over it, composed of the same material, and supported by walls of stone which proceed from the centre of the edifice. The bricks are laid in a mortar formed of Nile earth, as high as the walls extend, and above them in gravel. They measure $16\frac{3}{4}$ in. by $8\frac{3}{4}$ in., and about $5\frac{1}{2}$ in. in thickness, are well worked, and are formed of Nile earth, mixed up with various proportions of chopped straw, and are marked with the fingers as at Dashhour.

Another ruined brick pyramid exists at Howarah: the bricks laid in fine gravel. No entrance to it has been discovered. There are three other pyramids, two at Biahhmo and one at El Koofa, both built of stone, but of small dimensions.

Most of the pyramids have been connected with the plain by inclined causeways formed of large blocks of stone, some with a parapet wall on each side. These inclined roads were no doubt originally constructed for the conveyance of the stone, and of the other materials used in the erection of the pyramids, but they seem afterwards to have constituted the regular approaches. Herodotus mentions that they were adorned with the figures of animals, which were probably either sculptured hieroglyphics, or an avenue of sphinxes; and at Abouseer fragments of black basalt, at nearly equal distances, were found on the causeway. Pavements about two feet in thickness extended around the buildings, and where the rock was low the pavement was placed upon a layer of sand.

The pyramids correspond in their general arrangement; with one exception their sides are placed exact to the cardinal points; and in the excepted one the difference is only 4° 35′; the entrances are on the north side (the pyramid at Sakkarah being the only one having, in addition, an entrance on the south side), and in having the inclined passages leading to various apartments, which passages, to a considerable way down, have been filled up with solid blocks of stone or granite of the exact size of the apertures.

The discovery of sarcophagi, mummies, and other memorials of the dead, show that the pyramids were used for tombs, and the filling in of the passages with solid blocks proves that the interior could not have been used for astronomical purposes, and the question of those passages having been constructed for the purpose of seeing the Polar Star is set at rest by that circumstance; and Colonel Vyse, in his desire to further elucidate the question of the astronomical theory, communicated with Dr. Herschell, and has appended that distinguished astronomer's reply, which is to the following effect, viz.:—"That 4,000 years ago the present Polar Star, or Ursa Minoris, could by no possibility have been seen at any time in the twenty-four hours through the gallery in the great pyramid; but that the star α Draconis was at that time the Polar Star, and as it is comparatively insignificant, and only of the third magnitude, if so much, it can scarcely be supposed that it could have been seen in the day time, even in the climate of Ghizeh, or even in such a recess as the inclined entrance of the Great Pyramid, though it would have been directly in view of an observer stationed in the descending passage. No other astronomical relation can be drawn from the table containing the angles and dimensions of the passages, for although they all point within five degrees of the pole of the heavens, they differ too much and too irregularly to admit of any conclusions. The exterior angles of the buildings are remarkably uniform, but the angle of 52° is not connected with any astronomical fact, and was probably adopted for architectural reasons."

Col. Vyse's work also contains some valuable information in the form of notes by Mr. Birch, of the British Museum, upon the hieroglyphics discovered in the pyramids, with reference to the dates, pre-nomens, and royal standards of the monarchs by whom the pyramids were erected; but many of these hieroglyphics are quarry marks, some in red ochre, but instead of having been inscribed, like those on the pyramids at Ghizeh, upon stone brought from the Mokattam quarries, they were found also upon blocks quarried on the spot, and Mr. Birch observes—"This is remarkable; in the former instance they may have been intended to distinguish the materials which had been prepared for a royal edifice, but in the present case their use is not obvious, and they can only have served to denote the founder of each particular pyramid." But Mr. Harris, an English merchant, who has been resident in Egypt above twenty years, in a letter to Mr. Perring gives a more matter of fact meaning, by supposing that these incriptions were directions to guide those who embarked the stones at the quarries, who conveyed it to its destination, and who built it when there, and that some of the characters indicate the building for which the stones were destined, and others the position in which they were to be placed, and that these directions could not be necessary to all the stones of a building, but would be requisite for all or most of those composing the linings of the chambers, passages, and other particular positions.

The desecration of these magnificent mausoleæ by the intombment of subjects, as the inscriptions relate to the interments of a royal scribe and a military chief, is a surprising fact, which cannot now be satisfactorily accounted for; although history informs us that the memory of the monarchs who erected some of the pyramids was not held in much veneration.

As regards the period in which the pyramids were erected Mr. Scoles could not offer any satisfactory opinion; by some authors they are placed more than 2,000 B.C., or about 4,000 years since; by others 1,200 years later, or only 2,300 since. This latter opinion is supported by Mr. Wathen, an architect, who, in his work on the arts, antiquities, and chronicles of ancient Egypt, from observations made in 1839, has very fully entered into this subject, and supposes the spoils, the gold and silver, taken from the Temple of Solomon, by the king Shishak of Scripture, 970 B.C., were applied to build these pyramids, and the author has given some curious dissertations on the chronology and dynasties of ancient Egypt. Many circumstances show that those at Ghizeh were the first erected, and that the pyramids of Dashhour were constructed in imitation of the stone ones, and to have been formed of bricks on account of the comparative cheapness.

The circumstance of many of these pyramids being carried up in degrees or steps, agrees with a passage in Herodotus relative to the mode of building the large pyramid, which he describes as follows:—"This pyramid (the large one)," he says, "was constructed in the manner of steps, by some called parapets, by others little altars; such being its original construction, they raised the remaining stones with machines made of short pieces of wood, from the ground to the first layer of steps, and when the stone was let down on this, it rested on a second machine standing on the first layer, from this it was drawn to a second layer, where another machine lay to receive it, for there were just as many machines as layers of stones, or perhaps, continues Herodotus, they transferred the same single portable machines to each layer on removing the stone, and thus the upper part of the pyramid was first finished off, then the next part, and last of all the lower ground part. Now these parapets as they are termed correspond with the side degrees or platforms, as we would call them, seen in these pyramids, and on which the machines were placed; for the small steps formed by the sets-off of each course, as were seen in the large pyramid, previous to the insertion of the casing stones, would not have been wide enough for the machines to rest on."

The word parapet, as used in the translation, does not mean a protecting wall to a platform, as we in general understand it, but evidently the platform, and in the North of England it is so applied at the present time, and the foot pavement is called the parapet.

As connected with the pyramids, Colonel Vyse has given an account of Captain Caviglia's excavations in 1818 in front of the sphinx; when he discovered the steps, and a small temple in front of this gigantic figure, which is cut out of the solid rock. The paws stretch out 50 ft. in advance, and are built of masonry. That the monument is imposing in its aspect, cannot be doubted; but in its defaced state, it is difficult to perceive (to quote the words of the explorer) "the contemplative turn of the eye, the mild expression of the mouth, and the beautiful disposition of the drapery at the angle of the forehead," which rivetted so much the attention of Captain Caviglia.

Mr. Perring has annexed some remarks on the measure by which the pyramids were built, with reference to the cubit. The length of the ordinary cubit, as the name implies, was the distance from the elbow to the middle finger, containing six hands breadth, each of which was divided into four finger breadths. Mr. Perring says the dimensions of the pyramid agreed with a cubit as described in Ezekiel chap. xl. v. 5, "In the man's hand a measuring reed, of six cubits long by the cubit and a hands breadth," and therefore contained seven hands breadth, equal in English feet to 1·707 ft., and that by this measure a general agreement is obvious in the dimensions of the building.

The stone arched tomb near the great pyramid, named after Colonel Campbell, the Consul in Egypt, was next referred to; by some called the Nile girt tomb, being placed in a pit 30 ft. 6 in. by 26 ft. 3 in. wide, and 53 ft. deep, surrounded by a trench or narrow canal 5 ft. 4 in. wide and 73 ft. deep. The bottom course of slabs 5 ft. in length was bedded on a layer of sand 2 ft. 6 in. thick, (another instance of this mode of forming an artificial foundation), and the side walls were formed with small stones. The ceiling of the chamber is formed of slanting stones, with a horizontal one or stretcher between, making the middle part of the ceiling flat and the sides inclined. Immediately above this ceiling an arch commenced, which covered in the upper chamber; the intrados of this arch formed the segment of a circle which had a radius of 6 ft. 2 in., and a span of 11 ft., was 3 ft. 10 in. thick, composed of four separate courses, each well breaking joint. It had not been built upon a centering observes Mr. P. (but how he ascertained this does not appear.) The stones were 4 ft. long and 15 in. broad. Those of the first course had been cut to fit the joints, which radiated from the centre; with this course great care had been taken, but in the other rings the stones were rectangular and packed up at the back with chips. Each course was separately grouted with fluid mortar. The masonry was beautifully worked, and the joints were scarcely perceptible in the interior. The undersoil of the stones of the inner course of the arch have had the arrisses taken off, and were tooled round so as to resemble rusticated work.

There were indications that the central excavation and the trench also was covered by an arch, and the whole was probably covered by a pyramid. From an inscription on this monument, the tomb was made for a scribe named Ohaikop, either during the reign of Psammetichus II., anterior to 604 B.C., or of Apries, posterior to 570 B.C. This tomb contained three sarcophagi: one of the granite and a fragment of the basalt one is now in the British Museum.

This arch being in the present day one of ordinary construction would not have required so full a description, if it were not about the oldest stone one we are acquainted with; it shows that the principle of the arch was well understood at the time, and that many arches had been previously formed. The brick arches in the tombs at Thebes are of much older date, according to Sir Gardner Wilkinson.

It was worthy of notice that the arch of Campbell's tomb has no abutments and stood by itself, and its resemblance to the form of the sewers in the City of Westminster, must be apparent to every one conversant in that mode of building.

It was singular the Greeks, with these examples before them, did not construct arches (the curved form for ceilings being much used), and that the introduction of the arch was not, with these exceptions, more general, at least, in Egypt; and Mr. Scoles expressed himself on this account sceptical on the subject of the antiquity of these arches. He was of opinion that the arrangements and dates of the dynasties by Egyptian antiquaries, was not so satisfactorily based as to make it clear to his mind that the periods in which the kings lived, in whose reign these arches are said to be built, was free from the suspicion of error, and he concluded his paper by remarking, that the descriptions he had given of the pyramids, and other buildings, was entirely taken from Colonel Vyse's work, and that in general he had used the very words of the text.

REVIEWS.

Architecture of the Reign of George III. and the Regency. Pictorial History of England.

Historia quoquo modo delectat, says the great Roman orator; but he would probably have greatly altered his opinion, had he lived to read history as it is sometimes written now-a-days. Most assuredly we have not received so much *delectation* or disappointment from the concluding—and what we hoped to find the most interesting chapter of all on the history of English architecture and art in the "Pictorial England," the ground to be passed over being quite fresh, and consequently affording scope for original remark, and something more stirring than the mere echoes of long established opinions. We should have thought that any writer qualified for the task at all, would eagerly have availed himself of the opportunity so offered, to enter tolerably into critical remark upon the several architects and their works, of the period under review. Possibly we may wrong the writer himself, for the work being by various hands and literary assistants, subject to the control of the editor in chief, it is not at all unlikely that his manuscript may have undergone a good deal of pruning and curtailment; and should such be the case, we really compassionate him, it being one of the hardest miseries of authorship, except to a mere hack, who cares for nothing beyond his pay for the job.

However, we have only to take what we find, just as it is; and must therefore report of it as being an exceedingly rapid and condensed sketch, in which several names are merely *catalogued*, without comment of any kind—so that they stand like shadowy ghosts, of whom we are left to guess whether they are destined for Elysium or Hades.

Sir John Soane, indeed, may be said to be here put into the former place, and he is spoken of at much greater length than any one else. He is, besides, the only architect complimented with his portrait; but his spirit, we suspect, would not be a little perturbed, could it behold it, since this must be some degrees more offensive than the unlucky one painted by Maclise, which caused at the time such ire and so much *rumpus*.

But before we proceed to the estimate of Soane's professional character, we will quote an excellent remark from the opening paragraph of the architectural portion of the chapter.

"The exquisite refinement of Greek art, as it had been revealed by the great work of Athenian Stuart, and the other researches and publications to which it had given rise, had suddenly affected the public mind in a manner which left little room for the exercise of the judgment, and Greek art was unfortunately adopted, not as a *principle*, but as a *fashion*. The reproduction of its forms was demanded without reference to the propriety of their application, or to the relations which essentially constitute the beauty of architecture. A system which reduced the art and science of architecture to the appropriation of ready-made temples, and dispensed with so much of the burden of study and thought—a faith, in art, whose yoke was so easy—could scarcely fail to attract disciples; and Greek architecture (so called) came into existence in England in the most *abortive shape in which the narrowest spirit of imitation could produce it.*"

This is excellent; and the concluding words, which we have marked by italics, point out, in the clearest manner, one most mischievous radical error in the system of our Anglo or pseudo-Greek style, which, owing to opposite elements being merely brought into contact, instead of being, as far as possible, reconciled together and harmonized, is for the most part a patched and piebald one, and generally bald enough in all other respects. Let us hope, then, that this soul-less, mechanical, Brummagem Greek has had its day with us; for though a great deal of it will hardly outlive the century, there are, unhappily, some "*monumens*" in it which will record the classical dullness of the period when they were erected.

In the same degree as we cordially assent to the opinion above quoted, do we differ from that expressed by the writer in what he says in regard to Soane. Great praise is undoubtedly due to Sir John: he pursued his art, *con amore*, at all events—which is more than can be said of every one who writes himself architect;—he ventured to think for himself, and to break through the trammels of mere rules, and he certainly was fertile in ingenious ideas, expedients, and contrivances; this we readily admit, but never can we subscribe to the opinion, that the "great merit of his peculiar style is to be found in consistency of detail;" or that his compositions "derive, from a detail based on the purest examples of antiquity, and *always harmonious*, a character more essentially Greek than can ever be attained by the most literal transcript of Greek art, misunderstood and misapplied."

Of course what is misunderstood and misapplied is bad, and so far much of Soane's detail may be greatly preferable, but it does not therefore follow that it is entitled to be described as a Grecian character. The truth is that although, after he first began to do so, he was always aiming at a style of his own, he never wrought out for himself, even the consistent elements of one: he just got up to a certain point, and there stuck fast, unable either to advance, or to turn back again. Never was any artist more unequal,—not only in different, but in the very same productions. Even the Bank itself—his great and most studied work, exhibits almost the very opposite extremes of taste, on its exterior, for instance, in that charming little poetical bit of design at the north-west angle; and in the centre of the south front, which is little better than a mean and unmeaning jumble. The same in regard to the interior: there are many admirable ideas and delightful bits; but of the former, not one is fully wrought out; and the others are exhibited only in patches, or so as to appear such. "Considered as his architectural scrap book," observes a writer in the 'London Interiors,' —"the interior of the Bank is highly interesting, it is a collection of architectural episodes, but no regular architectural epic." Soane seems to have been always studying—and in that he was to be commended; but he was also, unfortunately too much addicted to the practice of mere experimentalizing, and of applying desultory and unfinished "studies" to what were intended to be finished works, utterly disregarding a very salutary precept inculcated in one of his own publications, advising that a design should be laid aside for awhile, and then be rigorously scrutinized and scanned with a fresh eye,—revised and corrected in every part. If he himself, therefore, followed this judicious piece of advice of his own, he was unable to detect in his own designs, those strange inequalities and incoherencies, and that want of keeping in them, which are so disagreeably striking to almost every one else. Even his contrivance was sometimes terribly at fault, as in the Treasury Buildings at Whitehall, where he has put a row of entresol windows immediately behind the hollow entablature of the order!—as he has also done in the centre of the south front of the Bank—a terrible failure, by the by, in every respect, for before he came to that part of the structure, he seems to have exhausted his ideas, and to be fairly at his wits' ends.

Specimens of Decorations in the Italian Style. By J. W. and W. A. Papworth. London: Ackerman, 1844.

We suppose that the connexion of the elder Mr. Papworth with the Royal School of Design showed the necessity and utility of this work, which consists of selections from the splendid Roman publications on the decoration of the Vatican, after the designs of Raffaello, and sometimes called the Raffaellesque style. The popularization of these beautiful designs is a worthy work; and we had great pleasure some time ago in publishing in the *Journal* (vol. vi. p. 1) some able observations of Mr. Poynter relating to the Loggie, which he had read before the Royal Institute of British Architects. There is in the Loggie to be found abundant examples of original conception, pure taste, and luxuriant imagination, than which no better studies can be presented to the artist in arabesque. The subjects, however, are so extensive, and the work in which they are recorded so elaborate, as to be entirely beyond the means of the bulk of the public, no plan could therefore be better than to present a selection of them at a moderate price. The Messrs. Papworth's work fulfils these conditions, and we most earnest recommends its use. At the same time we think it due to the importance of the subject, and to the standing of Messrs. Papworth in the world of art, to make some observations as to the mode in which the design has been carried out. It is a decided improvement on the ordinary works of the class, with Louis Quatorze and Louis Quinze ornaments, and decorations by Watteau, Lancret, &c. It affords copious materials for borders, corners, centres, bands panels, frames, wreaths, brackets, finials, scrollwork, pateræ, bosses,, foliage, &c. Thus the artist and artizan will have abundant choice of subjects, not merely for pictorial representations on flat surfaces, but also for works in metal.

On the due application of such examples in study, we should have liked to have seen some observations, for which we know the competency of the Messrs. Papworth, for this volume will necessarily be sought after, and in many instances, instead of becoming a stimulus to ingenuity, will only be used as a refuge for dullness. We are not in favour of cram works, to which a stolid individual resorts, picks out two or three bits and joins them together, we cannot say combines or unites them. This is a grand evil and requires redress: we do not want Raffaello mutilated; we do not want art dislocated, and nature bepatched; but we want compositions which shall breathe the spirit of Raffaello, and follow out the course which he himself has shown. We do not expect that every one should be possessed of genius or originality, but the key note being given we may obtain a well modulated exercise, or the works of Raffaello may teach a still better lesson, "Go and study in the school that he did—in the world." We should have liked to have seen some observations on this subject from the pen of the Messrs. Papworth, or if not, they might have availed themselves of that able and interesting criticism of Mr. Poynter, to which we have already referred. With this they must be well acquainted; but we do not observe that they have profitted by it, or shown that refined discrimination, which we have a right to expect from them. The Chimæras with breeches on (Part 1st, Plate 2nd,) might well have been excluded, and indeed the fabulous animals so frequently introduced might without any great prejudice have been totally omitted. To the trophies, small vases, and St. Peter's keys, (Part 2nd, Plate 4th,) we must also object. These are trifling points; but a work by the Messrs. Papworth should show care in trifles, for it is perhaps destined to teach the elements of taste to many a poor mechanic. We also consider the drawing in many places, particularly of the human figures, very careless. It is very true the authors say, "To bring them within the means of every designer, no needless delicacy of the graver has been expended upon these—the amusements of our leisure hours." Delicacy and carelessness are, however, two very different things.

The selection is of a very fragmental character; that may in some idea attach to the nature of the work, but we should like to have a better selection and a better collation. There are many specimens in an impure Roman style, such as Adams has shown in the pilasters of the Adelphi, while we should more willingly have seen such graceful, broad, and beautiful studies, as the acanthus, in plate 6, of the second part. We think, too, specimens allied in style might have been brought together. As to style, however, our ideas are rather at variance with those of the Messrs. Papworth, who hold forth the application of some of these ornaments to the Elizabethian style. This sounds to us something like barbarism; but at the best it is a clap-trap to catch the plasterers and compo-builders. Why did not the authors introduce more of Raffaelle's admirable adaptations of fruits, flowers, birds, and animals in composition? These form an admirable basis for study.

The observations we have made we should esteem hypercritical if applied to individuals of less popular standing than the Messrs. Papworth, but they do at all detract from our recommendation of the work as one of great value, and we are indeed so highly satisfied with it, that we recommend to the consideration of these gentlemen the propriety of also publishing some of these ornaments on an enlarged scale, say folio, for the use of students in schools of design. The Messrs. Papworth have rendered great service by this publication, and we hope they will persevere in this course of instruction.

The Year Book of Facts in Science and Art. By the Editor of the *Arcana of Science.* London: Bogue, 1844.

This is the volume for last year of this popular annual register of the sciences, containing a number of facts collated from various works published during the year. We are sorry not to see so many references to standard authorities as in previous years.

The Art of Land Surveying for the use of Schools. By John Quested. London: Relfe and Fletcher, 1843.

This little manual is for the use of schools, to which purpose it seems well adapted; we must, however, regret that so many books are accumulated on this subject with so few new results.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

Feb. 13.—George Rennie, Esq. in the Chair.

A paper by Mr. J. Grantham described a series of experiments on an iron vessel called the *Liverpool Screw*. This boat was 60 ft. long, 12 ft. 6 in. beam, and had 3 ft. 9 in. draught of water; she was propelled by two high-pressure oscillating engines with cylinders 13 in. diameter, and 18 in. stroke; the pressure of the steam in the boiler varied from 50 lb. to 60 lb. per square inch, and it was cut off at one-fourth of the length of stroke, working the remainder by expansion; the nominal power was 20 horses, but it did not really exceed $18\frac{1}{2}$ horses. The cylinders were placed diagonally, with both the piston rods working on the same crank, the driving shaft being beneath the cylinders, and running direct to the propeller without the intervention of either gearing or bands. The screw propeller was enlarged three times, and at last was left at 5 ft. 4 in. diameter by 20 in. in length; it was set out with a pitch expanding from 10 to 11 ft. on Woodcroft's plan; it was made of wrought iron, with four short arms with broad shovel ends, whose united area was 16 square feet, 13 ft. only of it being immersed, as some portion of the arms was constantly above the water; the angle of the centre of the float was 45°; the speed of the propeller was generally 95 revolutions per minute. With these dimensions the speed attained was described as $10\frac{1}{2}$ statute miles per hour. The amount of "slip" of the screw in the water, as ascertained by Massey's log, was stated not to exceed 5 per cent. Several experiments were detailed, which showed that there was not more tendency to "list" or to turn round by the action of the screw, than with paddle-wheels, and the vessel was said to have excelled all the other steamers of the port of Liverpool in towing out vessels in a rough sea.

Designs were submitted on this principle for a steam frigate and for large steamers working with oscillating cylinders direct upon the main shaft.

In the discussion which ensued, the various forms and modifications of screw propellers, and their relative merits were very ably treated by a number of speakers.

Mr. Rennie gave a sketch of the introduction of a kind of screw used by Mr. S. Brown with his gas engine, which was tried on the Thames; the more successful attempt of Mr. Smith, and the building of the *Archimedes* and other vessels; he mentioned also the claims of Mr. Sauvage, of Boulogne, to the invention, and his being recently rewarded by the King of the French. Mr. Rennie entered largely into the theory of the forms of the propellers, and in this he was followed by Mr. Farey, Mr. Galloway, Mr. Samuda, and others, and Monsieur Normand, of Havre, who is celebrated for giving such superior forms to the vessels built by him: he gave a slight sketch of the *Napoleon* French frigate, in which he eulogized the engines constructed by Mr. Barnes and the general result obtained with the vessel, but it appeared that the speed was not superior to what had been obtained with paddle wheels.

Pump Valves.—A model was exhibited by permission of Sir H. T. De la Bèche, from the Museum of Economic Geology, showing all the kinds of valves used in the pumps for draining the Cornish mines, and the merits and defects of the various kinds were very ably explained and commented upon by Mr. Jordan, under whose directions the model was constructed. Mr. John Taylor gave an historical sketch of the introduction of the various improvements, the causes which led to them, and the effects they had produced; the length of the discussion on the screw propeller left so little time for the subject of the valves that it was announced to be renewed at the next meeting, on Tuesday, February 20th.

THE ROYAL SCOTTISH SOCIETY OF ARTS.

January 22.—Professor Traill, M.D., F.R.S.E., President in the chair.

The following communications were made:—

1. Sir George S. Mackenzie, Bart., exhibited three elegant specimens of Mr. Cheverton's work in ivory, in a different style from that formerly shown, and communicated part of a letter from him. The subjects were the Mercury and Pandora of Flaxman, and Morning and Night by Thorwaldsen. These specimens were much admired. They can be executed at twenty guineas, inclusive of the frame. Their effect, when viewed as semi-transparencies, is also very fine.

2. *A Ball and Socket Levelling Instrument*, constructed by Mr. Adie, for Thomas Stevenson, Esq., C.E., and also an improved Portable Levelling Instrument and Rod, were exhibited. Communicated by David Stevenson, Esq., F.R.S.S.A., civil engineer. In this ball and socket spirit-level, designed by Mr. Thomas Stevenson, civil engineer, the first peculiarity is the substitution of a small circular level fixed upon the upper side of the tube for facilitating the setting of the instrument, instead of the delicate cross level at present in use. But the principal advantage of Mr. T. Stevenson's improvement consists in the combination of the ball and socket motion for the first setting, previous to the application of the parallel plate screws for the final adjustment. The ball and socket was long in use, but for about half a century it has been almost entirely discarded, and the parallel plate-screws substituted. In the level exhibited to the Society, the ball and socket has been restored, and the parallel plate screws retained, so that by this union the advantages peculiar to both systems have been attained. The person using this instrument is in consequence rendered quite independent of the rugged nature of the ground on which it is set, or the inclination of the telescope to the horizon, as by looking first at the small circular level, he can in an instant bring it nearly right by means of the ball and socket, after which, a slight touch of the parallel plate screws perfects the adjustment. In this way the observer can set his instrument with exactly the same rapidity and ease on a steep slope as on level ground, and is enabled to proceed with equal facility at such rugged stations as would in the instrument now in common use altogether exceed the range of the parallel plate screws. The practical surveyor will see the great saving of time and trouble resulting from the use of Mr. Stevenson's instrument.

Mr. David Stevenson also showed a *portable level and rod*, constructed to his directions, by Mr. Adie. With nearly the same accuracy as the large levels, this instrument possesses the advantage of much greater portability. It combines a telescope 10 inches long, a compass, and a level, and is packed in a flat leathern case measuring about 6 in. by $2\frac{3}{4}$ in., rendering it very convenient for perambulatory surveying, for which it was made. It rests on a tripod, which is also very portable. The levelling rod accompanying this instrument, when closed, forms a round staff 3 ft. 6 in. long, which is cut longitudinally through the centre. The two parts are hinged at one extremity, and when the rod is to be used they are opened and fixed by a spring. The scale is marked on the flat side, and when the staff is closed the figures are protected from injury.

3. (Part 1.) *Observations on, and Improvements proposed in the Ventilating and Warming of Factories;* with Remarks upon the essential importance of pure air for the preservation of the health of those engaged in employments carried on in a confined atmosphere, whatever be its temperature. By Robert Ritchie, Esq., Civil Engineer, Edinburgh. The first part of the paper gave a short account of the different methods which had been employed in heating factories by steam pipes, as now nearly universally adopted, describing the manner in which these were generally arranged; and concluded with a short description of improved ventilating arrangements which had been adopted in some extensive factories.

SECOND GENERAL MEETING OF THE ARCHITECTS AND ENGINEERS OF GERMANY.

Held at Bamberg on the 8th, 9th, & 10th of September, 1843.

We find in the *Allgemeine Bauzeitung* an account of the second meeting of the architects and engineers of Germany, which was last year held at Bamberg in Bavaria, on the 8th, 9th, and 10th of September. The first meeting was held at Leipsic. The meeting at Bamberg was held in the public assembly room, called the Concordia. Around the hall were exhibited the architectural drawings sent to the meeting.

Sep. 8th.—A public breakfast was held early in the morning. The rest of the morning was employed in the examination of the cathedral and other curiosities of the city. At 11 the meeting commenced, when Herr Barlet welcomed the members to Bamberg in the name of the citizens. To this speech Dr. Puttrich replied in the name of the members.

Dr. Puttrich then took the chair.

Professor Stier read a paper containing some remarks on the present state of architecture and its early condition.

Professor Wiessenfeld, of Prague, then communicated a plan for a third bridge at Prague, of wood, and of large span, to cross the river Moldau. The design was by a carpenter of Prague, for a colossal structure of wood and other materials, partly on the suspension principle, the span of which is proposed to be of 600 feet. A long discussion ensued on this, but without any determinate conclusion being come to as to its practicability.

Sep. 9.—Professor Stier opened the meeting with a paper on architecture, on rectilinear and arched or curved architecture, and their prospects in the present day.

Herr C. W. Hoffmann, architect, of Berlin, made a communication on the discovery by Ehrenberg of infusorial earth.

Herr Krafft, C.E., of Stettin, read a paper on béton or concrete foundations, as applied by Herr Neuhaus, C.E., on the Stettin Railway along the Oder, where it had been necessary to build a coffer-dam 30 ft. to 35 ft. deep, the depth of water being upwards of 20 ft. Herr Krafft strongly recommended the use of concrete for such purposes. In the present instance a strong sheathing of planks covers the water side and the inside, within which the concrete is rammed in to about a foot below the lowest water line and the rest of the wall of the embankment is then carried up with masonry. In the second design the masonry is also supported by piles under the concrete.

Herr Kollman, architect, of Augsburg, made some observations on the various legal rights existing with regard to water power, and the want of defined principles of legislation affecting it.

Herr Winkelmann, architect, of Berlin, gave an account of an improvement in Cupel furnaces introduced into the royal foundry at Berlin, and also into Borsig's foundry, consisting of a new arrangement of the blast-holes. The furnace is surrounded with a hollow cast iron girdle, having eight blast holes communicating with the furnace. The blast is said to be so much increased as to melt with 20 lb of coal 2½ cwt. of iron, whereas before it melted only 1½ cwt. Another advantage of this plan is, that by means of a pane of thick plate glass, set on the outside, the progress of the melting can be watched.

Herr Winkelmann also exhibited a model of the trussing for a bridge on a new construction.

Herr Hermes, architect, of Schwerin, gave a description, with drawings, of an improvement on the Turbine, introduced by Herr C. L. Nagel, of Hamburgh.

After dinner, at twelve or one o'clock, the Association took a trip by water to examine the Ludwig canal.

Sept. 10.—The Association met at breakfast at seven o'clock in the morning, and afterwards examined the City picture gallery. The business proceedings began at ten o'clock. The time for the meeting this year was left to the committee, and it was suggested that four days' meetings should be held instead of three. The place of meeting fixed upon is Prague.

This routine business being over, the company went to examine the collection of paintings belonging to the Cathedral Chapter. At two o'clock the grand celebration dinner was held, when a hundred sat down. Thus concluded the proceedings.

The number of members who attended was 90, and the number of drawings exhibited was 129, very few of them, however were original, principally studies and representations of churches. They filled four rooms.

NOTES OF THE WEEK.

A most important discovery connected with Egyptian antiquities has been made, fully confirming the anticipations of the great Dr. Young, that copies would be found of the decree inscribed on the Rosetta stone. Dr. Lepsius, in charge of the Royal Prussian Expedition, has discovered in Nubia a perfect copy of the decree, including the demotic inscription. This was announced last week in the *Literary Gazette*, and very great results are anticipated.

By the return of the Commissioners of Woods and Forests we find they have very laudably appropriated £580. to the purchase of old tenements, obscuring Holyrood House, and £711. for a similar purchase as connected with Arbroath Abbey. We wish this department were charged with the maintenance and restoration of our ancient monuments. In Scotland alone many fine ecclesiastical edifices might be preserved, which are now going to ruin.

A statue of General Bertrand is proposed to be erected by public subscription at Chateauroux, his birth-place.

A mining engineer is employed by the French government expressly to look after the mineral springs in France.

An exhibition of paintings will be held at Ghent next July, which will, it is said, be well worthy of the contributions of foreign artists, and of their examination.

A bronze statue by M. Moldknecht, life size, is to be erected at Condé sur Noireun to Captain Dûmont D'Urville, the navigator.

Mr. Cavé has lately completed a pair of 150 horse oscillating engines, or the two equal to 300 h.p., for an iron steam vessel, which he has likewise built for the French Government in Senegal; it is to be propelled by a screw made entirely of wrought iron, galvanized and coated with a peculiar varnish to prevent its corrosion by salt water. By a very simple contrivance, for which Mr. Cavé has taken out a patent in France, the screw can at all times be disengaged from the gearing and brought upon deck, so that the speed of the vessel may not be impeded by it when there is a sufficiency of wind to use sails without steam. Before Mr. Cavé decided on adopting any peculiar sort of screw, he caused an iron steam boat, with a steam engine of the power of 20 horses, to be tried up the river Seine, to be propelled by at least 20 different shaped screws, till at last he found one more effective than the other, which he adopted for the vessel.

We perceive by the daily papers that the launch of the *Janus* steam-frigate took place on Tuesday, the 6th instant, at Chatham Dock-yard, being a vessel of peculiar construction, designed by Vice-Admiral the Earl of Dundonald, better known as Lord Cochrane. After the launch she was taken charge of by the master-attendant, and was warped alongside the sheer hulk to have her machinery fitted. The form of the body of the vessel nearly resembles that of a wedge towards the extremities, is precisely similar at both ends, and is, consequently, capable of moving in either direction with equal facility; her capabilities of advancing and retreating in narrow channels, for the purpose of offensive warfare, are thereby made perfect. The following are her particular dimensions:—

	Feet.	Inches.
Length between the perpendiculars	180	0
Length of keel for tonnage	159	1
Breadth, extreme	30	0
Breadth, moulded	29	4
Depth in hold	19	1
Tonnage, old measurement .. 761 53-94		
Intended load draught of water, with 260 tons of coals	11	2
When launched her draught of water (with 40 tons of ballast on board), was—Forward ..	7	5
Abaft ..	7	2

The *Janus* is fitted with a rudder at each extremity, but on ordinary occasions one only will remain in place. The tillers work on deck. She has two capstans, and is provided with a pair of hawser-holes abaft as well as forward, but only one pair of riding bitts and one pair of catheads. Her armament will consist of a 10-inch gun at each extremity, throwing hollow shot of 86 lb. weight, and she will also be capable of mounting two 42-pounder guns. The engine by which this vessel is to be propelled is an invention of the gallant earl who designed her. It is to be a rotatory engine, which, it is said, will not occupy more than one-sixth of the space required for the common reciprocating engine. It may be placed so low as to be out of reach of gun-shot; it will have no beams, cranks, side rods, parallel motions, levers, &c.; and it may be fixed in less than a quarter of the time now required for fixing marine engines. While its first cost is considerably cheaper, it may be more easily kept in repair, (?) in the opinion of the projector, than the steam machinery now in use on board vessels of war.

A Government trial of the *Screw Propeller* took place on the 3rd instant with her Majesty's steamer *Rattler*, at the measured distance in Long Reach, in order to determine, as correctly as possible, her rate of going, as compared with that of her sister ship, *Prometheus*, which had been ascertained by the Government authorities the day before, by a similar trial. The *Rattler* having been built for the purpose of testing the merits of the screw propeller with those of the paddle wheels, is constructed as nearly as possible upon the lines and models as the *Prometheus*; they have both the same amount of engine power—viz., 200 horses; both vessels were laden to the same draught of water—viz., 11 ft. 3 in.; the steam pressure in both cases was regulated alike—in fact, every thing that could be conveniently done to render the trial a fair one was duly attended to. Under these circumstances more than ordinary interest was excited amongst the naval and engineering officers connected with the Woolwich Dockyard establishment, by whom the results of the various trials of both vessels were most minutely noted, and in the end summed up, contrary to the general expectation, in favour of the *Rattler*, to the extent of nearly half a knot per hour, their relative speed being as follows:—*Prometheus*, 8·757 knots; *Rattler*, 9·240 knots, or within a fraction of 10¾ statute miles per hour. The *Prometheus* is one of the third-class war steamers recently introduced into her Majesty's navy by the present surveyor, Sir William Symonds, and is, we are informed, under orders to sail almost immediately for the Mediterranean.

SEVERN IMPROVEMENT.

The Lincoln Lock and Weir being the first of the series connected with this important work, have been brought into full operation. The lock is 100 ft. long by 20 ft. wide, with a lift of 7 ft. at low water. The walls and invert are faced with blue Staffordshire bricks of excellent quality, and are built upon a foundation of red sandstone rock. The water is let in and discharged through a culvert 7 ft. high by 4 ft. 6 in. wide, built in one of the walls, and running parallel with the lock chamber, with which it communicates by seven arched openings, by this arrangement the lock is filled with such rapidity that vessels have been passed through it in 2½ minutes.

The weir which is 300 ft. in length, is constructed of two rows of sheet piling, the waling of which form the upper and lower sills, the intermediate space being filled with blocks of red sandstone; a large quantity of this material is also placed below the lower sill to protect the piles from the action of the water. Both the lock and the weir are placed in artificial cuttings, which arrangement required the waters of the Severn to be diverted from their original course. From a variety of causes this was a work of no small labour and difficulty, but it was successfully performed, and the water was turned into its new channel over the weir on the 30th of December last.

Four other locks, one being 150 ft. long by 30 ft. wide, together with their accompanying weirs, which range from 300 to 400 ft. in length, are in course of construction between Stourport and Deglis, near Worcester. The works below Worcester consist of a series of embankments, and the deepening of the navigable channel by dredging.

The whole of these works is being executed under the direction of Wm. Cubitt, Esq., as engineer in chief; Mr. E. Leader Williams, being the resident engineer, and Messrs. Grissell and Peto, the contractors.

CANNABIC COMPOSITION ORNAMENTS.

At the last meeting of the Royal Institute of British Architects and the Institution of Civil Engineers, several ornaments of this new material for decoration were exhibited. Any new material that may facilitate the introduction of ornaments into our dwellings cannot be otherwise than acceptable, for fortunately a great demand exists in the present day for decorations.

The Cannabic composition is an Italian invention, which, although it has been some years in existence, has only lately been brought to such a degree of advancement, as to justify its introduction into this country. The material which is used in this composition is the common hemp, which possessing great tenacity and equal pliability at the same time that it is procured in abundance and at a moderate price, affords every facility for carrying out the invention. It admits of application to any internal architectural ornament, as ceilings, bosses, truss moulding, brackets, panels, capitals, pilasters, and mouldings of every kind and in every style, as well as for external purposes. It has an exceedingly good surface, admitting of any kind of varnish, paint, or finish. For gilding it is most admirably adapted, likewise for painting, varnishing, burnishing, and bronzing, as may be seen, by specimens at Mr. Ponsonby's, the gilder and decorator in Piccadilly. It takes a beautiful bronze colour, and by gilding acquires quite a metallic surface and high burnish. The advantage of these properties in decoration will be well appreciated by the architect, as giving new resources for carrying out his ideas. Neither are the consistency and durability of the material less observable, being at the same time hard and elastic. From these properties it is not liable to crack when put up in a room. It possesses a great degree of sharpness and boldness, which it is the intention of the patentees to increase by using a greater degree of mechanical power. It is such a light material that it admits of being put up in large masses on ceilings and in other situations in relief. With regard to external properties, it is not at all effected by wet nor by the vicissitudes of the atmosphere, being waterproof. In centre pieces for ceilings, door-panels, and other compositions, as it admits of being executed in larger pieces, it is much less troublesome than the ordinary materials. The number of patterns for selection in the cannabic material at the present moment amounts to about four hundred, many of them quite new; but this number will speedily be increased, while the patentee will be most happy to afford every facility to architects who may wish to have patterns executed from their own designs.

The price, it is stated, ranges from about 10 to 20 per cent. below the prices of articles in common use, and it is on this ground that the patentees expect its extensive application. For decoration in the colonies and the East and West Indies, great difficulties at present exist, as most materials suffer rapid deterioration from the climate. The supply of a durable and cheap material will therefore be the means of extending ornamental decoration in our extensive possessions: it is likewise well adapted for the decoration of steam vessels.

ON SUPPLY OF WATER AT FIRES.

A great many proposals having lately been urged upon Government with the view of establishing in London, and all the large towns throughout the provinces, a system for the more speedy extinction of fires, viz., by attaching hose or leathern pipes, with branches, to the plugs and mains laid down in the streets, so that the water might be thrown to a sufficient altitude by its own pressure, without the aid of fire-engines, an experiment a few days since was made by Mr. Quick, the engineer of the Southwark Water Company, in order to ascertain how far it could be made applicable. The company not having the necessary apparatus to make the trial, the assistance of the Fire Brigade was granted to carry out the experiment, Mr. Braidwood, the superintendent of the force, being present on the occasion, the particulars of which will be found to be highly important. The report, which is extremely voluminous, states that it took place on the morning of Thursday, 8th instant, between the hours of 4 and 9 o'clock, Mr. Quick selecting Old Gravel-lane, Union-street, and Tooley-street, as the most favourable spots to carry on the operations. During the whole period the pressure of water at the company's works at Battersea was kept at 130 ft., and every service pipe or outlet was kept shut, so that the trial should be fairly made. The first experiment took place in Union-street, by having lengths of rivetted leathern hose ($2\frac{1}{2}$ in. in diameter and 40 ft. long) attached to 6 standcocks, placed into plugs, all situate within the space of about 700 yards. The water was conveyed from the head at Battersea, through 5,300 yards of iron piping, consisting of 4,250 yards of 20-in. main, 550 yards of 15-in. main, and 500 yards of 9-in. main. On one standcock being opened, the jet of water thrown from the copper branch (with $\frac{7}{8}$-in. hose pipe on) reached an elevation of 50 ft., and the delivery was at the rate of 100 gallons per minute. The next object sought was to ascertain the quantity of water that could be obtained from the plug. The branch-pipe for this purpose was taken off, but the length of hose remained on. The delivery was then found to be 260 gallons per minute, showing that nearly two-thirds of the water was lost by confining it to a small jet. Had the standcock and hose been taken away, there would have been quite sufficient water to supply three fire-engines, each delivery being equal to the discharge from the first standcock. Another was then opened, and the jet from the former was reduced to 45 ft. elevation. Other two were added, and the jet of the first was then 40 ft.; and on three being opened, the jet from the first rose to 35 ft. The fourth was opened, and the jet of the first decreased to 30 ft. The fifth was then brought into play (viz. six in all), and the jet from the first only measured 27 ft., fully showing that there was a regular gradation in the height of the jets, according to the number opened. The next trial was made in Tooley-street, the standcocks being used as in the former case. Some slight difference was observed in the elevation to which the jets were thrown, the first gaining 60 ft.; and when the whole were opened the height was reduced to 40 ft., the delivery of water being at the rate of 70 gallons per minute. Another trial was then made in a street leading into Tooley-street, where there was only a service-pipe laid down, called a 5-in. main. The first standcock threw a jet of 40 ft., and on the others being opened, the one furthermost from the first started only emitted a jet of 24 ft., and a delivery of 58 gallons.

FAILURE OF A QUAY WALL.

A good many years since a breast wall or quay was built at Ardentallan, in Argyleshire, for shipping stones from a quarry at which much work has been done. When Mr. David Smith, builder, at Oban, was erecting the beacon of Skervuil in Jura Sound, for the Northern Lights' Board, he fitted the courses of blocks for that work to their places on the quay, and has occasionally had upwards of 260 tons of stones upon it at a time, without accident. The quarry has lately been worked for the repairs of the Caledonian Canal, and on the 23d ult. there were between 170 and 180 tons of dressed stones lying upon the quay ready for shipment, when, to the astonishment of the quarriers, the crane upon the quay was observed to move and shake without any visible cause, and some openings appeared at the surface of the quay, which were rapidly widening; the men on the instant cried out for the foreman, who rushed to the spot, and saw the quay, with its crane and the cairn of blocks upon it, moving outwards from the shore, and sinking in the deep water; and in less than two hours the whole had proceeded seaward about 50 yards, and settled with a depth of 11 ft. water over them. This quay was 48 yards in length, and had a large space behind for arranging materials for shipment. The face wall was founded one foot under the lowest tide mark, upon a bed of strong blue clay, covered with a thin stratum of gravel; and at 100 yards from the site of the quay the water deepens to 4 fathoms. It is remarkable, that with much heavier loads this breast work should have stood so long without any apparent failure, and after the foundation was so much consolidated, that it should have completely left its site and settled in deep water. The whole mass is now so completely absorbed in mud and clay, that although the height of the quarry and materials could not be less than 20 ft., it has not lessened the depth of water at the entrance of the place.—*Scotsman.*

MEETINGS OF SOCIETIES FOR THE ENSUING WEEK.

Monday.—Royal Institute of British Architects at 8.—Some original Drawings, by Frederick Catherwood, Esq., Architect, Honorary and Corresponding Member, of Architectural Antiquities recently discovered in some ruined Cities in central America, will be exhibited and described.
—Chemical Society, at 8.

Tuesday.—The Institution of Civil Engineers at 8.—"Description of a bridge across the river Shannon at Portumna," by T. Rhodes, M. Inst. C.E.—"Description of a bridge over the river Whitadder at Allanton," by J. T. Syme.—"Description of a cast and wrought iron trussed girder for bridges, with a series of experiments on their strength," by F. Nash.

Wednesday.—Society of Arts, at 8.
—Geological Society, $8\frac{1}{2}$.
—London Institution, Finsbury Circus, at 7.

Thursday.—Royal Society, at $8\frac{1}{2}$.—Society of Antiquaries, at 8.

Friday.—Royal Institution, at $8\frac{1}{2}$.

Saturday.—Royal Institution, at 3.—Professor Brande, "On the Chemistry of Agriculture." Lecture IV.

AGRICULTURAL CHEMISTRY.

By Professor Brande, F.R.S., &c.

Lecture III.—*Delivered at the Royal Institution, Feb. 10, 1844.*

(Specially reported for this Journal.)

If the agricultural chemist had been asked, a few years ago, what were the essential ingredients of the soil, he would most assuredly have said that the earths and the organic matter present were all that were important; but that the principal part of the nourishment was due to the organic matter, and that the saline ingredients were of very little use. Now, however, he would have quite a different story to tell, and it is principally to Liebig that we are indebted for a more correct view of the subject; for it is now proved beyond doubt, that although the salts present in the soil may form a small per centage of the whole, yet they must not be considered as accidental, but as being perfectly indispensable to the plant, which, according to its nature, takes up one or other into its circulation, and without which it could not exist. By the salts must be understood all the substances consisting of a base united to an acid. The principal bases are potash, soda, lime, and magnesia; these are always present in fertile soils. The acids with which they are generally in combination are the carbonic, sulphuric, and phosphoric acids, and frequently silica, so that when the chemist talks of flint, he sometimes speaks of it as an acid, which it really is; for although not sour to the taste, being insoluble, it combines with bases, forming neutral and frequently soluble salts, which is a better proof of being an acid than the action on the tongue. When plants are burnt so as to destroy their organic part, their saline constituents alone are left, forming the ashes of plants, and the quantity of ash varies greatly with different plants and with different parts of the same plant, as will be evident by inspecting the following table:—

Quantity of Ash in 1000 parts of

Hay	90	Potatoe . . .	40	Birch	3
Red Clover . .	77	Turnips . . .	70	Oak	2
Wheat	12	,, leaves .	130	Elm leaves . .	120
,, straw . .	60	Elm	20	Willow leaves .	82
Oats	40	Willow . . .	5	Beech leaves .	42
,, straw . .	50	Beech . . .	4	Birch leaves .	50

An investigation of the properties of the principal salts in the soil and their components will make this part of our subject more intelligible. And first of their bases. These are metallic oxides, the metals of which were first obtained in a separate state by Sir H. Davy. They are named, respectively, of potash, potassium, of soda, sodium, of lime, calcium, of magnesia, magnesium, of baryta, barium, &c. But potassium, which, is, perhaps, the most easily obtained, may be taken as the type of the class. It is a white metal, like silver, lighter than water, which is also the case with sodium. When thrown into water it runs over the surface, decomposing it with great rapidity, liberating its hydrogen, which ignites from the heat evolved, and combining with the oxygen, forms potash, which is instantly dissolved. The alkaline property of the solution, may be rendered evident by its action on vegetable colours, turning yellow to brown, and frequently red to blue. If acids be added they will combine with it, forming neutral salts, which may be obtained by evaporation. The other alkaline metals go through the same process, although none so energetically as potassium; though sodium approaches very nearly to it in this respect. The proportions in which they combine are,

40 parts potassium to 8 oxygen, producing 48 potash,
or 24 ,, sodium to 8 ,, 32 soda.

From these figures it will be evident that wherever soda can be used as a substitute for potash, 32 lb. would do the work of 48 lb. of potash.

As it is very important to the agriculturist to ascertain whether a soil contains salts of potash or of soda, the distinguishing tests must be borne in mind. In order to get them in a proper state for testing, boiling water is poured on to a portion of the soil, and then the whole poured on to a filter; the water running through carries away all the soluble portions. If this be then evaporated, the resulting salt will frequently indicate, by its shape, solubility, and behaviour in air, which base it contains. They are generally in combination with sulphuric acid, and if it be the sulphate of potash present, it will be found to be very slightly soluble, and remaining unchanged by exposure; whereas if it be the sulphate of soda, it will be very soluble, and by exposure to air, become covered with a white powder, or efflorescence, as it is termed. This arises from its giving up to the air some of the water which it had combined with when crystallizing, and so falling into a white powder. The tests most commonly used in the laboratory, are tartaric acid and chloride of platinum. When the former is added to a solution containing soda, no precipitate is produced; but if to one containing potash, a very copious crystalline precipitate is produced of bi-tartrate of potash, or as it is commonly called, cream of tartar. When there is very little potash present, t forms very slowly, but it may be hastened by rubbing the sides of the vessel with a glass rod, when the crystals are deposited on the parts where the rod has rubbed, as though a little tickling coaxed the solution to deposit its crystals m re rapidly. With the chloride of platinum, soda gives no precipitate, but potash yields abundantly a yellowish brown deposit, consisting of the double chloride of platinum and potassium.

Some plants absorb but little alkali from the soil, whilst others take an immense quantity. Amongst the latter is the common wormwood, which impoverishes a soil of its alkali in a very short time. Indeed, so well known is that, that it has, for years past, been collected and burnt, and its ash, known as salts of wormwood, applied to many purposes on account of the quantity of alkali it contains. Similar to this is the grape, which appropriates to itself abundance of potash, which it deposits from its juice in fermenting, as salt of tartar. The alkalis are seldom found combined with carbonic acid, for although they are so in the ashes of plants, it arises from the decomposition by heat of other organic acids, they being converted into carbonic acid. In the wood sorrel, for instance, the juice is intensely sour, owing to the presence of binoxalate of potash; but after being burned, the oxalic acid is all decomposed into carbonic acid, the whole of the salt having become carbonate of potash.

But it will be interesting here to notice the bases of the inorganic acids. Silicic acid or silica has already been touched upon. Sulphur, the base of sulphuric acid, familiar to every one as brimstone, is found in nature both free and in combination; free, in abundance in Sicily, and in combination, plentiful in our own islands. With iron it is exceedingly common as iron pyrites or sulphuret of iron; recognized in coal by its bright yellow colour, and washed out of our chalk cliffs in rounded masses of almost every size, which are commonly looked upon as thunderbolts. When sulphur combines with oxygen, it forms sulphuric acid, which takes place spontaneously when iron pyrites is exposed to air and moisture. This acid may be formed artificially on a small scale by immersing a lighted mixture of sulphur and saltpetre (nitrate of potash) into a jar of oxygen gas standing over water; the sulphur then burns with a beautiful blue flame, combines with the oxygen, and forms sulphuric acid, which is dissolved by the water, forming a weak solution of oil of vitriol. Now this is remarkable for its fixity, so that it may be placed in a proper vessel over the fire, and the water boiled away, leaving the sulphuric acid. This is the method commonly employed in the manufactories for strengthening it. The acid consists of 16 parts of sulphur, 24 of oxygen and 9 of water, forming 49 parts of the strongest oil of vitriol. This acid is very rarely found free in the soil, as its noxious properties would make it the most sterile of land. But as will be shown hereafter, some plants possess the property not only of separating the acid from its alkili, but even of separating from it the sulphur, which it employs to form new combinations, as for instance, the essential oil of the mustard, and the radish, in which there is a considerable quantity of sulphur. But decaying vegetables will do the same, the sulphur in this case combining with the hydrogen which is being given off, and forming the offensive gas, sulphuretted hydrogen, familiar to all who have smelt a foul gun barrel, or a rotten egg. It is to this decompostion is due the nauseous smell of water in which vegetables have been boiled, and is continually taking place at the mouths of rivers, which empty into the sea vast quantities of rotting vegetable matter, which there meets with the sulphates in the sea water, and the decomposition takes place. Ships anchored in such situations have their copper corroded off in one-half the usual time, and to the same cause is also attributed the unhealthiness of certain African rivers. But although sulphuretted hydrogen is known to be very destructive of life when present in considerable quantity, it is doubtful whether it is so injurious to man when in the minute quantity which it must be in the open air, even in the worst situations; the daily experience of the chemist would seem to confirm this, for, from its being so much used as a test, he is continually breathing an atmosphere sensibly impregnated with it, and yet with impunity, as it has never been known to produce any effects analogous to the eastern fevers. To other causes, then, must be attributed the contagious influences present in the air of these shores, and nothing seems more probable than that it is due to certain decomposing organic particles, acting on the blood in the manner of a ferment. The best test for its presence, either in solution, or in the air, is a solution of sugar of lead, which it blackens even if present in a very minute quantity, producing sulphuret of lead. Though sulphuretted hydrogen is undoubtedly very pernicious to animal life, it is not so to plants, and its solution in water has been used with advantage even in horticulture, by Sir E. Solly. Indeed it is essential that many plants should be supplied with sulphur in some shape or other, as they require it to assist in forming some of their constituent parts. The gluten of wheat, for instance, could not be formed without it, and it is essential to the mustard, cabbage, turnip, water cress, and indeed to the whole of the large class of cruciferous plants. From this it is seen that the alkaline sulphates are frequently doubly useful in the soil, as being the source of alkali and also of sulphur. Their presence in solution is readily ascertained by baryta dissolved in nitric or muriatic acids, which forms the very insoluble white sulphate of baryta, not redissolved by nitric acid. By this means it is proved that whereas in wood ash the alkali is present as carbonate, in coal ash it is as sulphate, which is therefore a good top dressing for many crops.

When combined with lime, sulphuric acid forms sulphate of lime or gypsum. It is found in great abundance in many parts, in the neighbourhood of Paris as plaster-stone, where it is rendered anhydrous by burning, converting it into plaster of Paris, as it is termed. It crystallizes beautifully as selenite, found in clay districts. Satin spar is also a very beautiful variety of this substance. It is found anhydrous also, but not frequently. It exists in considerable quantity in the rock salt of Cheshire. In some countries it is found to form so large a portion of the rock salt, even of some kinds which are eaten at table, that if the table salt be dissolved from it, it still retains its form, as a spongy mass. In this way whole mountains are said to be disintegrated. This will also serve to explain an expression of scripture, which is otherwise obscure to us who use salt in a state of purity, respecting salt losing its savour; if a mass of rock salt containing much sulphate of lime, be exposed to heavy showers, the table salt is dissolved out, the original shape still being retained; and thus salt may be said to lose its savour. Of the virtues of gypsum as a manure, the agriculturist has lately heard a great deal, but there is no doubt that its virtues have been highly exaggerated. There is very little proof of its being useful to any plants which do not include sulphate of lime in their composition; but as lucerne, saintfoin, clover, and turnips contain a portion, there is no doubt it is of use to them, when applied as a top dressing. There are cases in which red clover may spring up, promising luxuriantly, but ultimately die away—the soil is tired of clover, as the farmer says; in this case sulphate of lime is frequently of great service, though it is by no means the only substance clover requires. We have Johnstone's evidence that clover and vetches are both improved by its use. Indeed the ashes of many plants show that they require it, as their sulphates frequently amount to as much as 10 per cent. of the ash. A wagon load of gypsum is said to be sufficient for 30 or 40 acres. The water falling on the surface slightly dissolves it, one part requiring 500 or 600 of water for solution. It may be owing to its sparing solubility in water, that we have so many contradictory statements of its efficacy, as the farmer who uses it on very dry land, or during a very dry season, would perhaps derive but little benefit from it.

The consideration of the phosphates, of bone manure, with the relation of the inorganic to the organic constituents of plants, will form the subject of the next lecture.

REGISTER OF PATENTS.

MACHINERY FOR CUTTING STONE.

Charlton James Wollaston, of Welling, Kent. Gentleman, for "*Improvements in machinery for cutting marble and stone.*"—Granted August 1. 1843; sealed February 1, 1844.

The first part of these improvements consists in a machine or apparatus for cutting blocks of marble or stone; the machine consists of a rectangular or oblong table of iron or other suitable material, supported upon the framing of the machine in a horizontal position upon two V slides, and is capable of being moved thereon in a direction of its length. On each side of the machine, and about the middle thereof, there is a vertical frame, and to this frame are attached the cutters, which are set at some distance apart, and stand off from the edge of the frame at different distances, so that each cutter, beginning from the lower one, will make its cut further and further into the block of marble or stone (which block is placed and secured by set screws upon the table of the machine), so that the cuts in the side of the stone will form a succession of steps, which peculiar arrangement of the cutters forms the principal feature in this part of the invention. The frames and cutters are moved up and down in a vertical direction by means of two connecting rods, each of which are attached by one end to the cutter frame, and at the other or lower end to a stud fixed into the face of the wheel, keyed on the end of a horizontal shaft, running under the table of the machine, the rotary motion of which gives the necessary motion to the cutter frame; the extent or range of the cutter frame can be regulated by putting the pin into certain holes drilled in the face of the wheel, at different distances from the centre thereof. There are also certain arrangements for moving the table upon which the block is fixed, so that the stone on the return stroke of the cutter frame moves back for giving clearance to the cutters, but when the same are about to cut into the sides of the block of stone, the table is moved forwards equal to the distance given for the clearance, and the depth intended for the next cut, all of which movements are self-acting or governed by the mechanical arrangements of the machine.—The second improvement consists in a mode of making stone pipes. The block of stone intended to be bored out is placed with its end upon a table; below the table, and in a vertical position, there is a metal tube, on the upper end of which is fixed several cutters; the table upon which the block of stone is fixed can be lowered by means of a screw, upon the end of the tubular cutter, which cutter, having a rotary motion given to it, bores a hole into the end of the stone equal in diameter to the cutter, the portion of stone cut out passes through the tubular cutter.

BLACK DYEING.

Frederick Steiner, of Hyndburn Cottage, near Accrington, Lancashire, Turkey Red Dyer, for "*A new manufacture of a certain colouring matter, commonly called garancine.*"—Granted August 8, 1843; enrolled February 7, 1844.

This invention relates to a mode of obtaining a colouring matter commonly called garancine, from spent madder, or madder after it has been used for dyeing, and is performed as follows:—The inventor constructs a large filter of brickwork, but without mortar, outside the dye-house, that is to say, a hole is to be dug in the ground, and lined with bricks, and upon the bricks is placed a quantity of stones or gravel, and a piece of fabric, such as common wrappering, and below the filter there is a drain to take off the water which passes through. A quantity of diluted sulphuric acid, of the specific gravity of 105°, water being 100°, is kept in a vessel near the filter; the spent madder which has been used for dyeing is allowed to pass, by means of a channel, from the dye pan to the filter, and when running in a portion of the dilute sulphuric acid, is allowed to run in with it, which changes the colour of the madder to an orange tint; after the water is drained off, the residue is put into bags, and the same put into an hydraulic press, and afterwards passed through a sieve, the madder is then put into a wooden or leaden vessel, and to every 5 cwt. of madder 1 cwt. of sulphuric acid of commerce is added by sprinkling, and the whole thoroughly mixed together. The madder in this stage is placed on a perforated lead plate, fixed about six inches from the bottom of a vessel, and between the bottom of the said vessel and the perforated plate, a quantity of steam is introduced, which passes through the said perforated plate and mixture contained in the vessel; a substance will now be obtained of a dark brown colour, approaching to a black, this substance is garancine and insoluble carbonized matter. The substance after being thrown out to cool, is washed with a quantity of clear cold water until all the acid is destroyed; it is then submitted to pressure, and after being dried in a stove is ground between a pair of ordinary madder stones, after which from 4 lb. to 5 lb. of carbonate of soda to every 100 cwt. of the mixture may be added to neutralize any acid which may remain. The patentee claims the manufacture of garancine from spent madder, or madder after it has been used for dyeing.

A NEW SUBSTANCE FOR PAPER.

Richard Archibald Brooman, of 166, Fleet Street, London, Gentleman, for the "*Manufacture of paper, cordage, matting, and other textile fabrics, as also for the application of the said materials to the stuffing of cushions and mattresses.*" Granted August 10, 1843; enrolled February 10, 1844.—Communicated.

This invention consists in a mode of manufacturing paper from the convolvuli of the cissus genus of plants, which are found in Guiana, coast of Africa West India islands, and other parts. The mode of converting this vegetable into paper is as follows:—The bark or rind is in the first place stripped off the stems, and the fibres separated by being bruised, after which the fibres are to be dried in a stove, or by other suitable means, to free them from the sap; they are then boiled for some hours with a quantity of American potass, and afterwards washed, and then bleached by the application of chlorine or other suitable matter; the next process, after the fibres have been properly bleached, is to card them with a metal comb, after which they are reduced by suitable machinery into a pulp, and may then be manufactured by the ordinary process into paper. The inventor states that the above may be combined with rag pulp, or other suitable material. There are also other herbs, known in the West Indian islands by the name of herbs conpunts, and also the bark of the West Indian pear tree, from which a good paper may be manufactured. That part of the specification, which relates to the manufacture of cordage, matting, and other textile fabrics, consists merely in the application of the herbs before referred to, which are rendered into filaments and then manufactured in the same manner as flax or hempen ropes. And lastly, this invention relates to the application of the aforesaid material, when reduced into fibres, to stuffing chair cushions, mattresses, &c. The patentee claims the application of the aforesaid material to the manufacture of paper, cordage, matting, &c., as above described.

PRESERVING OF PROVISIONS.

James Cooper, of St. John's Street, Clerkenwell, Middlesex, Provision Merchant, for "*Vessels of peculiar construction, and an apparatus for the purpose of preserving various articles of provisions for the use of families.*"—Granted December 5, 1843; enrolled February 5, 1843.

This invention, in the first place, relates simply to the arrangement and application of certain vessels for preserving fruit and other articles of provision; and, secondly, to a mode of stopping the vessels containing the fruit, &c., with corks or bungs. In carrying out the first part of these supposed improvements, the patentee, for the purpose of affording greater facility to private families in preserving meats, constructs a vessel of two or more parts made to fit one another, so that the vessel can be enlarged or diminished according to the size of a jar, containing the fruits or other matters to be preserved to be placed within it. This vessel is made at the lower end to fit an aperture, formed in the boiler of an ordinary kitchen range, so that the steam generated in such boiler can be turned to some useful account; this vessel is provided with a perforated bottom in order to allow the steam from the boiler to pass into the same; the jars containing the fruit or other article of food intended to be partially cooked, are successively placed within the aforesaid vessel, and subjected to the steaming process, when they have remained a sufficient length of time, the jars or vessels containing the fruit, which are made with a conical neck or opening, are to be tightly corked with as much expedition as possible, for this purpose the inventor forces the corks or bungs into the necks of the jars by means of a screw, which constitutes the second part of the invention; and consists in the application of a screw to the cork or bung, similar to that used in an ordinary screw press, this screw is to be kept constantly applied to the stoppers of the vessels until the contents are nearly cool. The patentee claims the mode of constructing a vessel or vessels in such manner that they may be applied to the boiler of an ordinary kitchen range, in order to preserve provisions in jars by the application of steam; and, secondly, to a mode of constructing apparatus for stopping jars and securing such stoppers till the contents of the vessels are cooled.

MUNTZ'S METAL SHEATHING PATENT.

In the Court of Common Pleas, Feb. 8 to 13. (Sittings at Nisi Prius, at Westminster, before Lord Chief Justice Tindal and a Special Jury.)

MUNTZ *v.* FOSTER AND OTHERS.

The trial of this cause, which lasted five days, commenced on Thursday, the 8th inst., and concluded on Tuesday evening, the 13th inst. about seven o'clock.

The Attorney-General, the Solicitor-General, Sir T. Wilde, Mr. Serjeant Bompas, Mr. M. D. Hill, and Mr. Cowling were counsel for the plaintiff; and Mr. Kelly, Mr. Jervis, Mr. Serjeant Channell, and Mr. Webster appeared for the defendants.

This action was brought for an alleged infringement of a patent granted on the 22d of October, 1832, to Mr. G. F. Muntz, M.P. for Birmingham, for "an improved manufacture of metal plates for sheathing the bottoms of ships and other such vessels." Copper sheathing for ships was lately in such general use, that it may not be recollected by the major part of the public that it was only about 50 or 60 years ago that the practice of sheathing the bottoms of vessels with metal was introduced, in order to protect the bottom from the barnacles and seaweed which adhered to a rough surface, and impeded the sailing of the vessel. Expensive as the process of coppering the bottom was, on account of the prime cost of the metal, the expense of rolling it into sheets, and the corrosion to which the metal was subjected by the action of sea water, the use of copper was found to be attended with this further inconvenience, viz., that being fastened to the bottom of the ship with iron nails, the iron very quickly rusted, the fastenings ceased to hold the metal, and the copper came off. Great as these drawbacks against the use of copper for this purpose were, the coppering of the bottoms of ships yielded advantages which more than counterbalanced the inconveniences by which the process was attended, and in order to make the invention still more useful Sir Humphry Davy turned his attention to the subject, and endeavoured to devise some method for counteracting the rapid oxydation which took place; as formerly the copper bottom of a ship rarely lasted longer than five or six years. It struck Sir H. Davy that if a portion of zinc were applied to the copper it would counteract the process of oxydation, and a vessel sheathed with copper and zinc plates, in accordance with his theory, was sent a voyage to a distant part of the world, from which it returned perfectly uninjured, so far as the bottom was concerned, by the salt water, but at the same time it was as foul as if there had been no metal at all upon the bottom. The experiment had succeeded too well; it had prevented any oxydation from taking place. The problem, therefore, still remained to be solved, whether any metallic composition could be found for the sheathing of ships, by the use of which the bottom could be kept clean, and at the same time too great a degree of oxydation might be prevented. To the solution of this problem Mr. Muntz, who is a metal roller at Birmingham, directed his mind, and commenced a series of practical experiments, for the results of which he took out a patent in 1832. The invention slowly but steadily attracted the notice of the shipping interest of the country; and it appeared that in 1834, in the port of London, 20 ships were sheathed with metal under Muntz's patent, the number gradually increasing, till, in the year 1843, there were in the same port 257 vessels sheathed with the new composition, of which 17,947 cwt. were sold in the last-mentioned year. The composition was a mixture of copper and zinc, which was cheaper than copper, was more easily worked, and lasted longer, being also sufficiently hard to allow of its being fastened to the sides of the ship with nails of the same composition.

The specification of the plaintiff's patent thus described the nature of his invention:—"I take that quality of copper known to the trade by the appellation of 'best selected copper,' and that quality of zinc known in England as 'foreign zinc,' and melt them together in the usual manner, in any proportions between 50 per cent. of copper to 50 per cent. of zinc, and 63 per cent. of copper to 37 per cent. of zinc, both of which extremes, and all intermediate proportions, will roll at a red heat; but, as too large a proportion of copper increases the difficulty of working the metal, and too large a proportion of zinc renders the metal too hard when cold, and not sufficiently liable to oxydation, I prefer the alloy to consist of about 60 per cent. of copper to 40 per cent. of zinc." It was proved by the testimony of several witnesses who were examined on the part of the plaintiff, and who were not contradicted, that any person acquainted with the trade of a metal roller could manufacture this composition from the description of the invention contained in the specification; and it appeared that between February and April, 1843, the defendants had made a quantity of sheathing, amounting in value to about 700*l.* or 800*l.*, some of which was sold by them in Liverpool, and which was declared, upon subjecting it to a minute analysis, to be as nearly as possible composed of the same proportions of copper and zinc as those pointed out in the plaintiff's specification as the best alloy for the purpose, namely, 60 per cent. of copper and 40 per cent. of zinc.

The defence set up was, that there had been no infringement of the patent; that the invention was not new, and that Mr. Muntz was not the first and true inventor; and, also, that the specification was bad for uncertainty, &c. Upon the first point, the infringement, the evidence seemed very clear; but the main ground of defence was, that in the year 1800 a Mr. Collins took out a patent for a composition for sheathing ships, which it was argued was substantially the same invention as that which the plaintiff claimed as his own. The specification of Collins's patent said, "The yellow sheathing (the sheathing in question) consists chiefly of zinc and copper. The compound must be heated, and in that state rolled. 100 parts of copper and 80 of zinc afford a good composition; but the proportions may be varied, or other metallic substances added, provided the property of bearing the mechanical process, when added, is not destroyed." Evidence was given on the part of the defendants to show that some of the metal sheathing made by them after April, 1843, was made from the specification in Collins's patent alone, and several witnesses were also called to prove, on their behalf, that a composition of copper and zinc, in the proportion of 60 per cent. of the former to 40 per cent. of the latter, had been made in the years 1828 and 1829, but it did not appear that any plates of this composition had ever been applied to the sheathing of ships. The defendants also raised various objections to the specification of the plaintiff's patent.

Lord Chief Justice Tindal, before he proceeded to charge the jury, told them that if they were desirous of hearing the whole of the evidence read over which had been given during the five days through which the trial had lasted, he should wish to take another day for the purpose of reading it through, in order that he might save their time; but if, having heard the evidence, to which they had paid great attention, and having taken copious notes, they did not require that assistance he would at once proceed to call their attention to the points on which they would have to give verdict.

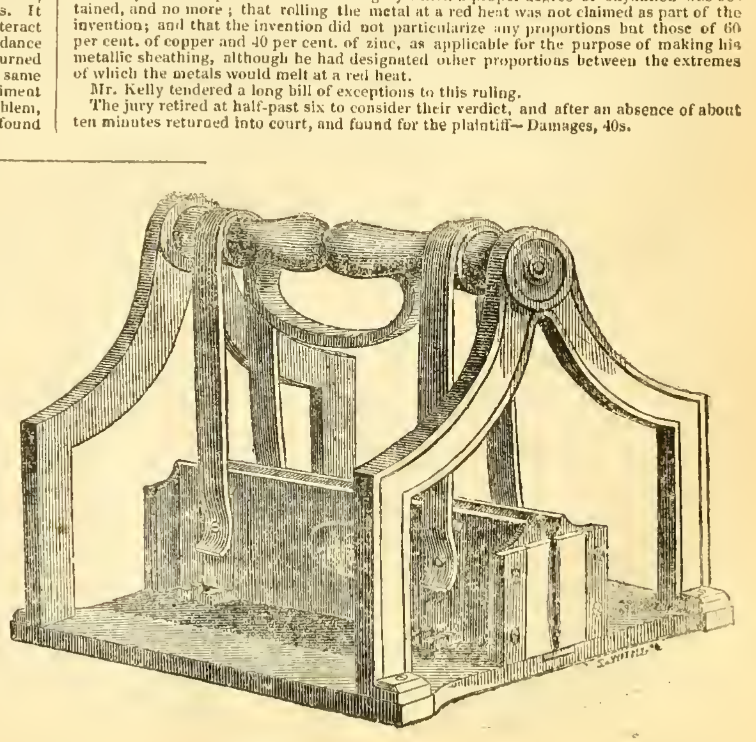
The jury immediately said, that it would not be at all necessary for his Lordship to read over the evidence to them.

The Lord Chief Justice then left it to them to say, In the first place, whether there had been any infringement of the patent granted to the plaintiff, assuming the patent to be good; secondly, if so, whether the manufacture was a new invention, or whether it had been already made public by Collins's patent; and, thirdly, whether the specification of the plaintiff's patent was sufficiently plain and intelligible to enable other persons to make the composition for which the patent had been granted. His Lordship also gave it as his opinion, upon the matters of law arising in the case, that the nature of the plaintiff's invention was well described by the title of the patent—"An improved manufacture of metal plates for sheathing the bottoms of ships or other such vessels;" that neither "best selected copper" nor "foreign zinc" formed part of the invention, which consisted in the discovery of a composition for sheathing by which a proper degree of oxydation was obtained, and no more; that rolling the metal at a red heat was not claimed as part of the invention; and that the invention did not particularize any proportions but those of 60 per cent. of copper and 40 per cent. of zinc, as applicable for the purpose of making his metallic sheathing, although he had designated other proportions between the extremes of which the metals would melt at a red heat.

Mr. Kelly tendered a long bill of exceptions to this ruling.

The jury retired at half-past six to consider their verdict, and after an absence of about ten minutes returned into court, and found for the plaintiff—Damages, 40s.

MADDEN'S IMPROVED KNIFE CLEANER.



THE accompanying engraving is a representation of a new Knife Cleaner, Polisher, and Sharpener, the invention of Mr. Madden, of George Street, Adelphi. It performs what it professes to do in a very effectual manner, with one half the labour and time by the old method, making no dust or noise. The great merit of the invention is its compactness and portability.

The machine is fixed upon a stand 12 in. long by 8 in.; it consists of two parallel cheeks of iron, the interior faces of which are slightly bevilled, and lined with buff leather; these cheeks are pressed together by two springs by which they are suspended: on the top of the cheeks is a groove to receive the brick-dust. When a knife is to be cleaned, it is placed between the cheeks at one end, and drawn backwards and forwards, which causes a small portion of the brick-dust to drop down, and by which means the knife is thoroughly cleaned.

The price of the machine is 15*s*.

CARRINGTON BRIDGE, NOTTINGHAM.

(With Engravings, Plate 2.)

This bridge was erected from the designs of H. M. Wood, Esq., Architect to the Corporation of Nottingham, and subject to the approval of Thomas Woodhouse, Esq., C. E. to the Midland Counties Railway. It was built at the joint expense of the Corporation of Nottingham and the Midland Counties Railway Company, at a cost of £5,945*l.*, and makes a new and beautiful approach to the Railway Station. The novelty of this bridge consists in the flatness of the arch (the span being 70 feet and the versed sine only 5, which is less than any iron bridge I am aware of,) it is also remarkable for having ornamental scrolls for spandrils. The width of the roadway is 50 feet. The masonry and approaches were executed by Mr. Henry Sharp, and the ironwork by Messrs. Cort and Co., ironfounders, &c., of Nottingham, and Leicester, and the work was completed in the most substantial and durable manner. The quantity of cast iron used in the course of erection amounted to 146 tons, and the wrought iron, including bolt and tension rods, about 1,568lb.

This bridge now forms a very pleasing object, and is one of the principal ornaments to the interesting town of Nottingham, and does equal credit to the public spirit of the inhabitants, the talent of the architect and the skill and enterprise of the contractors.

The bridge was commenced in the early part of 1842, and completed the same year, and much to the credit of those that were employed, not the slightest accident occurred during the progress of the works, not even so much as fracturing a stone or breaking a rope. After proper scaffolding had been thrown across the canal from abutment to abutment (under which the boats containing the ribs were brought), with necessary hoisting tackle, and a crab on each abutment, the whole of the ribs were hoisted into their places in 15 days. An attempt was made to test the ribs in the foundry yard, but in consequence of the difficulty in procuring suitable abutting places to carry the heavy weights intended to be applied, and the probability that they would not be fairly proved, it was abandoned, and they were afterwards tested in their places at the bridge in pairs, the weight consisting of pig lead, equally distributed over the whole length of the ribs, and the following is the result:—

		Weight applied.		Deflexion.
1st pair	..	50 tons	..	$\frac{3}{8}$
2d "	..	80 "	..	$\frac{3}{4}$
3d "	..	80 "	..	$\frac{3}{4}$
4th "	..	80 "	..	1
5th "	..	80 "	.	$1\frac{1}{8}$

No permanent set of any consequence was perceptible after the weight was withdrawn. Before the experiment, the ribs were securely wedged in their places, as shown in the drawings, and no evil effect appears to have arisen since the completion of the bridge from the expansion and contraction of the metal, as assumed by some engineers, and for which they make allowance in their works.

To form the roadway, Memel planks 4 in. thick were bolted to the ribs, this is, in my opinion, the only defect in the design of the bridge, as in works of this nature imperishable materials only should be used, covering plates of cast iron should have been substituted, which, although more expensive in the first instance, would have been the cheapest in the end, as timber in such a situation cannot be calculated to endure more than 20 years. The joints of the planks having been properly caulked, a layer of tar and pitch of equal parts mixed with sand, in proportion of half a peck of sand to nine gallons of tar and pitch, was applied in a hot and fluid state three quarters of an inch thick, which made a covering impervious to moisture. The roadway was formed of Mount Sorrel granite, with which was mixed a small portion of tar and pitch, and from the adhesive nature of the resinous matter, with the assistance of a roller, it readily consolidated and formed a compact mass. Roads or streets composed of this material make a very smooth and pleasant surface to travel over; it forms a very hard road, is perfectly clean in the winter, as the subsoil cannot work through it, and is free from dust in summer, an advantage of which no other road material, that I am aware of, can boast.

Iron as a material for bridges is growing more extensively into use, and its superiority over other materials, as to durability, facility of construction, and its capability of being moulded to any pattern, so as to form highly ornamental structures, becomes daily more evident; and its more general introduction in public buildings, manufactories, &c., would be of great utility.

The details of construction will be sufficiently understood by a reference to the engravings.

Reference to Engraving, Plate II.

Fig. 1. Elevation of bridge; scale 1 in. to 20 ft. Fig. 2. Half elevation of external rib, cornice and railing. Fig. 3. Ditto of inner rib; scale $\frac{3}{16}$ in. to 1 ft.

Fig. 4. Plan of ribs and braces; scale $\frac{3}{16}$ in. to 1 ft.

The scale of the following figures is $\frac{1}{2}$ in. to 1 ft.

Fig. 5. Section through external rib. Fig. 6. Section through external rib and cornice A to B. Fig. 7. Section through inside rib, A to B, 2ft. 3in. from centre to outward. Fig. 8. Back of plinth. Fig. 9. Transverse section of stay from E to F on Fig. 4. Fig. 10. Section from L to M of ribs. Fig. 11. Section from G to H of ribs. Fig 12. Plan of abutment plate. Fig. 13. Section of ditto from X to Y. Fig. 14. Transverse section of abutment plate of quoin from V to W. Fig. 16. Section of bracing frame from C to D on Fig. 4. Fig. 16. Transverse stay.

B. B., C.E., & Cy. S.

TUBULAR BOILERS.

(With Engravings, Fig. 1 to 4, Plate 3.)

It is our intention occasionally to give drawings founded upon the most approved mode of construction, of marine engines and boilers; we now commence with a tubular boiler for 60 H.P., and shall hereafter give designs for one of 150 H.P., and afterwards of 300 H.P., up to 500 H.P.

The drawings represent a tubular boiler, of the most improved construction, as used on board our fast river steamers, and now introduced into the vessels of Her Majesty's navy. The power is of 60 horses, say two marine engines of 30 H.P., or 3 ft. stroke, and $31\frac{1}{2}$ in. cylinders, making 30 strokes per minute. It may be manufactured in one piece, and with its apparatus *complete*, would weigh not more than 10 tons, a manifest improvement on the old system of *flue boilers*, which, for the same power, could not be made of less weight than 16 to 17 tons, and occupying, superficially, a space of 14 ft. square. The weight on the safety valve may be 10 lb. per square inch. The steam expanding in the cylinder at one-third of the stroke. It would easily perform this duty, with a moderate consumption of fuel.

The surface, and detail of construction, are as follows:—There are six rows of tubes of 19 each, or 114 in all: they are $2\frac{3}{4}$ in. diam. inside and about 3 in. outside. The superficial area will be $2\frac{3}{4}$ diam. = 5·94 area × 114 tubes = 677 square inches total sectional area of tubes.

The surface of tubes

$$2\tfrac{3}{4}\text{ diam.} = 8{\cdot}64\text{ cir.} \times 66\text{ in. long} \times 114\text{ tubes} = \frac{65007}{144} = 451{\cdot}4\text{ sq. ft.}$$

Plate surface. Fires (above grate) and uptakes .. 148·8

Total absorbent surface of boiler .. .. 600·0

Grate bar surface 7·0 × 2·1 × 3 fires = 43·9 square feet.
Area of grate uptake = 12 in. by 75 in. = 900 square inches.
Area of tubes (as above) .. = 677 ditto.
Area of chimney uptake 14 in. × 48 in. = 672 ditto.
Area of chimney = 24 in. diam. .. = 452 ditto.

To be evaporated per hour = $74\frac{1}{2}$ cubic feet of water, under a pressure of 16 lb. per square inch.

Results of surface, per nominal horse.

Grate bar surface $= \frac{43{\cdot}9}{60} =$ 07·25 square feet per horse.

Tube surface $= \frac{451{\cdot}}{60} =$ 7·5 ditto ditto

Plate surface $= \frac{148{\cdot}8}{60} =$ 2·5 ditto ditto

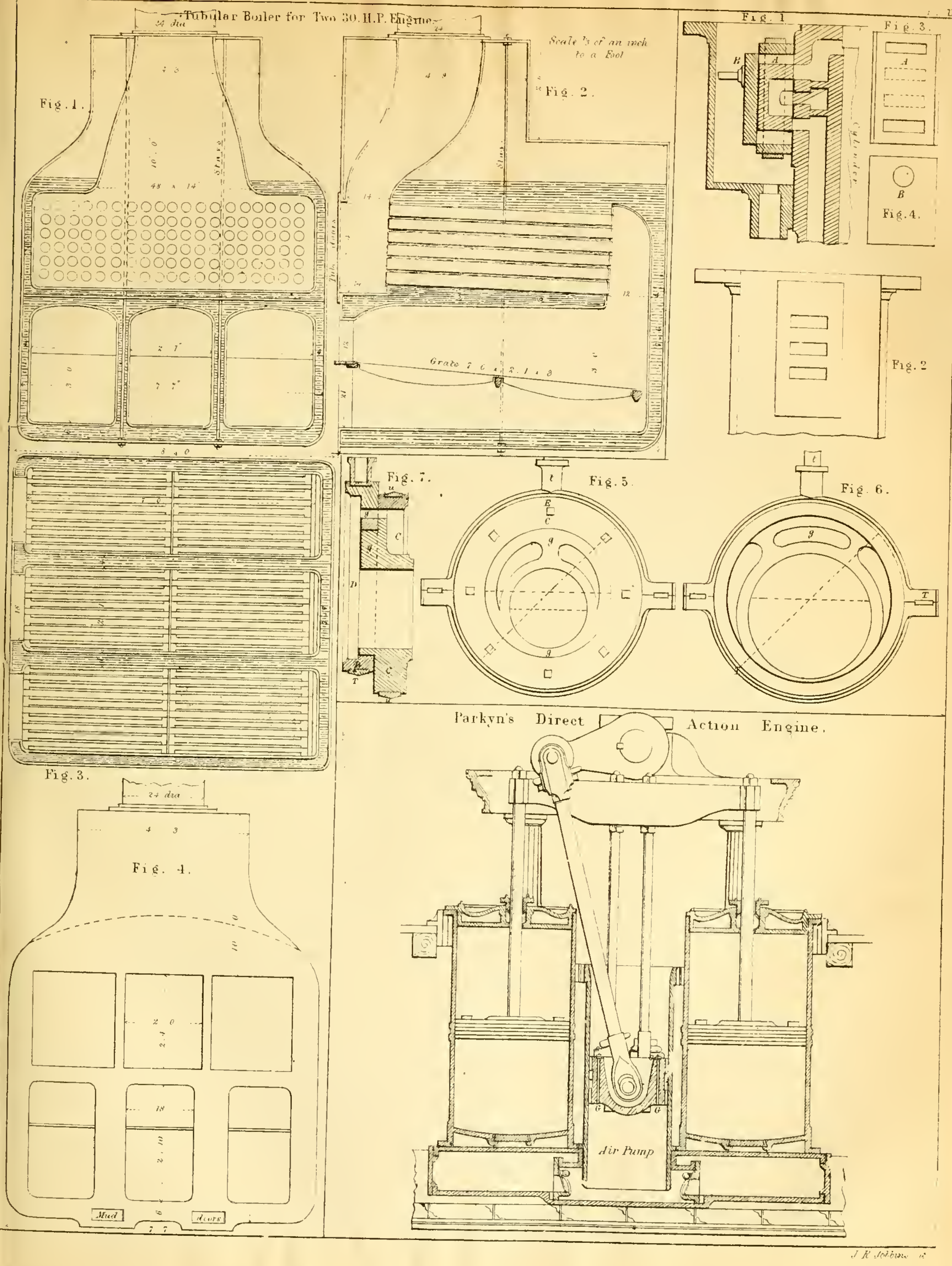
Total 10 square feet 10·0

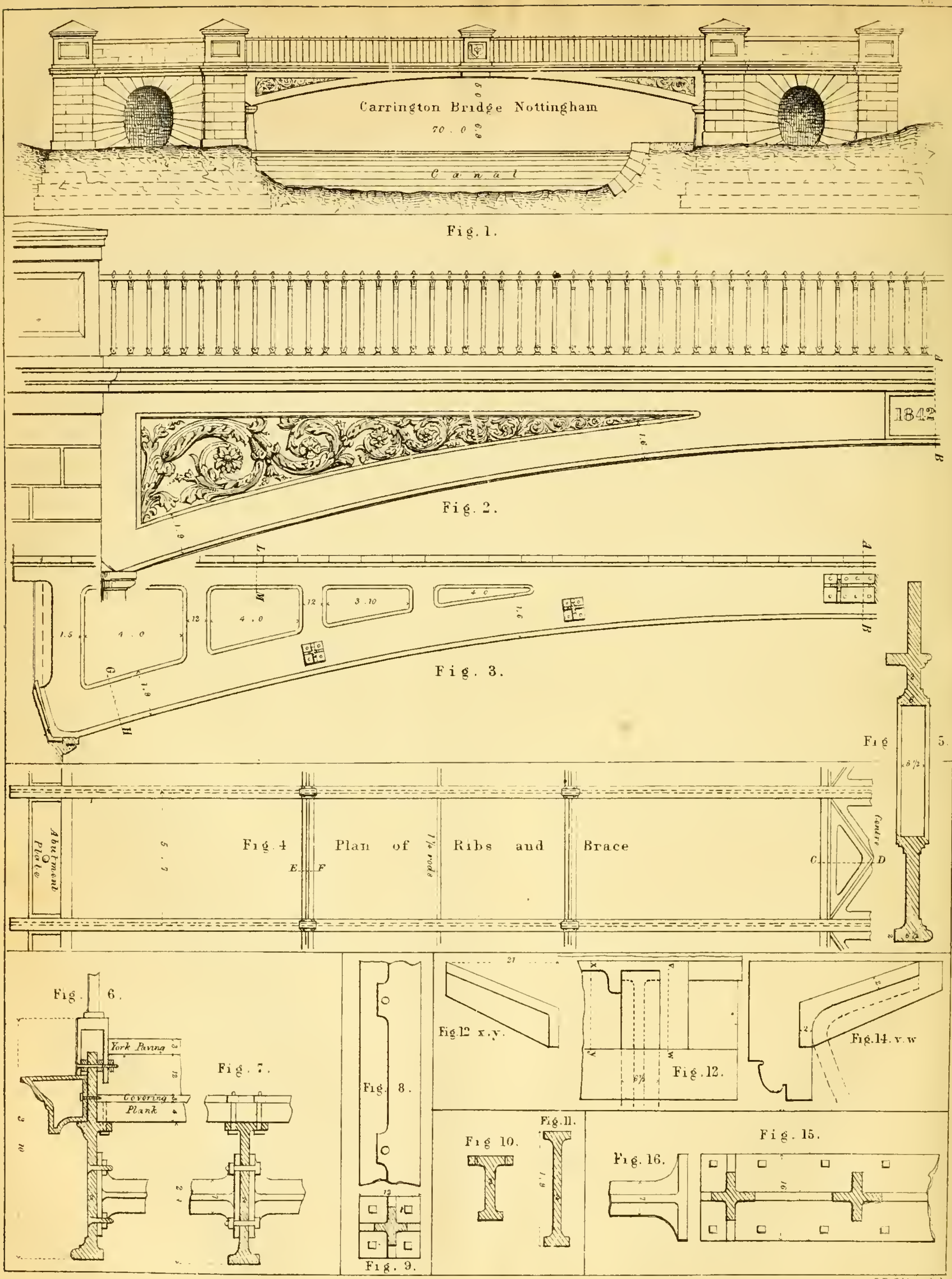
Area of tubes $\frac{677}{60} =$ 11·25 square inches per horse.

Ditto of grate uptake $\frac{900}{60} =$ 15·00 ditto ditto

Ditto of chimney ditto $\frac{672}{60} =$ 11·20 ditto ditto

Ditto of chimney $\frac{452}{60} =$ 7·50 ditto ditto


Tubular Boiler for Two 30. H.P. Engine
Scale 1/3 of an inch to a Foot
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
24 dia
Mud
doors
Fig. 1
Fig. 2
Fig. 3.
Fig. 4.
Cylinder
Fig. 5.
Fig. 6.
Fig. 7.
Parkyn's Direct Action Engine.
Air Pump



J. R. Jobbins lith

The materials of which such boilers should be constructed, are as follows—

Furnaces, of best Low Moor iron ⅜ in. thick; the grate and uptake should be of the same kind and substance. The tube plates are sometimes made of mixed metal; but we prefer Low Moor iron of ⅝ inch gauge. The tubes (if of brass) should they be those made by Alston, which are bare ⅛ in. thick, or 12 wire gauge. If made of iron, they should be those of Russell & Co.

A difference of opinion exists as to the advantages arising from the use of brass or iron tubes, although practice has hitherto been almost confined to the former; but it appears likely that a great change will shortly take place in this particular, arising from the injurious effects produced by galvanic action on the iron shell of the boiler, which in many boilers has occurred to an alarming extent. Of course this would be actively obviated by the use of iron tubes, and the advantage of the one over the other, is solely a commercial question, determinable by practice only. We think the *iron* tubes will be found the best in all respects, especially if means are taken (and they are simple) to prevent the accumulation of salt and calcareous deposits.

The shell and chimney uptake may be of best Staffordshire iron, ⅜ in. thick, and ½ in. below, say for 2 ft. up from the bottom, where the decay is generally very rapid. Care should be taken in properly staying every part.

PARKYN'S DIRECT ACTION ENGINE.

(With an Engraving, Plate 3.)

Sir—I herewith send you a drawing of a Double Cylinder Engine, which I patented in England last year. I have erected an engine, similar to that shown on board, the Iron Boat, Prince Albert, built for the Montreal and Laprairie Ferry.

The engraving is a longitudinal section through the engine, showing the method of connecting the cylinders with the air-pump, and transmitting the power to the main shaft. The novelty of the plan is the way in which the air-pump is worked, securing greater economy of space and fewer moving parts, and consequently less friction—these being the primary objects to be attained by all plans of direct acting engines. The cylinders are 42 inches in diameter, and 5 feet stroke. The air-pump is 28 inches, and the same stroke. The plunger of the air-pump is worked down to within 3 in. of the flooring of the vessel, thus securing the longest possible stroke for a given height, with an adequate length of connecting rod, which in the engine shown is ten feet. F, F, are the two foot valves—the discharge is at the side. The two valves G, G, in the air-pump plunger are to allow for the exit of any air that may collect in the pump.

The valves of the engine are four in number, two for the steam on the left, and two for the exhaust on the right they are of the kind generally denominated the Equilibrium Valve, and worked by two eccentrics, one for each pair; this is adopted to secure the means of cutting off the steam valve at any part of the stroke. The engine can be started, stopped and handled by a force not exceeding 40 lb. applied to a lever 3 feet long. The condenser is immediately below the nozzles, thus securing instant condensation.

The engine at ordinary working makes 21 revolutions with a pressure of steam of 18 lb. per square inch in the boiler, and cutting off at half stroke, driving a wheel 26 ft. 6 in. diameter, 7 feet wide with 20 inches of dip. The vacuum in condenser averages 28½ inches as indicated by the barometer.

The boat is 178 feet long between the perpendiculars, 175 feet on keel, 25 feet beam, depth of hold 8 feet, and 2 ft. 9 in. draught of water when light. The boilers are upon the tubular principle, and constructed to burn wood fuel. The boat before the navigation closed was 23 days upon her station, and seemed to answer all the purposes for which she was built.

I thus submit to the criticism of English engineers the first Double Cylinder Engine that has been manufactured in Canada, and erected on board the first iron boat built in the colony.

I am, Sir, your obedient servant,

William Parkyn.

St. Mary's Foundry,
Montreal, Dec. 12, 1843.

P.S. In such class of vessel as the Helen Macgregor, described in the *Journal* for November, an engine on the plan here submitted could be got in the same space, having a 6 feet stroke and 12 feet connecting rod.

[It is very evident that Mr. Parkyn's engine is a copy of the double cylinder engines of Messrs. Maudslay & Co.; this engine being in every respect, but one, exactly similar to that patented by Joseph Maudslay and Joshua Field on the 7th of May, 1839, and described in the *Journal*, p. 73, Vol. III, 1840. The only novelty, is in placing the air-pump between the cylinders, and making it the guide for the bottom end of the connecting rod; the air-pump is therefore necessarily open topped, and working under the pressure of the atmosphere. This arrangement most undoubtedly reduces this kind of engine to a minimum of space per horse power, and admits of a longer connecting rod than Messrs. Maudslay and Field's engine, for the reasons given by Mr. Parkyn—his working the air-pump piston to within an inch or two of the vessel's bottom. There is considerable ingenuity in the scheme, although, if our memory serves us rightly, we have seen it before printed and described in some work, but which we cannot refer to just now. It possesses all the faults of Maudslay's engines, and which we think have been urged against them with much reason—namely, greatly unbalanced weight, and consequent irregularity of motion, and perhaps of more consequence still—the surety of a difference in the friction of the two pistons, throwing a heavy strain, and wear and tear on the piston rods and working parts connected therewith.

Mr. Parkyn's engine possesses all these disadvantages, to which must be added his open topped air-pump, which adds to, instead of reducing the unbalanced weight—for he has to bring up the bucket or plunger against the atmosphere, which in a pump of 28 in. diameter, is equal to four tons or close upon half the power of one cylinder (vacuum pressure.)

As the condensation water is, under ordinary working, about equal to one fourth of the air-pump's content per stroke, it follows that the power requisite for its expulsion into the hot well is exerted only during the last quarter of its descent, and until it reaches that point it is totally inefficient as a balance to the working parts, and then it has become useless from their accelerated motion. Messrs. Maudslay avoid this, although they increase their weight and space, by placing the air-pump as shown in the drawing before referred to (Vol. III., 1840.)

There is still another objection to Mr. Parkyn's plan. The velocity of the air-pump plunger is *double* that generally given, it is necessarily the same as the piston, instead of a moiety, and this would be a serious objection in the minds of many English engineers. In the case of a *bucket with valves*, we should agree as to its impracticability, but we do not think the objection applies with so much force when a solid plunger is used, (as by Mr. Parkyn,) and the delivery valves are made of sufficient capacity. We know of several good engines, that have the strokes of their cylinders and air-pumps equal, the *Prince Albert*, of London, for instance, just occurs to us. The friction is, of course, greater, in the ratio of 2 to 3, and probably the wear of the air-pump would be considerable, from the oblique action of the connecting rod: but these are matters for practice to determine, and we shall be glad to hear again from Mr. Parkyn, after his engines have been at work for some time, and perhaps he can then favour us with some indicator diagrams taken from the cylinder and from the *under side* of the air-pump plunger—these would assist our judgment materially, and be very interesting.

The steam and eduction valves, used by Mr. Parkyn, are those of the Cornish engines—generally known by the name of double beat valves; two sets of eccentrics are applied, and the expansion of the steam is effected by a slot in the eccentric notch, which can be altered at pleasure, and is both novel, simple and effective: but it is not applicable to slide valves.

On the whole it is a creditable production, although, as we have said before, it is a decided infringement of Maudslay's patent, in so far as the employment of two cylinders, piston-rods, T piece, &c., is concerned. However, we cannot help again expressing our pleasure at these liberal exchanges of practical knowledge, between the new and old world, and feel gratified at our *Journal* being the means of communicating them to the public.]—Editor C. E. & A. Journal.

Railways.—First Report from the Select Committee.—The Select Committee appointed to consider whether any what new provisions ought to be introduced into such railway bills as may come before this House during the present or future sessions, for the advantage of the public and the improvement of the railway system, and likewise to consider whether any and what changes ought to be made in the standing orders relating to railways, and who were empowered to report their opinion thereupon from time to time to the House, have considered the matter referred to them, and have agreed to the following clause be inserted in all the railway bills now coming before or passing through Parliament, viz., "And be it further enacted, that nothing herein contained shall be deemed or construed to exempt the railway by this or the said recited acts authorized to be made from the provisions of any general act relating to such bills which may pass during the present session of Parliament, or of any general act relating to railways which may pass during the present or any future session of Parliament."

VALVES AND ECCENTRICS FOR WORKING STEAM EXPANSIVELY.

(With Engravings, Figs. 1 to 7 Plate 3.)

Sir—Enclosed I send you a description and sketches of an elegant apparatus for cutting off the steam at any required part of the stroke; which (judging from the clumsy manner in which that object is often done) I believe to be not generally known.

The accompanying sketches (Plate 3, Figs. 1 to 7,) are taken from the engine used for mechanically ventilating the Reform Club House, in Pall Mall, made by Messrs. Easton and Amos, Engineers, Southwark, and is, I believe, their invention, and has been found to answer the purpose well. It is a curious fact that the same valves have been patented twice *since* they were introduced at the Reform Club House in 1840. In the Mechanic's Magazine, July 15, 1843, there are abstracts of the patents referred to,—1st. Robert Wilson, engineer, of Manchester, specification enrolled June 22, 1843.—2nd. James Morris, merchant, of Cateaton-street, London, specification enrolled June 22, 1843; so that these patents were both sealed and enrolled on the same day for the identical invention, and that invention having been in public use at least two years previous. I hope this will show you the value, if well executed, of your new plan of giving abstracts of all patents connected with the professions of the engineer and architect.

I remain, Sir, your obedient servant,

George Spencer.

Engineer's Draughtsman.

5, Hungerford Street, Strand.

Description of the Valves and Eccentrics.

Fig. 1, is a Section through the Passages, Cylinder, Valves, and Valve Box.—Fig. 2, Front Elevation of Cylinder Face.—Fig. 3, Plan of Valve.—Fig. 4, Valve Cover.—Fig. 6, Plan of Non-Shifting Eccentric.—Fig. 7, The Shifting Eccentric.—Fig. 12, Section showing both Eccentrics together.

The valve A is similar in construction to the ordinary slide valves, except that there are two steam ways passing *through* the valve; this valve is made to slide on the cylinder face by means of the non-shifting eccentric C, and never varies in the distance it travels. The valve cover B is made to cover the two steam ways exactly, and slides on the top of the valve A, and is worked by the shifting eccentric D. The eccentrics C and D are bolted together by a bolt passing through one of the square holes E in C, figs. 5, 6, and 7, and through the circular slot *g g*, in D; bands T pass round both eccentrics, to which the rods acting on the weigh-shaft levers are attached. The object gained by this arrangement is to give a uniform sliding motion to the valve A, while the slide cover B, and its eccentric D, are so contrived that its travelling distance may be varied as required. This adjustment is managed in the following manner:—on the non-shifting eccentric C, a boss *g* is cast, on which the shifting eccentric D fits, and may be moved round and bolted in any required position as before mentioned; now if the point x of D be brought to the point x of C, the eccentric will not cause any motion to the valve cover B, but if the point x of D be brought to the point x 1 of C, then the valve cover B will have a rectilinear motion equal to the diameter of the circle of which the distance from x to x 1 is the radius, or any intermediate length of motion may be given to the valve cover by altering the position of the shifting eccentric—and thus the steam may be cut off easily at any required part of the stroke.

NOTES OF THE WEEK.

The Director of the Silesian Railway has invented the following means to enable passengers, in case of distress, to communicate with the engine driver. A circular hole, closed by a flap, is made in the top of each carriage roof, and which can be opened by means of a string, so that the passengers can pass through the hole a signal of distress, which the engine driver can see, and instantly stop the train. An instance of the utility of this arrangement recently occurred on the line, a noise like the bubbling of boiling water being heard behind one of the carriages; after waiting for some time, a civil engineer in the carriage passed through the roof the distress flag, and the train being stopped, it was found that one of the axles had got red hot, no doubt for want of grease. Of course the danger was immediately checked. We do not, however, place too great a value on the contrivance, as it would be a great source of annoyance in the hands of silly old women.

A description of the interesting, but little known, objects of antiquity in the Sagre Grotte Vaticane, or Hypogeum of St. Peter's, has at last been published by direction of the Papal Government, from the pens of Sarti and Setclini, illustrated with 42 copper-plates.

An elegant building has been erected at the Hermitage, on Mount Vesuvius, called the Vesuvian Meteorological Observatory.

A plan for the improvement and restoration of the Campagna Vicana, has been well received by the King of Naples.

A new grotto has been discovered at Monte di Cuma, near Naples, by the seaside. It is esteemed by some to be the true Sybil's grotto.

The first artesian well has been begun at Naples in the garden of the Royal Palace.

Great exertions are being made for the maintenance of the Flemish language and literature in Belgium.

The Government of Hamburgh have signed a contract with an Anglo-Hamburgher company for lighting the city with gas.

Nine statues, representing the nine Muses, have recently been brought to the Hotel de Ville, at Paris. They are for the decoration of the grand festival gallery. More than 200 sculptural artizans are employed in finishing that magnificent gallery.

The town of Breteuil is about to erect, in gratitude to M. Laffitte, a fountain, surmounted by his bust. The amount voted is £80. In 1829, M. Laffitte gave to the town a hall and market-house, which cost £1,600.

The ruins of a Gallo-Roman town, of great extent, have been found in a large forest near St. Saulge, in the Nivernais. It possessed a temple, forum, many streets, and every day vases, pottery, and objects of sculpture, are discovered.

The Minister of the Interior, in France, has given orders for the opening of a part of the Museum of the Hôtel de Cluny on the 15th inst.

The bronze statue of Admiral Duquesne has been placed on a provisional pedestal, alongside of the statues of the other marine commanders in the midst of the Court of the Louvre. It is only placed there for public exhibition, being destined for Dieppe. This is a very good way of exhibiting public statues, and should be imitated here.

The Minister of the Interior, in France, has presented to the town of L'Orient a picture representing a naval exploit of Captain Dusaulçhoy.

Father Ungaretti, employed on the catalogue of Egyptian antiquities at Rome, has been struck with a paralytic stroke.

A panorama is being exhibited in Germany of Hamburgh before and after the fire.

The City Picture Gallery, at Mentz has finally been located in the saloon of the Palace.

News has been received of Mr. Fellowes' operations in Lycia. The expedition is in excellent health, and a great many good things have been obtained. Among them is a monument representing a mythological being driving a car, in which is a triple-headed monster, being a lion at one end, with a goat rising from its back, and a scorpion or serpent at the other end. Mr. Fellowes has named it the Chimæra tomb, and to prepare it for shipment he has caused it to be sawed in two. The Medea is to begin embarking the objects of art by the end of the month.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

February 19.—T. L. Donaldson, Esq., V.P., in the chair.

A paper was read by Frederick Catherwood, Esq., Architect, Hon. and Corresponding Member, on the "*Antiquities of Central America.*"

The Mexican Indians, besides a perfect knowledge of stone cutting, and laying, were well acquainted with various kinds of mortar, stuccoes, and cements, and large masses of excellent concrete are found in many of their buildings. They were, in fact, so far as the mechanical part went, accomplished masons. In another department of art which requires more knowledge and science than the building of pyramids and temples, they were in no wise inferior to the Egyptians—to the preparation, mixing, and use of pigments. Their painting is indeed superior both to their architecture and sculpture, and they went even beyond the Egyptians in the blending of colours; approaching more nearly to the paintings found at Pompeii and Herculaneum.

In one of the rooms of a large building at Chichen Itza are paintings covering the entire walls from the floor to the ceiling. (For a plan of Chichen Itza see *Civil Engineer and Architect's Journal*, Vol. VI. p. 133.) The apartment may be 30ft. long, 12ft. wide, and 15ft. high. The figures are not more than 6in. to 8in. in height, but most interesting subjects are represented, abounding with life, animation, and nature. In one place are seen warriors preparing for battle, in another the fight is at its height, castles are attacked, defended, and taken, and various military executions follow. This forms one section of the wall. In another are seen labours of husbandry, planting, sowing, and reaping, and the cultivation of fruit and flowers. Then follow domestic scenes, and others apparently of a mythological nature; indeed, almost everything requisite to give us an intimate acquaintance with Indian life is depicted. The subjects are too numerous to mention, and such was the multitude of figures and objects, that a month would not have sufficed for delineating them. Unfortunately these beautiful paintings are fast hastening to decay, and every day adds to their approaching obliteration, from the visits of Indians.

The pervading type of the architecture in the central parts of America and Yucatan, consists in first constructing immense pyramidal mounds, or terraces, of greater or less height, and on these placing their sacred edifices and palaces. Whether these mounds, or, as some call them, pyramids, (and by the Indians they are called teocalli,) are in general solid, or contain in all cases passages and apartments, remains yet to be ascertained. In the few that have been opened, by accident or design, small arched rooms have been found. The buildings are generally long, low, arched, and of a single story, a plan frequently adopted by the Spaniards on account of the shocks of earthquake to which many parts of the country are exposed. In a few instances buildings of two and three stories were met with. The teocalli before-mentioned are found in great numbers throughout the country. They are frequently of large dimensions, of a pyramidal form, but do not terminate in a point like the Egyptian structures. They have on their summits platforms of sufficient extent for their temples, which contained statues of their deities, and in front was seen conspicuous the sacrificial stone or altar, convex on its upper surface so as to raise the chest of the human victim.

Mr. Catherwood thought there could be but one opinion as to the altars, idols, and sacrificial stones at Quirigua and Copan, having been constructed and used for these dismal rites. Indeed the channels cut on the upper surfaces of these sacrificial stones left no doubt on his mind as to the uses to which they were applied.

Another, and not less distinguishing, feature than their mounds and pyramids are the arched rooms found in all their buildings; he called it an arch, because it has all the appearance of one, and answers most of its purposes, and the inventors were on the very threshold of discovering the true principles of the arch. It invariably consists of stones overlaying each other from opposite walls, until the last meet over the centre of the room, or what is still more commonly the case, when the last stones approach within about 12 inches of each other, a flat stone is laid on the top, covered either with solid masonry or concrete. The joints of the stones are all horizontal. The roofs have a slight inclination to throw off the rain, and are cemented. This form of arch appears at first sight original, and is so in as much as regards the Indians, but the same principle was used in the earliest times by the Egyptians, the Greeks, and the Etrurians, and would, in all probability, suggest itself to any people who had to construct a stone roof over a space too wide for them to cover with flat stones. He had been indebted to Mr. Ainsley a short time ago for a sight of his beautiful drawings of Etrurian remains, and among them is shown an arch, which, if he had met with it in Central America or Yucatan, he should have undoubtedly taken for one of the usual arches of the country. It is at a place called Cervetri, and forms a part of the Galassi tomb. The finding similar arches in Etruria and Yucatan, and not very dissimilar pyramids in the latter country and Egypt, was no proof to his mind that a communication must have anciently existed between the respective countries. Similar necessities may well have produced similar results.

As regards analogies in architectural ornaments in the new and old world, the same argument applies. The one most frequently met with, and perfectly alike in Greece and Yucatan (which he would call the twisted rope or cable), is an ornament likely to be found wherever rope making was understood.

Copan may be called the City of Idols, as it abounds with monolithic statues of Indian deities. The city stood on the bank of a river, and was surrounded by walls; that on the river side is still from 60 to 90 feet in height in some places. The remains of a vast temple or collection of temples lie scattered about, with innumerable fragments of mutilated ornaments and statues. The statues are generally about 12 feet in height and four feet square, the front and back having representations of human figures, habited in a most singular manner, with towering head-dresses of feathers and skins of animals, the necks adorned with necklaces, the ears with ear-rings, and the feet with sandals, like those of the ancient Romans. The sides are carved with hieroglyphics, which no one has yet been able to decipher. They were all painted. There are no remains of arched buildings here, though no doubt such formerly existed, but immense pyramidal mounds and terraced walls are met with to a great distance in the surrounding forests.

Quirigua is the next place of interest in this part of the country. It is in many respects similar to Copan, but probably more ancient. It consists of ruined mounds and terraces, with many colossal statues, deeply buried in the entanglement of a tropical forest. Some of the statues are 26 feet in height of a single stone, the sculpture is in low relief, and as usual there are numerous hieroglyphics.

At Ocosingo the arch was met with, before alluded to, with the usual accompaniments of mounds and terraces, and an ornament over one of the doorways not unlike the winged globe of Egypt.

Palenque, in Chiapas, the most southern province of Mexico, is better known than any other of the ruined American cities. It was probably abandoned and in ruins when Cortes passed near it in his celebrated march from Mexico to Honduras, as no mention is made of it in his despatches. The principal building is called the palace. It stands on an artificial mound, whose base is 313 × 260ft. and 40ft. high, with staircases on the four sides. The building itself measures 228 × 180ft., 25ft. high, and of one story. The front and rear have each 14 doorways, and eleven on each end. The piers dividing the doorways still present traces of admirable stuccoes, which were painted. The interior is divided into three court-yards, with a tower in one of them. Every part appears to have been elaborately decorated with sculpture in stone, stuccoes, and paintings. In several of the apartments Mr. Catherwood noticed that the walls had been painted several times, as traces of earlier subjects were discernible where the outer coat of paint had been destroyed. The paintings were of the same nature as the frescoes of Italy, water colours applied to cement. The other buildings are inferior in size to the palace, but all on high mounds, richly decorated with numerous stone tablets of hieroglyphics, and sculpture of figures, well executed, which have awakened a lively interest in the antiquarian world. The whole is shrouded in the depths of a tropical forest, which has to be cleared away at every fresh visit of the traveller.

Next came the ruins of Uxmal, which for their vast extent, their variety, and being for the most part in good preservation, may claim precedence of any other remains of antiquity in Yucatan. (Of these a plan and view will be found in Vol. VI. of the *Journal*, p. 135.)

The Casa de las Monjas, or House of the Nuns, is a building forming four sides of a square, and enclosing a court-yard about 300ft. each way. Each of the four buildings presents a different design, so also do the rear fronts and the ends, presenting no less than sixteen different façades.

The Grand Teocallis, called by the Indians the House of the Diviner, stood to the eastward of the last-mentioned building, and within a hundred yards of it. The pyramidal part rose to the height of 100ft. above the plain, with two noble flights of stairs leading to the platform on the top.

The Casa del Gobernador, or House of the Governor, is next in importance. This immense building is constructed entirely of hewn stone, and measures 320ft. in front, by 40ft. in depth. The height is about 26ft. It has 11 doorways in front and two at the ends. The apartments are narrow, seldom exceeding 12ft., just large enough to swing a hammock, which was, and still is, the substitute for beds throughout the country. Some of the rooms are long, measuring 60ft. and 23ft. high. There does not appear to have been any internal decorations, nor are there any windows. The lower part of the edifice is of plain wrought stone, but the upper part is singularly rich in ornament. Taking the front, the ends, and the rear of the building, we have a length of 712ft. of elaborate carving, on which traces of painting are still visible. The peculiar arch of the country has been employed in every room. The lintels of the doorways were of wood, a more costly but less durable material than stone, and from its hardness more difficult to be worked. Unfortunately they have all decayed, and the masonry they supported has fallen down, and much of the beauty of the building is thus destroyed. The Casa del Gobernador stands on three terraces, the lowest is 3ft. high, 15ft. wide, and 575 long; the second is 20ft. high, 250ft. wide, and 545ft. long; and the third is 19ft. high, 30ft. broad, and 360ft. long. They are all of stone, and in a tolerable state of preservation. These are the principal buildings at Uxmal, and the others are much inferior in size and preservation.

At Kabah, in addition to richly decorated façades, some very curious internal decorations were found. At Zayi an immense edifice of three stories in height. (Of Zayi a description and engraving will be found in Vol. VI., p. 135.) At Labnah a handsome gateway. At Bolonchen a natural curiosity in a deep subterranean well, the descent to which is by long ranges of ladders of dangerous construction. At Tuloom a walled city. At Izamal some large mounds, and a colossal head. And, finally, at Aké a collection of large stones on a high mound, not unlike a Druidical monument.

With regard to the age of these monuments, Mr. Catherwood differed from Del Rio, Du Paix, Lord Kingsborough, and Waldeck. The growth of tropical trees has not been sufficiently studied to make them a safe criterion to judge of the age of such monuments. The accumulation of vegetable mould to the depth of 9ft. is another proof that has been adduced in favour of their high antiquity, and doubtless in a northern climate would indicate a remote age, but not so in the tropics; vegetation there is so rank and rapid, that within less than twelve months from the first visit to Uxmal, Mr. Catherwood found the whole place so overgrown with shrubs and small trees, that nothing but the high Tescalli were visible, and the outline of the other monuments, and a thick deposit of vegetable mould covered the places they had so short a time before cleared away. Mr. Catherwood met with no physical marks surely indicating a high antiquity; on the contrary, the whole course of his observations led him to form an opposite opinion. It is also proved by undoubted testimony that many of the buildings, now in ruins, were in use by the Indians at the time of the Spanish invasion. He did not think he should be safe in ascribing to any of the monuments (which still retain their form) a greater age than from 800 to 1,000 years, and those which are perfect enough to be delineated he thought it likely were not more than from 400 to 600 years. The roots of trees, and the tropical rains, are the chief elements of destruction, and daily and hourly is the work going on. Another century will hardly have elapsed before the whole of these interesting monuments will have become undistinguishable heaps of ruins.

If it be so difficult to determine the age of the monuments, it can scarcely be less so to ascertain who were their architects. At all events it is probable that the Tolteques and their descendants erected the buildings we have been considering this evening. The Mexicans, or Aztecs, adopted the arts and civilization of their predecessors, and used the same method of astronomical calculation.

Mr. Tite observed that the greatest resemblances to the American styles he had observed, were in the buildings of Ceylon and Java, described in the works of Sir Stamford Raffles. There seemed to him something like an analogy in the buildings.—Mr. Catherwood said he had not noticed it.—Mr. Tite asked whether he had examined the masonry with regard to the way in which it is formed, and whether it is so executed as to induce the belief that the Toltecs were a cultivated people. He also inquired whether they were acquainted with the working of metal, as for instance, had any idols of bronze been found, as in Egypt and elsewhere.—Mr. Catherwood said decidedly that the masonry was regular and well executed. All that is known with regard to their power of working metal, was the testimony to it adduced by the historians of the early conquests of Cortes and others. There had also been found many beautiful objects, some of gold, some of silver, but mostly of copper. Their proficiency in the arts was also illustrated by the delicate paintings on their MSS., some of which he had intended to have brought with him, but being on a kind of bark, they were so fragile as to be liable to injury.—Mr. Tite said he had some wood engravings of them in the well-known work *Purchas's Pilgrim.*—Mr. Poynter, in reference to the analogies discoverable in the ornaments, cited a case of the peculiar Greek scroll, which is an emblem of water, being formed on a Peruvian vase, where it evidently had the same meaning, the fish being represented underneath it, as it is sometimes found in the Greek.—Mr. Donaldson inquired if any windows were found in the Toltecan buildings.—Mr. Catherwood said none, only doors. The doors in some of the large buildings were very ornamental. That at Chichen Itza was highly decorated.—Mr. Donaldson asked if there were any bed-mouldings to their cornices.—Mr. Catherwood said none. In answer to another inquiry, he said the material of the buildings he had seen was limestone, there had been none of sandstone or granite seen by him, and he was disinclined to believe there were any. It was said that the great sacrificial stone in the city of Mexico was of granite, but he had not examined it. It is very generally supposed that the Egyptian buildings are of granite, but he had been much surprised after two years residence in the country, to find that with the exception of one or two small buildings, they were all of grey sandstone. He said that no cramps had been found among the masonry, and that the material of the beams of the doors was sapote wood, on which the carving is very sharp and beautiful. Mr. Stephens had got two beams away, but they were afterwards destroyed by fire. Mr. Donaldson asked whether the wood was used as an object of rarity, or because they had not stones long enough to cover the entrances.—Mr. Catherwood said the wood was used purely as an object of luxury, as it admitted of richer carving.—Mr. Poynter asked if any quarries had been found.—Mr. Catherwood replied none, nor tombs. This was a matter of deep regret, for such a discovery would have been highly interesting. They heard of many campos santos, but in only one instance did they find a burial ground, when they obtained a skull, which had been examined by Dr. Morton of Philadelphia, who had pronounced it exceedingly curious.—Thanks were then voted by acclamation to Mr. Catherwood. We should observe that around the room were arranged a number of drawings by Mr. Catherwood, which excited much attention, from their remarkable union of architectural precision with pictorial effect.

INSTITUTION OF CIVIL ENGINEERS.

Feb. 20.—The President in the Chair.

The discussion on the *screw propeller*, which was carried to so great a length at the last meeting, was resumed. Mr. Grantham explained the construction of the propeller used on board the *Liverpool Screw.* It was formed of four arms.

Mr. Grantham being present, stated that he had come prepared to answer a question which had been put at the last meeting respecting the angle at which the blades were set. The mean angle of the blade, taken in the line of the radius, was 45°, and this had given a most admirable result. The particular object of his paper had been to prove, by the data obtained in the experiments on the *Liverpool Screw*, that it was both practicable and desirable to construct the wheel of such a large diameter and long pitch, that its motion would be comparatively slow, so much so, as to admit of its being driven direct from the engines similar to the ordinary paddle wheels, and to use the condensing engine. He stated that he most approved of the form of screw adopted by Mr. Ericsson with the expanding pitch. He objected to the form exhibited in some of the models laid on the table; propellers thus constructed could not conveniently be made to present a large surface to the water, without which a considerable slip would take place and a consequent loss of effect. It also formed an additional obstacle to direct action. Mr. E. Galloway contended that the amount of slip was greater than was imagined owing to the following current at the stern. He also argued that there was no advantage to be gained by the expanding pitch. Mr. Cowper related some experiments made on a small toy, (with blades in the form of a screw propeller,) which is projected into the air, by having a rapid rotary motion communicated to it—form these he was to give a decided preference to the expanding pitch. Mr. Braithwaite confirmed Mr. Grantham's statement regarding Ecrisson's propeller, and promised at a future meeting to give the results obtained on board the *Princeton* steamer, U. S. America.

The discussion upon the *valves of pumps* was also resumed. The resemblance between the disc valve of Palmer and Perkins, and that invented by Belidor was examined, and the general opinion appeared to be that Messrs. Palmer and Perkins' valve would be found very useful in large pumps for mines, through which much sand or chips passed. The general question of valves with large openings with their influence on the working of the deep mines of Cornwall and other places was noticed.

The discussion occupied so much time that no papers could be read; those, therefore, which had been appointed for the 20th, were announced for reading on the 27th instant.

ELECTRO-MAGNETIC MOTIVE POWER.

At the Royal Institution, on February 9th, W. R. Grove, Esq., gave a lecture "*On the Progress made in the Application of Electricity as a Motive Power.*"

The subjects of Mr. Grove's communication were, 1, a brief summary of the laws of the electro-magnetic force; 2, a description of the chief modifications of the engines to which that force has hitherto been applied; 3, the commercial statistics of its application; 4, the purposes for which this power is available. In dealing with the first of these subjects, Mr. Grove exhibited, by many illustrative and successful experiments, the well-known re-actions of iron and other metals on each other, when exposed to the influence of an electric current. The actual application of these familiar phenomena was then shown in the working models of several machines, which were set in action by the nitric acid (or Grove's) battery, invented by Mr. Grove, and described by him four years ago at the Royal Institution. These machines may be divided into three classes; first, those acting by the immediate deflecting force, as shown in the galvanometre, Barlow's wheel, &c.; secondly, those on what is called the suspension principle. In these, two powerful electro-magnets are fixed contiguous to the periphery of a wheel, and in the line of its diameter, plates of soft iron being fastened on this periphery at short and equal intervals. The electro-magnets are so arranged as to lose their attractive power as soon as they have drawn through a given space each plate of iron, necessarily presented to them by the revolution of the wheel, but are immediatly re-invested with this power, in order to operate on the next plate. By these means the wheel is kept in constant rotation on its axis. The remaining class of electrically-driven machines are applications of the principle of Ritchie's revolving magnet. In these, an electro-magnet, balanced on a pivot, so as to rotate in a horizontal plane, is arranged between the poles of a permanent magnet. Hence, the alternate attractions of the opposite magnetic poles, combined with its own momentum, cause the electro-magnet to continue rapidly revolving. Having noticed machines, on these various principles, by H. Fox Talbot, Esq., Mr. Hill, of Swansea, and Professor Wheatstone, Mr. Grove proceeded to his third subject, the commercial statistics of electro-magnetic power. It appears by the experiments of Dr. Botto, that the consumption of 45 lb. of zinc will produce an effect equivalent to a single-horse power for 24 hours. The cost of the zinc metal, at 3*d.* the pound, would amount to 11*s.* 3*d.* About 50¼ lb. of the nitric acid of commerce would be required to dissolve the metal in the most economical and effective manner. The charge of this, at 6*d.* the pound, would be 1*l.* 5*s.* 3*d.* The whole expense, therefore, of obtaining the effect of a one-horse power by an electro-motive apparatus, would be 1*l.* 16*s.* 6*d.* In this calculation the cost of the requisite sulphuric acid is assumed to be fully covered by the value of the salts of zinc produced in the operation. The same amount of power produced by a steam engine would not cost more than a few shillings. Mr. Grove explained that this comparitive costliness of the electro-magnetic machines resulted from the sources of their force, zinc and acid being manufactured, and consequently costly articles; whereas, coal and water, the elements of the steam engine's force, were raw materials, supplied at once from the earth. Mr. Grove took this occasion to observe, that the experiments of Botto, just alluded to, were made with his (Grove's) battery; and that upon the cost of the constituents of this, the calculations were founded. At first sight, this battery would appear a dear form, from the expense of the nitric acid; but a little consideration proves the contrary of this. Compare it, for example, with a battery merely charged with dilute sulphuric acid (the cheapest possible electrolyte), to perform an equivalent of work, (as the decomposition of a given quantity of water,) a series of three cells of the ordinary battery is necessary; hence the consumption of three equivalents of zinc, and three of sulphuric acid. But the intensity of the Grove's battery is such, that the same resistance can be overcome by one cell, consuming only one equivalent of zinc, one of sulphuric acid, and one-third of nitric (there being in this acid three available equivalents of oxygen.) Independently of this smaller consumption, Grove's battery has the advantage of occupying only $\frac{1}{16}$th of the space of the other constructions. In concluding his communication, Mr. Grove mentioned the two well-known applications of electric power—the electric telegraph and the electric clock. To neither of these can steam, or, indeed, any known force, be so applicable as that which travels with a greater velocity than light itself.

STEAM NAVIGATION.

THE GOVERNMENT STEAM VESSEL CONTRACT.

Since the publication by us of the Specification and Conditions issued to engineers for constructing engines for four second class and two first class vessels, Government have extended the space allowed for the engine room 6 feet in length for both class vessels; this is still too little: if the beam engine is to be introduced, it ought to have been extended to at least 12 feet, otherwise engineers will not be able to carry out their own ideas as to the most effective mode of construction; they will be obliged to cramp their ideas to make the engine suitable to the Government dictates as to space. We believe the limitation originated in a great mistake, as it is supposed by many persons that the tubular boiler, which is now being very generally introduced, occupies less space; this is true as to bulk, but not superficially, for it is requisite to construct tubular boilers with as large a fire grate and back flue as for the flue boiler, for if a given quantity of steam is to be generated, the same quantity of fuel will be required for a tubular boiler as for a well constructed flue boiler. We consider that Government was most decidedly wrong in limiting the space at all; it ought to have been left entirely to the judgment of the engineer to make their own designs, and it would then have been the duty of the Government officers, to have compared each design, and decided upon that engine which appeared to them to be the most effective for *permanent* service, for a few feet in length in such large vessels, as from 180 to 220 feet in length, cannot be of such consequence as the effective working of the engine.

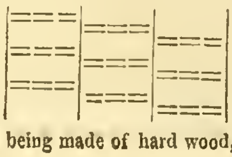
We have before alluded to the necessity of Government making a rigid enquiry as to the comparative duty, expense of working and repairs of each description of engines, whether beam or direct action of the several descriptions that have been introduced within the last 10 years; we trust this will be no longer delayed: and there is one other enquiry that ought also to be made, that is, as to the length of the Government steamers; in our opinion the second and first class vessels are too short, they would be better if built from 10 to 20 feet longer, which would give that space which is so essentially requisite to make a comfortable engine room, the most important part of a steamer.

THE SCREW AND PADDLE WHEEL TRIAL.

In page 85, of last week's *Journal*, we gave the particulars of the Government trial of the screw propeller and the paddle wheel, with her Majesty's steam ships the *Rattler* and *Prometheus*, the former vessel was fitted with the screw, and the latter the paddle wheel; as the experiment is one of importance, we have taken the trouble to obtain the proportions of the *Rattler*. We understand that as far as the build of the vessel, the proportions of the *Prometheus* are nearly the same.

Dimensions of H.M.S. Rattler.	Feet.	Inches.
Length, extreme	195	0
Ditto on decks	176	6
Ditto on keel for tonnage	157	$9\frac{1}{2}$
Breadth, extreme	32	$8\frac{1}{2}$
Ditto moulded	31	10
Depth of hold	18	$7\frac{1}{2}$
Burthen in tons $888\frac{34}{94}$		
Draught of water (mean)	11	3
Area of midship section at 11 ft. 3 in. ..	280	
Engines—Maudslay's 4 cylinders, aggregate power 200 horses:—		
Diameter of cylinders	0	40
Length of stroke	4	0
Diameter of screw	9	0
Pitch of ditto..	11	0
Length originally	5	6
Do. as reduced on the occasion of the trial	3	0
Number of threads two.		

The gearing at present consists of two motions, which gives a velocity of four to one of the engine. The first motion of two to one consists of a large spur wheel and pinion, the cogs of which are divided into three parts thus—



those of the larger wheel being made of hard wood, and the smaller one of iron; this sub-division of the wheels, prevents that very disagreeable rattling which is so much complained of.

The second motion consists of a large and small drum, with their surfaces divided into seven convex parts, thus—

upon which seven leather straps, of five inches in width, are kept tight by a suitable pulley or drum for that purpose. The drum and straps have merely been put in to try their efficiency, and to allow the multiple to be diminished or increased as circumstances may require. It is intended, when the experiments have been completed, to remove the drums and straps, which will be replaced by a single wheel and pinion of requisite proportions.

It is estimated that from 18 to 20 H.P. is absorbed in transmitting the power of the engine through the medium of straps at so great a velocity as is required to drive the screw.

Diameter of Gearing.	Feet.	Inches.
Diameter of spur wheel	11	2
Width	2	6
Pitch	0	5
Diameter of pinion	4	4
Ditto large drum	10	6
Ditto of small drum	6	9

The boilers are upon the ordinary flue principle.

The boilers of the *Prometheus* are upon the new tubular principle, the diameter of her two cylinders $52\frac{1}{2}$ in., length of stroke 4 ft. 6 in.

LAUNCH OF THE "QUEEN" NEW FERRY STEAMER.

On Saturday, 12th inst., a fine iron steam boat, the property of the Birkenhead Commissioners, and intended to ply between Woodside Ferry and George's pier, was launched from the yard of Mr. John Laird, the builder, North Birkenhead—amidst a large concourse of spectators, the occasion having excited considerable local interest, the vessel being of a new and peculiar construction, which it is fully expected will greatly expedite the trip across the Mersey, particularly from the Cheshire side. She is somewhat larger than the *Nun*, (the largest boat now on the station,) being 110 ft. long by 22 ft. beam; her plates and ribs are of extra strength; and she is put together with that fidelity, firmness, and improved fastenings, for which the constructor (who has had greater experience than any other iron ship-builder) has long been justly celebrated. Her deck is flush, and uninterrupted by unwieldly erections, from end to end, her paddle frame-work being carried along her whole length, dying into her extremities, and enclosed by continuous bulwarks, so that the full length and breadth, including the over-hangings, is rendered available for the accommodation of passengers. She is moreover finely moulded, and will doubtless prove herself very speedy. Her peculiarity consists in her being constructed that she may be propelled with either end foremost, so that the delay of backing out, and then running a-head from the shore, especially from the Woodside slip, and which occupies on an average from four to five minutes each trip, (or nearly half the time of crossing,) will be altogether avoided—itself a great desideratum not only as regards passengers, but expenditure of fuel. This is accomplished by a rudder at each end, so contrived that it may be fixed firmly amidships, forming a cutwater when that end (which was before the stern) is required to become the bow. So far the plan has before been in operation, though with but partial success, from the difficulty of securing the respective rudders to form a stem, and their liability, even on slight contact at their outer edge, to be carried away or deranged. Mr. Laird has, however, contrived a remedy for this liability to damage by an outward and standing guard of iron, forming a cutwater outside the rudder when that end is the bow, and within and just clear of which the rudder works, when it becomes the stern, in which case, from its comparative thinness, it offers little or no resistance to the speed of the vessel as a stopwater. This guard is secured, below, to the keel, and above to the stern. The rudders do not rise, as in ordinary vessels, to the top of the external part of the stern post, but occupy the space only between the line of the keel and the water or draught-mark of the vessel. When not in use it is not perceptible to the eye, forming, as it were, a secret door. It is secured, when forming part of the stern below, by dropping a strong bolt, which firmly attaches its outer edge to the guard, so that the whole becomes as one piece, forming a deep holding-on fore-foot. A steam frigate for the navy has recently been built, having two rudders, with the object here sought, on the suggestion of Lord Dundonald. How she will succeed we have not yet ascertained; but we doubt not but additional strength and safety would be secured by the adoption of Mr. Laird's "patent guard." Another steamer of precisely the same size and construction, and for the same proprietary, is in a forward state in Mr. Laird's yard. The *Queen* will be propelled by engines of 60 H.P., with oscillating cylinders, by Messrs. George Forrester & Co. (See *Journal* for last November, p. 367, and Plate XIII.) The engines and boilers will occupy a space of only 21 ft., leaving a large space forward and aft for cabin accommodation.

The Princeton.—The *Times* correspondent (A Genevese Traveller) writes—"A great object of interest to our citizens at this time is the United States war-steamer Princeton, just built under the superintendence of Capt. Stockton, which now lies in this harbour, and is daily visited by crowds of interested spectators. This steamer is constructed with Ericsson's propeller. Its steam machinery is placed entirely below the water line, out of the reach of shot. Its engine is extremely light and simple of construction, occupying only about one-eighth of the bulk required by the ordinary British marine-engine of the same power. It gives a direct motion to the axis of the propeller without the aid of cog-wheels or auxiliary gearing of any description. It is styled the semi-cylindrical steam engine, and is the invention of Captain Ericsson. For the vast power which it includes in so small a compass, and for the exquisite symmetry and proportion of all its working parts, this engine is the theme of general admiration. The armament of the Princeton includes two huge wrought iron guns (introduced by Capt. Stockton), placed one at each end of the ship, the largest weighing 10 tons, and with a bore of 12 inches, carrying a ball of 213lb. This gun is placed on a wrought iron carriage, also contrived by Captain Ericsson, and which, without the use of the ordinary breaching, checks the immense recoil, and the vessel suffers but a very slight shock from the discharge. By means of this carriage this huge gun is managed by half-a-dozen hands with perfect facility. The peculiarity of the steam machinery of the Princeton and its being placed out of the reach of shot are supposed to give her obvious advantages over all other steamers now afloat intended for naval warfare."

Clock-work.—The Paris papers speak of a psychological phenomenon, who is astonishing the people of that city, by a remarkable display of mechanical contrivance and mental resource. The objects of curiosity are a peasant of the Tarn, and his clock, (similar to the famous one of Strasburg, whose recent restoration by M. Schwilgue excited so much interest,) which this peasant, with no other aid than a strong will, a marvellous instinct' and an enthusiastic imagination—undertook to construct. For several years, he has been engaged on this work, and has succeeded, through difficulties which would seem quite insurmountable, and by mechanism whose simplicity is its greatest wonder, in combining the various and complicated movements—showing the hour of day at the principal points of the globe, the four Evangelists and twelve Apostles who strike the hours and quarters, the cock that crows at noon-day, &c.

A bust of Parian marble, in good preservation, and of excellent style, as it is said, has recently been dug up, at Cherchell, in Africa, supposed to be that of Ptolemy, son of the second Juba, and last King of Mauritania Tingitana, which is valuable as being unique. Cherchell is the ancient Cæsarea, the capital of that kingdom. The bust is the portrait of a man in the freshness of youth, with the royal fillet on his brow; and has a striking resemblance to the likeness on the coins of the Ptolemy in question. It is destined for the Royal Museum.

Another method of applying the waves of the sea has been recently contrived, which promises more practical results than the propelling scheme. The object is to make the breakers on a dangerous coast serve as their own warning signals to sailors. The inventor proposes to have hollow buoys moored near the dangerous coast or sand bank, to which buoys pipes somewhat like organ pipes are to be affixed. Metal tongues, on the principle of accordions, are to be fitted to the pipes, so that when the buoys are tossed up and down by the breakers the air may be forced through, and cause them to utter warning sounds, which would become louder and louder as the sea raged more fiercely and the danger increased.—Morning Post.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM JANUARY 27, TO FEBRUARY 24, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

Robert Johnstone, of Baker Street, Middlesex, gent., for "Improvements in the construction of lamps for the combustion of naphtha, turpentine, and other resinous oils." January 27.

Henry Vernon Physick, of Bath, civil engineer, for "Improvements applicable to machinery for driving piles." January 30.

William Edward Newton, of Chancery Lane, civil engineer, for "Improvements in the preparation of caoutchouc or India rubber, and in manufacturing various fabrics, of which caoutchouc forms a component part." (A communication.)—January 30.

Ezra Washington Burrows, of Swinton Street, St. Pancras, civil engineer, for "Improvements in the construction of engines for producing and communicating motive power by the elastic force of steam, or by manual or animal labour." January 30.

George Millar Clark, of Albany Street, Regent's Park, tallow chandler, for "Improvements in night lights, and in apparatus used therewith." January 30.

William Lucas Sargant, of Birmingham, for "Improvements in the manufacture of barrels for fire arms." (Partly a communication.)—January 30.

Baptiste Buret, of Leicester Square, merchant, and François Marius David, of the same place, manufacturer of gas apparatus, for "Improvements in the manufacture of gas." January 30.

William Fletcher, of Moreton House, Buckingham, clerk, for "Improvements in the construction of locks and latches applicable for doors and other purposes." January 30.

James Silcock, of Birmingham, engineer, for "Improvements in planes." January 31.

Robert Hodgson, of Princes Street, Clapham Road, Surrey, engineer, for "Improvements in propelling vessels, and in the machinery for working the same." February 2.

William Sangster, of Regent Street, Middlesex, umbrella and parasol manufacturer, for "Improvements in umbrellas and parasols." February 6.

Benjamin Aingworth, of Birmingham, gent., for "Improvements in manufacturing buttons for wearing apparel." February 6.

Thomas Southall, of Kidderminster, druggist, and Charles Crudgington, of the same place, banker, for "Improvements in the manufacture of iron and steel." February 8.

James Johnstone, of Willow Park, Greenock, Esq., for "Improvements in steam boilers." February 8.

Christopher Nickels, of the York Road, Lambeth, gent., for "Improvements in the manufacture of crape, or substitutes for crape." February 8.

Ezra Jenks Coates, of Bread Street, Cheapside, merchant, for "Improvements in apparatus for facilitating the reduction of fractures, dislocations of bones, and for maintaining their parts in their just positions. (A communication.)—February 8.

Charles Wheatstone, of Conduit Street, Hanover Square, gent., for "Improvements on the concertina and other musical instruments, in which the sounds are produced by the action of wind on vibratory springs." February 8.

John Cox, and George Cox, of Georgie Mills, near Edinburgh, manufacture of leather and gelatine, or "Improvements in the manufacture of leather and gelatine." Feb. 8.

George Straker, of Newcastle-upon-Tyne, shipowner, for "An improvement, or improvements in ships' windlasses." February 8.

Edwin Sheppard, of Manchester, foreman in the works of Messrs. G. C. Pauling & Co., contractors and builders, for "Improvements in machinery or apparatus for planing, sawing, and cutting wood, and other substances."—February 8.

William Edward Newton, of Chancery Lane, civil engineer, for "A new or improved system or apparatus for obtaining and applying motive power for propelling on railways or water, and for raising heavy bodies, applicable also to various other purposes where power is required." (A communication.)—February 8.

Joseph Gibson, jun., of Birmingham, japanner, for "Improvements in ornamenting glass."—February 10.

Henry Hawes Fox, of Northwoods, Gloucester, doctor of medicine, for "An improved mode of constructing fire-proof floors, ceilings and roofs."—Feb. 10.

William Geeves, of Little Portland Street, cork and cork gun wadding manufacturer, for "improvements in prepared wood for lighting or kindling fires."—February 12.

William Edward Newton, of Chancery Lane, civil engineer, for "An improvement or improvements in furnaces." (A communication.)—February 12.

Job Haines, of Tipton, Stafford, coal master, and Richard Haines, of the same place, coal master, for "An improved method or methods of making or manufacturing links for the construction of flat chains used for mining and other purposes."—February 13.

Bennet Woodcroft, of Manchester, consulting engineer, for "Improvements in propelling vessels."—February 13.

James Overend, of Liverpool, gentleman, for "Improvements in printing fabrics with metallic matters, and in finishing silks and other fabrics." (A communication.)—Feb. 13.

Andrew Kurtz, of Liverpool, manufacturing chemist, for "Improvements in apparatus to be employed for drying, evaporating, distilling, torrefying, and calcining."—Feb. 13.

Elijah Galloway, of Union Place, City Road, civil engineer, for "Certain combinations of materials to be used as a substitute for canvas, and other surfaces employed as grounds for painting, and some of which combinations are applicable to other purposes."—February 14.

Samuel Dobree, of Putney, Surrey, esquire, for "Improvements in the manufacture of fuel." (A communication.)—February 17.

John Lionel Hood, of Old Broad Street, gentleman, for "An improved composition, or mixture of metals, applicable to the manufacture of sheathing for ships and other vessels, bolts, nails, or other fastenings." (A communication.)—February 17.

John Kibble, of Glasgow, gentleman, for "Improvements in transmitting power in working machinery, where endless belts, chains, and straps are or may be used."—February 17.

William Losh, of Newcastle-upon-Tyne, esquire, for "Improvements in the manufacture of metal chains for mining and other purposes."—February 17.

Alexander Alliott, of Lenton, bleacher, for "Improvements in fulling, stretching, drying and dressing goods manufactured of wool, cotton, silk, and other fibrous materials."—February 19.

Caleb Bedells, of Leicester, manufacturer, for "Improvements in the manufacture of elastic fabrics."—Feb. 19.

Christopher Nickels and Benjamin Nickels, of York Road, Lambeth, manufacturers, for "Improvements in the manufacture of elastic fabrics, and in rendering elastic fabrics less elastic."—February 19.

Alfred Jeffery, of Bruton works, Limehouse, for "Improvements in treating wood, and certain other substances required to be exposed to water."—February 19.

Alexander Parkes, of Birmingham, artist, for "Improvements in the manufacture of certain alloys or combinations of metals, and in depositing certain metals."—February 21.

William Sheldon, of Birmingham, japan painter, for "Improvements in the manufacture of buttons and in japanner's ware, and articles in substitution of papier-maché."—February 21.

Ezra Jenks Coates, of Bread Street, Cheapside, merchant, for "Improvements in the forging of bolts, spikes, and nails."—February 21.

Henry Charles Howells, of Hay, gentleman, for "Improvements in the fastenings of parts of bedsteads and other frames." (A communication.)—February 21.

Thomas Liddell, of Newcastle, engineer, for "Improvements in apparatus for preventing explosion in steam boilers."—February 21.

Robert Rettie, of Gourock, Scotland, civil engineer, for "Improvements in gridirons, frying-pans, and other cooking utensils and heating apparatus."—February 24.

Francis Studley, of Shrewsbury, gentleman, for "An improved mill, or apparatus for grinding grain, with or without sifter or dresser, also for cobbling, bruising, crushing cutting, splitting, or dividing seed, pulse, berry, or other articles."—February 24.

Alexander Alliott, of Lenton, Nottingham, bleacher, for "Improvements in scouring, bleaching, and dyeing."—February 24.

Thomas Masterman, of the Dolphin Brewery, Broad Street, Ratcliffe, common brewer, for "A method of mechanism for the speedy cooling of liquids, being within certain degrees of temperature, and which method, or mechanism, he terms a "Refrigerator." February 24; two months.

William Rouse, of Great Barton, Bury Saint Edmund's, wheelwright, for "Improvements in carriages, and in parts of carriages applicable to certain purposes." Feb. 8.

Peter Rothwell Jackson, of Strawberry Hill, Manchester, engineer, for "Improvements in the construction and manufacture of wheels, cylinders, hoops, and rollers, and in the machinery or apparatus connected therewith, and also improvements in steam valves." February 24.

Henry Brown, of Selkirk, for "Improvements in carding silk, cotton, and other fibres." February 24.

Benjamin Bailey, of Leicester, framesmith, for "Improvements in machinery for manufacturing looped fabrics." February 24.

Caleb Bedells, of the borough of Leicester, manufacturer, for "improvements in the manufacture of bonnets, collars, capes, caps, shawls, coats, gaiters, scarfs, stockings, gloves, and mits." February 24.

Gaspare Conti, of James Street, Buckingham Gate, gent., for "Improvements in hydraulic machinery to be used as a motive power." February 24.

John Aitken, of Surrey Square, for "Improvements in atmospheric railways." Feb. 24.

Archibald Trail, of Great Russell Street, Bloomsbury, for "An improvement in th manufacture of sails, for ships and other vessels." February 24.

James Smith, of Queen Square, Westminster, Esq., for "Improvements in slubbing, spinning, twisting, and doubling cotton, and other fibrous substances." February 24.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By Henry Fulton, M.D.

No. 7.

Antrim House, Dublin.

Madame Catalani, according to report, had ceased to exist; this, however, has happily turned out to be erroneous. The Royal Institute of the Architects of Ireland, was also reported to have expired: this is also happily unfounded; for although lately showing but little sign of life, they have roused from a state of lethargy and have had a meeting. All we know of this meeting is, that "a very interesting paper was read from the respected Vice-President:"—how we wish we could get a peep at it. But although when the queen of song shall be removed from us, she will leave us no memorial of her skill, save the perishable recollection of her powers of melody; not so the Royal Institute of the Architects of Ireland, who have favoured us with the more lasting memorial of their skill and taste in compo, of which we endeavour to give an outline at the head of this article, and if the reader do not admire it as much as we think he should, let the fault rest with the sketch rather than the original.

To do the Institute justice, and if in political matters justice be not done to Ireland, there shall be no portion of it withheld on the present occasion: in justice then, we must say, that one of the best situations which the City of Dublin affords has been selected; an old friend was to have a new face. Antrim House is situated at the angle of the best and most fashionable if not the largest square in Dublin; a noble street opens on the other side of the square, forming a vista, at the end of which the edifice is situated, occupying the field of vision; it was an old fashioned brick building, without any pretension to architectural display, having seven windows on the first floor, and presenting a frontage of 72 feet.

On its coming into possession of the late noble President of the Institute shortly after his election, it was no doubt thought a good opportunity to show his taste, and that of the Institute, and to rescue the latter from the imputation that it had done little or nothing as a body to further the art. Some persons go so far as to say that the Institute had nothing to do with the *in-compo-rable* alterations, and that the design was given by a mere builder, but I think it must in all fairness be presumed that the council of the Institute were consulted. I do not assert positively that such was the case, but it is reasonable to suppose it, for the noble President was what Mr. Gwilt would call a "mere amateur," and how could he know anything about it, unless indeed his taste was "formed, guided and directed," by Mr. Gwilt's Encyclopædia. No, we must suppose that he left all to the Institute, except the payment of the bills. And on the occasion of his lordship being installed as President, the Institute called his attention to the discreditable fact of "grossly ignorant pretenders being confounded with the instructed professors of the art," and in reply his Lordship expressed "his desire to promote the interests and objects of the Institute, by affording them his countenance and support." The Institute also informed his Lordship, that "it would ill become a body whose profession has a peculiar connexion with the principles of good taste to address the language of adulation to a nobleman whom they deemed fitted, from his nice perception of those principles, to be their patron and their guide." And again, "your good taste and your information are too well known and too generally admitted to allow your judgment to be disregarded. Those who have hitherto looked with coldness on our professional claims, will not willingly bear the discredit of appearing indifferent to a society which your Lordship sanctions and adorns, by your connexion with it." By the way, that is laying the compo on his Lordship in good style; but, at all events, it proves my position, that it is impossible the design could be that of a mere builder or "grossly ignorant pretender." Some might think that his Lordship himself had designed the demi-façade, for such it is; but this cannot be, for I have understood that after it was finished he did not approve of it, and men seldom disapprove of their own works, or at least confess it if they do.

Having thus disposed of the preliminaries, we proceed to speak of the demi-façade itself, and although it is undoubtedly a pleasing task to speak of an edifice where everything is to be admired, still we feel overwhelmed with the responsibility and the fear that it may be beyond our ability to do justice to its merits.

The first thing we have to admire is the head of this front, in common parlance we shall call it a cornice, although not certain that it is exactly one. It is certainly not a *bold* cornice, no, that would have been unsuitable in Ireland, for there the word "bold" is synonymous with naughty, hence they say in that country "a bold boy," meaning a naughty one; this is not, therefore, a naughty cornice, and as it is a remarkable one, it must consequently have more than a negative quality, and be a remarkably good one; that it is so, may be proved, for it does not excite the least alarm in the mind of the most timid as to its stability, or the power of the walls to support it, and any old gentlewoman, either in pantaloons or petticoats, may pass under it without apprehension; besides, it has the advantage of casting no shadow, and surely it would have been bad taste to throw any part of the demi-façade into the shade: moreover, it would have been unfair to have taken an undue advantage of a good situation to have placed a bold cornice where *it* could only be seen to advantage: no, no, equal justice forbids us to think such an expedient would have been proper; let those who admire bold cornices reserve them for bad situations and not throw them away on good ones.

> "To throw perfume on the violet
> Is wasteful and ridiculous excess."

The Greeks to be sure sought to obtain broad shadows and the play of light and shade in their compositions; but they were quite wrong, for the more enlightened Chinese consider shade in a picture as a decided blemish, let us, therefore, hear no more senseless twaddle about *chiaro oscuro*, for the noble President of the Institute was at the same time President of the Board of Control, and in that capacity well acquainted with the state of taste in the East, and it may be taken for granted that the President's taste was more Chinese than the exploded "*gusto Greco*," so ably opposed by Sir William Chambers. Indeed, according to that highly esteemed architect, the Greeks knew little or nothing of the art, for we find him saying—"In the constructive part of architecture, the ancients do not seem to have been great proficients; I am inclined to believe that many of the deformities observable in the Grecian buildings must be ascribed to their deficiency in that particular." To be sure he never saw a Greek edifice; but what of that, for if they presented nothing worthy of observation, what would have been gained by seeing them? He had, however, a perfect conception of the deficiencies of the Parthenon, and was the first almost to suggest that it would have been improved by the suitable addition of a steeple!

We hear a great deal now-a-days of the advantage of obtaining a play of light and shade by means of detached columns and bold cornices; but I would ask what right have columns and cornices to play with light and shade, let them mind their own business, and be prevented from playing idle pranks like *bold* boys.

Observe, again, in this edifice, the happy expedient with regard to pediments: the Greeks and Romans placed them on the gable ends of their edifices; but if so placed in the present instance, they would have been hid by the adjoining houses, and we might as well have had none at all; but by placing them above the windows, we are left nothing to regret. Small minds, indeed, might object that they were necessarily diminutive in such situations, but magnitude is relative, and if any of the inhabitants of Lilliput will favour us with a visit they must deem these pediments to be as large as those forming the gable end of any temple in their own country. But although these pediments are necessarily small, yet they are worthy of being praised more highly than it is in our power to do, on account of having their cornices with an equal if not greater projection than the crowning cornice of the edifice itself; this latter is 72 feet long, and each of the pediments little more than half as many inches, which shows the talent and resources of the projectors in giving greater importance to the lesser parts.

The original idea of a pediment was that it should surmount a portico, now a portico is an opening, so is a door, so is a window, therefore why should not a window or a door have a pediment? These pediments are not all of the same form, but by a happy mixture of pyramidal and segmental, the spectator is presented with "a pleasing variety." We may be indebted for this to a difference of opinion existing in the council of the Institute as to the relative merits of the two figures, not that the reader is for one moment to suppose that it is intended to insinuate that the members of the Institute are not most harmonious on all matters of importance; but only that they were divided in the selection of two figures of equal merit. How happy should we be with either, and still more so with both.

Ignorant persons may be inclined to find fault with the slashing, gashing and frosting of the lower portion of the façade; but if they will only be at the trouble of examining the tatooed head of a New Zealand chief in the British Museum, they may see that the beauty and interest of it consist in those kind of gashes and slashes; and if such expedients add to the beauty of the human face, why may they not be suitable to the face or façade of the human dwelling? And in point of fact the frost-work, though rustic and vulgar in itself, yet in such master hands seems as if produced by the fair fingers of science to set off the edifice to advantage. Formerly the house had only one door, now it has two.

With a due regard to economy, as well as to afford a pleasing contrast, the compo is only carried up as far as the window stools of the first floor, thus forming a demi-façade, which viewed in connexion with the parallelopepids of the remainder and the window ornaments and cornice, obviate the effects of monotony, so frequently to be observed in other designs. Suetonious mentions in praise of Augustus, that he found the city of brick and left it of marble; may we not conclude in praise of the Institute, that it found Antrim house of brick and left the half of it compo.

II. *Gresham Club, London.*—In the West-end we have clubs, and why should we not have clubs in the East? The wise men are said to have come from the East, but certes the architects of that quarter do not display much wisdom in such erections as we are threatened with in the shape of the Gresham Club, as it appears in the published lithographic design. The outline of the edifice is well enough; that is, it is in keeping with the Farnese style, and although there is a kind of offset or bay at the end of the main building, yet as this is not carried up all the height, it has not the effect of breaking up the general outline, thus far all is well; but how shall we speak of the miserable details?

I have never yet spoken of such devices, as the centre window above the entrance presents to us, because I thought such windows had been scouted out of practice by every one having the least pretension to taste in architecture: in short, I considered that a reference to them, "even by a mere amateur," would almost have been tantamount to an insult to the profession; but here it is, an ugly arch with an ugly key stone springing from two Corinthian columns, and these latter flanked by two others connected by bits of cornice, and the interspaces fitted with transoms and muntons, forming what is called a French window. Bad indeed must be the taste of any one who conceives that any form of arch is improved by a projecting keystone, inasmuch as it destroys its completeness and simplicity of form, however, the keystone in the plan appears to break into the frieze which is placed above the arch; and above this frieze we have a cornice, on the centre of which rests a window supported in heraldic style by two curly-cues something like a lion and unicorn, giving the said last-mentioned window the effect of a broken pediment. Hercules with *his club* might have been substituted for the upper window, or like the Colossus of Rhodes he could stand with a foot on the apex of each curly-cue, and admit the window between his legs, to complete the picture. The principle of arches imposed on columns, as here exhibited, is the state of architecture in the transition or debased Diocletian style before it passes into the Gothic; it is the worthless grub before it expands into the beautiful butterfly.

The Rev. James Dallaway, in his "Discourses on Architecture," (a very interesting work,) has fallen into a mistake with regard to the date of the origin of arches on columns. At page 7, London, 1833, he says, "the Basilica of St. Paul's at Rome, by Constantine, has the earliest instance of arches constructed on columns instead of piers, which was universally the Roman method." Now if the reader will look at Adam's views of Diocletian's palace at Spaltro, he can see examples of it in almost every plate, and many of them flanked by rectangular compartments, as in the Gresham design, and in the east end of St. Martin's Church. Although the interval between the time of Diocletian and Constantine is so short as scarcely to require notice, yet the precise date, as well as the locality, is of great importance, as fixing the Pagan and not Christian origin of the practice.

Columns are quite unsuited for window ornaments, for their effect never can be good in any case or under any circumstances when the intercolumniations must be wider than the best examples of antiquity. Columns well proportioned and properly placed form the great and distinguishing beauty of the Greek style, and this never should be lost sight of even in its degenerate offspring, which climate, manners, uses, and convenience impose on our adoption. But although the Greek style does not furnish us with columns for any such illegitimate purpose as we see them here applied to, it gives us mouldings in abundance, which may with advantage be used instead of them.

A due proportion of ornament gives pleasure to the spectator, but the thing overdone turns the composition into ridicule, and, as in the Gresham Club, places it on a level with the tasty exhibition of the compo shops in the Paddington and Commercial Road, for besides the window with the arched head and rectangular wings, we have no less than twelve pedimented windows in front, destroying all repose and preventing the edifice from having the least claim to dignity, which it would otherwise have from its unbroken outline. And again, the cornices which support these pediments rest on pulvinated friezes or bustles; and if there be one form in ancient or modern architecture worse than another, the pulvinated frieze is the example; it too forcibly reminds one, of those of our fellow creatures, whose heads appear too heavy to be supported on the vertibral column, and hence their backs protrude, so these friezes protude, weighed down as it were by the *great* weight of the *little* gables, which they appear to have been unable to support.

> "Atlas groaned the world beneath—
> They groan beneath "—a pediment.

It has been urged, and with some reason, that the use of projecting quoins is necessary to define, I may say insulate, a composition, and that it gives it the appearance of stability; but if quoins are to be used with that intention, surely it is not absolutely necessary that they should be pared and frittered away to show open joints. I admit that I never saw or heard of projecting quoins (headers and stretchers as I believe they are called) with *close joints*; but would they not look better than open ones, and give all the desired effect with more simplicity and less effort and expense than the present mode.

It will be long ere "even the mere amateur" of Greek architecture shall be reconciled to the expedient of transplanting triglyphs to friezes which have no architraves and columns beneath them; the soil is not congenial, nor does their introduction in the Gresham Club House seem likely to prove an exception. To be sure we find these well placed in such situations in the Egyptian style, but there they have a different character; nor are the Egyptian the debased offspring, but rather the parent of the Greek triglyphs—as we may almost say—the cause and not the effect.

It is to be hoped that if *Clubs* shall continue to be trumps, those architects who hold the honours in their hands will in future play the game according to Hoyle, and not lead the knave to be taken by their competitors queen. With all its imperfections (and it has some to which many of the remarks in this paper are applicable) the Reform Club is still the king of trumps; but the best court card has yet to be played.

CANDIDUS'S NOTE-BOOK.

FASCICULUS LVI.

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

I. Some of our own public buildings are strange patchwork—merely masked just in front, though more than that side may be exposed to view. The National Gallery, for one, betrays more offensive meanness, as we are allowed to see that the back is a mere brick wall; a defect that might have been avoided by continuing the east end so as to form an architectural screen with a mere portal or opening through it for the public thoroughfare behind the building; which would also have given some importance—now very much wanted to that elevation. The exterior of the British Museum is the work of a mere builder, without the slightest pretension to architectural design or effect. What its façade will turn out we shall see in good time. The Post Office has nothing but its portico to recommend it as a work of architecture; all the rest is of very inferior character: and even were the façade many degrees better, the general effect in the view from the north west, would always be unsatisfactory, unless the north end of the building were altogether different from what it now is.

II. There is a point in Grecian architecture, as adopted by modern architects which does not seem to have been taken at all into consideration, particularly by American architects, who though they affect the Grecian temple form, in their principal structures, and lay so much stress upon classical columns, &c., of imposing dimensions, do not scruple to introduce windows without even attempting to keep up the style in those features, for more frequently than not, they are either mere apertures in the wall, or very tame and poor in design. This is one of the ill consequences of servilely copying features, wholly unfit for the intended purpose, without very great modifications—so great, in fact, as to convert them into something quite different from their original character. Where windows cannot be got rid of, at any rate columns may be dispensed with; and, as the former are, in such cases, absolutely necessary, so also should they be treated as *essential* features in the design, and be made to contribute to beauty instead of marring. In general, *astylar* composition is far better suited for modern purposes, than *columnar*. With reference to Gwilt's "Encyclopædia," we may here remark that nothing whatever is said on the subject of the architecture of the United States. Some little information relative to it may be picked up from Dunlap's work "On the arts of design, &c.," but it is so very meagre as to be more tantalizing than instructive.

III. It was rather a singular omission on the part of Mr. Gwilt, that when dealing out his blows against architectural amateurs, critics, and writers, he did not level a hit against lecturers upon architecture at literary institutions, and such places, for, they also contribute to increase the mischief, by giving persons a turn for amateurship, and directing their attention to the subject—at least, if they address their audiences to any purpose at all. If such teachers and leaders of the people are also professional men, instead of being an excuse, that can be only an aggravation of their offence—in the eyes at least of such very strict and orthodox persons as Mr. Gwilt—since they ought to know better than to divulge to the profane the profound *arcana* and mysteries of their art. Rather does it behove them to warn the "ignorant public" against prying into anything of the kind—very far above the reach of their faculties, and therefore to be submissively believed in, with becoming stupid wonderment, and with unquestioning confidence in the infallibility of those who are the lawful depositaries of all such mystic learning. It is odd, too, that Gwilt had not a fling at Loudon, if only because the latter, besides entertaining and advocating views directly opposite to his own, initiated architectural journalism, and, moreover, strenuously endeavoured to expel mere pedantry and mysticism from criticism, and establish principles of æsthetic rationalism in their place. In fact, hardly any two writers have laboured to promulgate more opposite views, and let them be ever so orthodox, Gwilt's are certainly by far the less liberal and less popular ones. That he goes against the stream is very evident, since so far from being attended with the desired effect, his attempt to throw ridicule and discredit upon, and so put a stop to non-professional—and as he deems it, unlicensed architectural writing and study, has only served to draw down upon himself a great deal of severe and not unmerited reproach. Instead of being at all intimidated by his growlings, the class of writers whom he would fain suppress altogether, seems to have gained fresh courage. Another reverend "literary idler" has just appeared in the field, in addition to those who had previously done so, since Mr. Gwilt first uttered his denunciation against the whole race. Exclusively of the opinions contained in it, his idea of an Encyclopædia is an unusual one, for persons naturally look, in a work of the kind, for the very latest and freshest information; whereas his stops short at the very point where abundance of new matter and fresh subjects presented themselves. Were we to judge from his work, we might fancy that the history of art in the present century, not only in this country, but all over Europe—in fact throughout the whole civilised world, was a mere blank. Yet, if excess of delicacy withheld him from venturing to comment on the works of contemporary architects at home—though it did not from falling foul upon contemporary writers—he might have ventured to express his opinions quite freely in regard to those of other countries. Besides, if he was fearful of giving umbrage by it, he might have dropped critical remark altogether, and confined himself to a mere historical report, and descriptions of buildings, as has been done in some other encyclopædias. He might too, without impropriety, have given a place in his "Catalogue" of books, to some of the best architectural treatises which have appeared in publications of the kind, for instance, those in Brewster's Encyclopædia, the Britannica, and the Metropolitana, by Telford, by Hosking, and by Narrien.

IV. Flattering as are just now the prospects of art in this country, as far as one great national work—the "Palace of Westminster," is concerned: it is matter of very doubtful question, if the influence so occasioned will be a permanent or an extensive one. There are two other influences equally powerful and active among us, which must more or less counteract, if they should not absolutely neutralize that of art; namely, party spirit on the one hand, and fashion on the other. Why the former, which is so entirely distinct from, should ever be allowed to interfere in matters of art, let others explain—if they can; yet so it is; highly favourable opportunities are frittered away, one after the other, by their being converted into little better than mere jobs bestowed by party favour—no matter on which side. It is no doubt very natural—perhaps amiable, in public men to endeavour to serve their friends, but it is frequently most fatal to the interests of art—a truth proved by many very striking and notorious instances. This is certainly not the way either to advance art or encourage talent among us—quite the contrary; therefore, if such unhappy and mischievous system cannot henceforth be set aside altogether, matters must continue to go on pretty much as they have done; for all the mere talking about art, will prove of no real service to it. In the ordinary affairs of life, common sense prevents people from postponing their own obvious interests to party considerations or political feeling. Provided he be a competent *artiste* in his profession, the most ultra conservative cares not though his *chef de cuisine* be an out and out radical; neither does his Grace of Canterbury relish his fare at all the worse because it may happen that his French cook is a Papist. And why should they? Is it not strange then that persons who would not risk the chance of an ill-dressed dinner, or, other domestic blunders, by employing incompetent servants, should thrust, as they not unfrequently do, very incompetent and ill-qualified ones upon the public.

V. As far as mere size goes, the Tract Society's new building in Paternoster Row, fully rivals the Reform Club House, and greatly surpasses any of the ornamental façades in Lothbury and Moorgate Street. There is plenty of it in regard to extent and height—more especially as the situation itself is exceedingly confined; nevertheless, it does not look by any means so large a mass as it might have been rendered in appearance, owing to its being not only so divided, but so varied in design, that it shows like five quite distinct and separate houses, viz., three of a single window (of three openings) in breadth on the upper floors, and two intermediate ones of three windows in breadth. In this case it is not the mere "*breaks*" in the elevation that are objectionable, on account of their cutting it up into too many petty divisions; that would have been a comparatively minor defect; but here the want of unity amounts to absolute contradiction and disruption of the whole, if intended to pass as a single piece of design, owing to the inserting, mixing up, and dovetailing together two quite different designs after cutting them into slices for the purpose, taking three of the one, and two of the other. Thus, three of the compartments on the ground or shop floor, have columns forming a small order raised on pedestals; while the intermediate ones have arches which rise higher than the capitals of those columns, whereby all continuity of line is completely broken, for it is not kept up in the degree it is done where the imposts of arches are on the same level with capitals of columns in other parts of a composition. As to the style, it must for the want of an other term, be accounted Italian; but it is certainly of a very lame and doggrel kind. If it seem harsh to say this, it is also not a little hard to be compelled to do so: here was at all events a very fair opportunity for producing a more than ordinarily good specimen of its peculiar kind; something exhibiting the same carefulness in design as is manifested in one or two façades lately erected in Lothbury and Moorgate Street. There is no economy in adopting a poor design, good taste costing no more than barbarous ugliness—if always so much.

Charcoal most effective in the Growth of Plants.—Mr. Barnes of Brecon, says, "Charcoal is the most astonishing article to make use of for all purposes of cultivation, and especially for plants under artificial treatment. I judge from many year's experience of its use. My pine soils consists of nothing but charcoal and loam, without a particle of manure of any sort. Every plant under my care has some charcoal used about it. I never saw the plant that did not delight in it, and to heaths it is most especially acceptable." Mr. Stewart, gardener at Stradsell Hall, has exhibited to the Horticultural Society some cucumbers grown in equal parts of loam and charcoal, without any manure. No stimulant could have given better fruit so far as health was concerned.

CATHEDRAL OF THRANDIA.

An extract from Torfæus relative to King Olave, and the Cathedral of Thrandia (Trondiem, or Dronthiem), in the kingdom of Norway; read at the Royal Institute of British Architects, as a supplementary paper to one read at a previous meeting, "*on the Architecture of Wisby, in the Island of Gothland,*" by John White, Esq., Architect. (See *Journal*, p. 144, Vol. IV., 1841.)

Four miles from Agdanesia towards the east, at the southern shore of the gulf of Thrandia, is situated the old and very famous city of Nidarosia, at this time generally called Thrandia, which that most powerful and pious king, Olave Fryggvinus, caused to be founded on the western bank of the mouth of the river Nid, where there was formerly the estate of Nidarnesia; and hence it obtained the name of Nidarosia, derived from the river Nid, which, in the genitive, makes *Nidar*, and the word *os* which means the mouth of a river.

Of the Cathedral of Thrandia.

This city of Nidarosia, not uncelebrated as being the residence of the archbishop, had many temples and monasteries, which, however, the cathedral church far eclipsed in magnificence, and the admirable elegance of its structure; which, in few words, we might clearly prove not to have any equal in artificial beauty, whilst it flourished entire, throughout the whole of Christendom. Now, however, the greater part of it, except only the sacred chapel or choir, lies prostrate and overthrown; and, when we confess candidly with much regret that we cannot give as a perfect description of it, as we ought, it may not be disagreeable to put forth to the public notice the few remarks, which are here subjoined.

Of the relics of St. Olave, and the building and magnificence of the Cathedral of Thrandia. History tells us that the body of Olave (who was called St. Olave), son of Harold, King of Norway killed by the hands of his subjects, was concealed and preserved, by removing it from place to place, by his friends, lest it should fall into the power of his enemies, and be ignominiously treated; until at length it was magnificently entombed in the temple of Nidarosia, (which was consecrated to St. Clement, by Bishop Grimkel and Einar Thambaskelfer) on the permission of King Sweyne, son of Canute, and his mother Alfiva, who at that time possessed the supreme authority, and that a short time afterwards it was exhumed (on account of some miracles by which it was declared to have been lifted up, after it was committed to the ground) and placed in the temple itself (where the place appeared fitter and more commodious), enclosed in a gilded tomb; this in the next following years they sometimes opened, and shaved the hair and beard, and pared the nails; and, impressed with a belief of its sanctity, the archbishop, with his bishops, abbots, priors, and monks, and the whole ecclesiastical synod, by spreading and propagating abroad these miracles, which were reported to take place at his corpse, occupied the minds of men, and, at stated periods of time, carried it about with great pomp and splendour, after the Papistical fashion: to which an immense multitude of persons, not only from Norway, but from Denmark also and Sweden (Suecia), and other distant parts flocked, offering large presents, whence were collected incredible sums of money; from which, among other things, a silver coffin was made, in which they placed the sacred (as they say) relics of the King; and this again was enclosed in two wooden shells, shining with gold, silver, and precious jewels. They built also a cathedral of a very ornamental structure (viz., the archbishop's of this place, supported by the assistance of the kings), of which even now a part appears entire; yet this admirable work was not finished in the reign of one king; in as much as Harold the Strong, King of Norway, and brother of St. Olave, first had its foundations laid on that sandy hill, where the body of his brother Olave had been buried first: and afterwards Olave, his son, surnamed the "Just," or "Peaceful," finished it, with the assistance of the Archbishop Eystein, and dedicated it to Christ, and placed upon its altar the coffin of St. Olave. (This is incorrect; for that Eystein, who built the cathedral, of which to this day some part remains, when that temple, which Harold erected, was destroyed, lived long after.) Under succeeding kings, however, in course of time, when immense weath was daily accumulating, as much by the presents of the natives as of foreigners, it was elegantly adorned in many ways; until at length one of the archbishops added a choir of a most beautiful and magnificent structure, and which, as we said above, is the only part that remains.

But as it never was our lot personally to examine with how much art this cathedral was reared, and of what dimensions it was, we can only subjoin here, in few words, what we have heard of it from the accounts of others. First, as regards its form; it is said chiefly to represent a cross, wholly composed of the natural (living) and cut rock; and the entire walls, inside as well as outside, every where sculptured with admirable skill, together with innumerable images, and figures executed with perfect workmanship; while, at the corner of the temple, where it verges towards the west, twelve stone statues of the apostles of colossal size are seen; these are all gilt over, and the corner of the temple is gilt also. It has, moreover, numerous rows of marble columns, within and without, made from different sorts and colours of marble, so exquisitely polished, that some think they were cast like metals. Of these you may see sixty, elegantly carved, at the southern gates of the temple; and as many think it would be an arduous and difficult task to determine the cost of rearing these gates, how much more difficult would it be, to ascertain the expense of rearing this whole temple, and to estimate it according to the magnificence of the whole work. It is said, too, that each sort of marble considered more excellent for this fabric, was conveyed hither from Ireland and Greenland: but that a softer, white, and variegated kind, was supplied in abundance from the district of Thrandia. And as this royal cathedral in elegance of structure and entire magnificence of execution shone pre-eminent, so also it surpassed in its other ornaments, for it had a most rich sacred repository, stored with books, cups, dishes, priestly garments, holy bags, with other things of the same kind, and vessels of the church. Thus the archbishop, with a pompous train, clothed with a mantle (superhumerale) of cloth of gold (attolicum), bore on his back an image of the Holy Trinity, made from pure gold, as they are commonly represented; and at the same time had carried about the coffin of St. Olave (which, as we said before, was placed in two wooden coffins enclosed in one another) by sixty men (no less were necessary); from the edges of the coffin, which was overlaid with gold and silver, innumerable purses were suspended to receive donations. Upon it stood the penitentiary priest, as he is called, offering the indulgences of the Pope of Rome, or remission of sins to those who gave money. This cathedral was also very rich, in proportion to the power of the kingdom, in vast revenues and large possesions; so that in the banquetting rooms of this place, jugs, cups, dishes, and plates of silver, and indeed every sort of silver implements, have been always used with the utmost prodigality, which in other places were preserved in the vestibule (exedra.)

But since this complete magnificence and glory of the world rested on an unstable and slippery foundation, quicker than one could have conceived, it all fell down with an awful destruction; the cathedral, indeed was thrice set on fire by lightning, and the fluid flying so as to be seen a long way across the Gulf of Thrandia, consumed the monastery called Holmklostur, and reduced it to ashes; which was a certain proof that this had not happened by chance but by the will of the Almighty, who would not permit their grave and dreadful errors and idolatry, by which they had seduced the wretched people, with their taking his holy name in vain, to go unpunished. And, in a similar way, the pomp and luxury of the ecclesiastics of this order, and the power and authority of worldly rule, all of which had depended upon the dominion of the Pontificate, fell altogether, upon the removal of their cause, when, by Divine grace, the light of the true Christian religion shone on these shores. Yet it is much rather to be lamented than recommended, that, at the beginning of the reformed religion, the reformers not content with taking away from the temples and monasteries whatever gold, silver, and other treasures once employed for the use of the Pontiffs, were found there (such as priest's garments and other utensils), but prompted by nothing else than an innate spirit of wantonness and malice, they threw down and destroyed those elegant structures; unnecessarily burning a great quantity of very useful works, and precious relics of antiquity, in a foul conflagration, stripping of every decoration entirely, the sacred temples, basely plundering them of all their ornaments, and perpetrating robbery detestable and totally unworthy of the name of Christianity.

In this way, too, Otto Stigius had burnt the very beautiful library of the Cathedral of Thrandia, with a number of useful books of great price, and monuments in the cemetery. By a similar conflagration, one Thordus, surnamed Kodde, maliciously destroyed all the books and ancient manuscripts of the repository of Stafangra (Stafan grenois exedra). In the same storm the silver coffin in which the body of St. Olave was buried, with the two wooden ones which were before spoken of, with all the gold and silver and precious jewels (of which one eclipsed the rest, and which the Archbishop Eric Valkendorp had bought for 240 tons of butter (Vigenti tonnarum, dodecadibus butiri) and had inserted amongst the rest on the edge of the coffin) stript off, was taken away, as was also the great silver cross, wont to be carried in state, by three men, before the tomb of St. Olave, the cups, dishes, holy bags (hierotheca), and the other treasures of the cathedral, gold and silver, chosen from the repository (exedra) and banquetting room. Besides the ornaments of the altar, jewels were also taken away, beautiful bells, and the like, laden with which a certain large ship, about to cross into Denmark, sunk before Agdanesia, and never afterwards appeared. And a little while before, a large portion of the same money, on its way into Denmark in a huge ship, was taken for booty by some Batavian pirates; this happened in the year 1541. Amongst the other ornamented works of this town, the royal throne in the precinct of the church, of which many steps were of rock sculptured and worked out with surprising art, most elegantly constructed, may be justly reckoned, on which formerly the kings when they were chosen, or when the people paid their homage, were wont to sit. And, indeed, whatever we have said of the elegant and magnificent structure of the Cathedral of Thrandia, is to be also understood of the work of the wall, and of the marble elaborately sculptured with the finest art. For it is sufficiently clear, that very many temples and edifices in the Christian world, have much eclipsed this one of Thrandia in the gold and silver, and more abundantly adorned with precious things; but that they are not to be compared to it in the artificial structure of its wall. Rutger, son of Hermann, in his description of Norway, has the following:—"There was once a most magnificent edifice, surpassing all the other temples in the whole of Europe, or indeed in the whole Christian world; and there are some who affirm that it had not a like or equal; for whether you regard the workmanship or extent, by its square blocks of stone, its splendid columns and perfect finish it moved every beholder with admiration." So spoke Rutger.

AGRICULTURAL IMPROVEMENT OF IRELAND.

Sir—I am encouraged by your article in the last number of the *Journal* on "Agriculture and Engineering," to send this paper, hoping from its appearance in a scientific journal, that the subject may obtain more attention than I suppose it would receive if inserted in a political one; and as the remarks made by you must naturally turn the attention of the profession to a subject peculiarly interesting to the inhabitants of this island, I propose giving some idea of the state of land, and of the subjects intimately connected with it, which a residence of a few years in this country has made me acquainted with, so that a correct opinion may be formed, in England, of the real wants of the *people*, and of the means of supplying them. As regards the profession, that it may be seen if proper steps be taken here, and *in England*, a vast field may be opened for the profitable display of those talents which the civil engineer's practice in the sister country has astonished the world with, and which (may I be forgiven for expressing the opinion) has, I believe, raised my native land to that proud position over the nations of Europe she now holds, "the pride and envy of them all."

The great want of the people is, *the means of subsistence*. This may be subdivided into want of labour, and want of the knowledge how to obtain the necessaries of life, which the holders of land in England usually have; that is, want of instruction in the business of farming, which they have not as yet, and which I fear from the present absence of example, and from the limited means of obtaining the necessary knowledge, they will be slow in acquiring. If remedies can be found for this state of things, my opinion is, the country will be prosperous and happy. The idea may be ridiculed, that the ills of Ireland are contained in these two deficiencies, yet to an unprejudiced mind, devoid of political animosities, or religious bigotry, acquainted with the situation and feelings of the peasantry, having but one object in view, the improvement of their temporal or social condition, and with a knowledge of what may be done by a change in the system of agriculture, I believe such a mind must acknowledge, that if *all* their necessities are not supplied by providing these deficiences, yet much will be done, and the remainder will follow. But it is a difficult thing to reason with men under daily privations, their whole prospect of spinning out the thread of life hanging upon holding the land they are in possession of, with nothing to fall back upon if they lose this, and with the knowledge, not anticipation, that their bodily strength will be useless in providing food—they cannot be employed, they are not wanted, there is nothing to be done. Is it not miserable to know that this is true, that in Ireland, a country more than any other requiring the employment of labour, where it can be obtained at the cheapest rate, and where the mass of the people are literally in want from the non-employment of them, that this should continue. It must not be so. You in England must remedy it, and when you have done so, the agitation which has so successfully ran over the country will be destroyed, and the people will not be led by the rhodomontade of designing men.

In considering the propositions I am about to make, it is necessary to bear in mind; 1st, That there is *no demand* for the labour of the people; and, 2d, That the small farmers who occupy from 10 to 20 acres of land are, from the want of instruction, unable to obtain one half of the profit that can be realized by a person understanding the business of agriculture. After describing the usual system of farming by such tenants, I think it will be unnecessary to enter into calculations to prove my second assertion; and as to the first, the fact is so well known, it will be supererogation to make a remark for substantiating it. The usual system practised, is to raise a crop of potatoes, after this wheat, then oats, 1, 2, and some times 3 or more successive crops, if the land is able to produce anything resembling one. The ground is covered with weeds, never fallowed, or fallow crops raised. Potatoes, from the mode of sowing, are useless for cleaning the ground. The land is then let out to *rest;* and it may be taken as the general system with occupiers of land in this class, that out of 10 acres, with land in grass to starve a cow upon, for it is not food for one, and with land at rest, one half of the farm never pays anything. The cause of resting land is the want of manure, and as the stock is roaming over the impoverished pasture for at least two-thirds of the year, the straw of the farm is only saturated with wet, and in place of being nutritious manure made under cattle, it is nothing but rotten straw, useless, as compared with what it might have been if the stock had been fed in stalls and the manure made by them. The reason they do this is, that no better mode is known to them; they have no examples, but bad ones, to copy; no one to instruct them, no place to obtain the necessary information.

To provide employment, I propose, 1st, the regulation, compressing, deepening, straightening, and widening of all the rivers that may be navigable or otherwise; all rivulets and streams, in every district, where they conduct the main supply of water from the valleys to a river or other large reservoir: and as this is the first step necessary for the improvement of property, it is the first thing that should be done. This will be more beneficial than railways at present; because railways congregate large numbers to one district, removing them from their homes, and are useful to the people only that reside near the line, or a few miles from it; the increased expense of living lessens very materially the advantages of labour to the man that is obliged to leave his family to obtain it, and besides the applicability of railways generally is a matter of some doubt; in a few cases they will pay a fair interest for the outlay, but if carried generally through Ireland they would not. The deficiency of manufacturing produce, the small number that travel by coaches, are fully explained in Mr. M'Neil's Report on the Dublin and Cashel line; the large districts which it is found necessary to include for the support of this undertaking, proves that this view of the case is something more than theoretic. Another reason why railways would not now be so useful as this plan is, that employment is required in every part of the country, which railways could not give, but the regulation of rivers and streams is required in all places, or nearly so. The interest on the outlay could be obtained everywhere, as the benefits from it would be immediate—results not so certain in railway speculation. The immense tracts of low land wastes might then be brought into profitable and permanent cultivation. An example will prove the correctness of my anticipations. A retired officer bought an estate in Tipperary: 200 acres of it was flooded by the Shannon for a great portion of the year; it was nearly valueless, it could not be drained, and was useless without it. The improvements at Killaloe lowered the waters of Lough Derg, they have not been since flooded, and his lands are improving rapidly. The Calla's are irrigated, and the appearance of the whole district in the short space of twelve months is quite altered. It is perfectly dry, crops are growing luxuriantly, where the Shannon rested for four months in the year; and I am sure the benefit to these 200 acres, by this alone, is not less than 80*l*. per annum.

Now, I know places on insignificant rivers where as much mischief is done to property as the mighty Shannon did on this; it is not in single places, but extends generally through Galway, Mayo, King's county, and Tipperary. In fact, I believe, and the opinion is founded on actual inspection, and considerable consideration, that one-twentieth of the lands of these counties is absolutely useless, and perfectly unprofitable, from this cause alone. A proprietor engaged me to inspect an estate which was much injured by a river, or rather rivulet, to report to him as to the means of remedying the injury, and to estimate the expense attending the execution of what I might propose to be done. I did so. About 150 acres of his land, 40 or 50 acres of his neighbour's, and 15 acres of a third party, were entirely unimprovable from an obstruction of the stream by a ledge of rocks; I proposed they should be blown out, and the level above reduced three feet; the estimate of the whole expense was less than 40*l*.; it was acknowledged that the 200 acres and upwards would be improved 10*s*. per acre per annum, without any further outlay, but if internal draining were carried out, the whole might be cultivated, and made equal to the higher land on the estate. Cattle can never be on it more than two months of the year, and then have nothing but coarse semi-aquatic grasses to feed on; these are produced on a fine alluvial soil, twelve inches deep, incumbent on lime stone gravel, but saturated with water. Still this has not been done. Why? Because only one of the proprietors agrees to assist in defraying the expenses of the work. In another case, an intelligent Scotch proprietor had 20 acres incapable of being drained, from the shallowness of the river, and consequently uncultivated; five acres are fit, to use his own terms, "as pasture for a flock of geese only," the cost of this work is £140; it is in progress of execution at his sole expense, and the increased value will be 8s. per acre by his estimate, by mine 12s.; however take his, and you will see the interest of 5 per cent. can be paid, even in the latter case. How much more in the former?

I think I have shown there is room for the profitable employment of the people, in the regulation of rivers, and that to a very considerable extent. But how is it to be done? Not by Government volunteering to assist proprietors for the purpose of *inducing* them to improve their estates; not by offering loans to the estates requiring them; nor by a drainage bill empowering two to force one, alone. If these steps are relied upon, they will be found miserably insufficient. Government if they wish to improve the condition of the landowners and peasantry, must act on Napoleon's plan. Give the proprietor a choice of borrowing from them the money required, and executing the work himself, under the direction of district engineers, appointed by a board of intelligent agricultural gentlemen, assisted by experienced civil engineers, sitting in Dublin; and then say if *you* do not do this *we* will, and will then apportion the share of expense according to the benefit derived, for which your estates must pay the interest. The law of the land recognises this principle. In 1732 the Barren Land Act was passed by the Irish Parliament, which empowered the Court of Chancery to enquire into the interests of persons claiming waste lands, *and to oblige them to contribute to the drainage thereof in proportion to such their interest.* Common sense points out, that where a dense and starving population require employment, and that means for providing them therewith can be usefully applied, not only for *their* benefit, but also for the benefit of the country at large, that where private objections, or narrow minded niggardliness, obstruct the good, that they should be disregarded; and even if it were allowed that the rights of property would be interfered with, still, is the public good to be sacrificed by the neglect and incompetence of landed proprietors? Should they not be compelled to see their own interests and benefit mankind? It is only such persons that could complain; the improving man of intelligence would rejoice; for the good he intended doing could no longer be nullified by the neglect of his neighbour.

Another means of giving employment and improving the condition of the people, is by the reclamation of waste lands; I do not mean the bogs: there is enough to do without them, and our successors in some centuries to come may find it to be then perhaps to their advantage to undertake this. The Waste Land Society, of which the Earl of Devon is chairman, have begun in the right way; but the limited means at their command, compared to the demand for their assistance, enable them to be a model only to Government. I attended the last annual inspection made by his Lordship on the lands of Ballinakill. Three years before that I visited it; then it was a wild, dreary, desolate mountain; now how does it look? Seventy or eighty families are living in comfort on it, the cottages are clean, neat and comfortable, the crops equalling, if not excelling, those grown in the demesne of the neighbouring Baronet; good roads have been formed, fences erected, draining executed, turnips and clovers feed their stock, and all appears improving and satisfactory. A neighbouring gentleman, Mr. Featherstone, has purchased a tract of the same mountain, his tenants surpassed, if possible, in improvement, the Society's. He has built a handsome residence for himself and family, young plantations have sprung up, and in as sheltered and comfortable a spot as the most fastidious could wish for, where a few years since a solitary bird could not be seen, so desolate appeared the place; there he told me all he did had paid him, he had *created* an estate, and that many of his tenants having reclaimed, with some little assistance from him, portions of land, had sold their interest in them to others for large sums, and taking a new spot, had begun again in the same mountain; and were in better circumstances than the lowland men holding the same sized farms. But how was this? The answer is worthy of particular attention. On the Society's and Mr. Featherstone's tracts the tenants were not allowed to waste their time in laborious unprofitableness; they were instructed what to do, in reclaiming, draining, and cropping, by experienced agriculturists, employed by the proprietors to do so; and in this only lies the secret. The educated man's duty was to think, advise, instruct: the labouring man's to act, and well has the system answered. There are a million and a half acres of such mountain wastes in Ireland, which if improved, would support 3000 families, or 180,000 persons. Without alluding to the advantage bringing this into cultivation would be to England, in the increased supply of provisions to your markets, without looking to the great national improvement this would be, but merely viewing it as a charitable act, how immeasurably does it surpass the poor relief acts, the emancipation and other political measures.

How can this be done? Easily. Large sums are annually voted to the Dublin Society, and expended in their botanic gardens, &c. Let Government grant £10,000. per annum to assist the Waste Land Society. Colonel Robinson knows well what to do with it; and if with so much money he should at all hesitate how to apply it, the Earl of Devon can assist him. Associated with them, let there be Captain Larcom, Captain Kennedy, or perhaps Mr. Stewart French, would be better, as he knows where, and how to begin; let him be the representative of Government; and I venture to say that with such men, with an efficient staff of practical men, and backed with the £10,000; more would be done for the improvement of this country, in an incredibly short space of time, than 100,000 soldiers could ever accomplish.

There are said to be 300,000 acres of land covered by the expansion of lakes and rivers, to which may be added 600,000 acres that are saturated with water, rendered unprofitable, but uncovered; £10,000,000 per annum of agricultural produce is said to be lost to the kingdom by unreclaimed land; and yet nearly three millions of the inhabitants are destitute from the want of employment. Now if such statements are true, and they have been reported by Government officers, if England pays for agricultural produce £10,000,000 per annum to foreign nations, which could be provided her by this country, and if in addition to this a dense and starving population are discontented, almost disaffected, and that this is occasioned by the want of employment, surely it is the interest of the British Government to try the experiment I most humbly have recommended, and the result, there can be no doubt, will fully equal that obtained by the Waste Land Society.

But these plans only relieve the persons without land; what is to be done for those occupying it? Before I state my opinion, allow me to put you right as to the landlords of Ireland. As a class, they are the most abused, but I am happy to say, it is by those who know least about them. Their worst fault is, I believe, that they do not see their own interests sufficiently, that they view their estates with local eyes, instead of doing so with eyes enlightened by a study of other countries, by viewing what has been done in other places through judicious improvements. It is really very difficult to convince many that their incomes can be at all increased by improvements; and when we see men who are presumed to be educated, still lingering in the old beaten track of dubiousness, unwilling to try for the improvement of their condition, because their fathers did not do, as we would, it is not a matter of surprise that those under them, the uneducated, should follow and persevere in the systems practised of old, which they have been taught almost to revere, certainly to follow, changes from which, their superiors have characterised as theoretic nonsense, wild speculations, mad schemes, &c. But to return to the calumnies heaped on landlords; many have ejected, in some cases I believe with unnecessary cruelty, *but it is not general;* I know many inheriting fine estates, and large debts, good men, incapable of assisting their tenants, and unable to allow time for payment of rent from the pressure of their creditors. These men, if they are not paid, are compelled to seek tenants capable of doing so. Then comes the difficulty of obtaining possession; the occupier knowing the impossibility of obtaining subsistence if he leaves, endeavours to retain possession in spite of law, and the landlord is compelled to obtain an *habere*—scenes of distress follow. But what is the cause of them? *Want of labour.* In fact, I believe if constant employment could be obtained, many of the small farmers would give up their holdings, and that farms might be consolidated, which, with improvement in the system of agriculture, would be a vast advantage to the country; but whilst the deficiency of employment continues, I consider it cannot be done without causing so much misery that no advantage to a few could justify. Had Irish landlords, English tenants, or tenants with the same capital, same education, and same intelligence, you would hear nothing of the disagreements of landlord and tenant. The Irish would not be a whit behind the English landlords, and Ireland would be prosperous; but to do this, *you* must raise the character of the Irish tenant, and this brings me to the subject of the improvement of the small Irish farmer. All you require to do, is to instruct him in the practice of agriculture. I look upon it to be as absurd to put a good piece of land into the hands of small farmers, uneducated, understanding nothing of the proper systems of farming, such as the Irish small farmer, and direct him to manage it, as it would be to give, one who never learned to write, a good pen, and order him to do so. They must be taught. Agriculture is a business, requiring an apprenticeship of practice and reading to be master of. But such perfect mastery is not required in the Irish farmer; let him be taught the primers of the business on the soil where he lives, by men fully competent to teach and direct him, let these agriculturists be men of intelligence, capable of understanding the composition and management of the various soils they will meet with; they must be fully conversant with green cropping. Rotation, house feeding, and soiling, the ingredients and application of manures, draining, sub-soiling, and irrigation; the management of dairies, and milch cows; and let them be located one in every parish where such services are required, paid out of the county cess by the grand juries, at or near the rate of £100 per annum, and be directly under the surveillance of a committee of gentlemen in each parish, and of the district inspectors appointed by the government board before referred to. The cost will be for the *whole country* about £250,000 per annum, to be continued for seven years; or in the whole £1,750,000, by which time there will be sufficient knowledge obtained by the people, for dispensing with their further services. To assist in meeting this sum, the police might be reduced in a few years, although at first it would be unwise to do so; but as the people increase in comfort, there will be less crime, and less need of such large forces to prevent it.

The advantage to the tenant would be, increased comfort, increased confidence with his landlord, and a prospect of continuous prosperity and eventual independence. To the landlord the advantage would be equally great, certainty of his income, peace and prosperity on his estate, in which he will be a sharer, from the tie that would then exist between the proprietor and occupier, and the increased value of his property, from the improved condition of the tenantry.

There is no interference with the rights of property in this; the benefits of proprietorship are increased. The necessity of supplying the information proposed, is shown by the adoption of the means, to an insignificant extent, certainly, by the agricultural societies. They have done much good, but not sufficient for the object in view, (viz.,) elevating generally the condition of occupiers of small farms; nor can it be done by such means, the instruction must be more general and more explicit, than the agriculturist has time and opportunity of giving.

Let me insist upon it, that all the tenants require is instruction, you may teach them reading, writing, arithmetic, and even the higher branches of education; but it is all useless as applied to the tenantry of this country, if they are not taught agriculture. It is this by which they are to subsist, by which landlords are to receive their incomes, by which Ireland is to prosper, and therefore this instruction should be provided by Government in the direct manner I have ventured to suggest. Increasing the franchise will not provide food; the equalization of churches will not grow potatoes; nor will the Repeal of the Union fatten cattle. But these effects are expected by a Repeal.

Reduction of rents are not *generally* necessary, nor would it be adequate to the wants of the people, and would be a decided injury to landlords. Instead of reductions of 10*s*. per acre, which in most cases would be 30 per cent., teach them to swell their 3*l*. produce into 5*l*., not by increase of prices, for that cannot be controlled, but by increased production. Remember, that potatoes and milk are their only fare, that with this they are contented, if they have sufficient; that their wants are few, and yet unsupplied; their privations many, and unrelieved; that a starving people may be made easily to rebel, perhaps be as easily subdued; that people in such circumstances deserve pity as much as punishment for many crimes; that immediate suffering, present distress, dread of the future, and remembrance of the past, have caused the rapid progress of the Repeal movement, and that you, Sir, with the English people, are alone able to relieve their distresses, to supply their wants, and this can be done by increasing the demand for labour, by supplying the practical information they require in the business of agriculture: then will plenty succeed poverty, happiness displace misery, and Ireland become a great and prosperous portion of the kingdom, a helpmate for England, and a blessing to our country in the over ruling hands of God.

Your very obedient servant,

J. B——N, C.E.

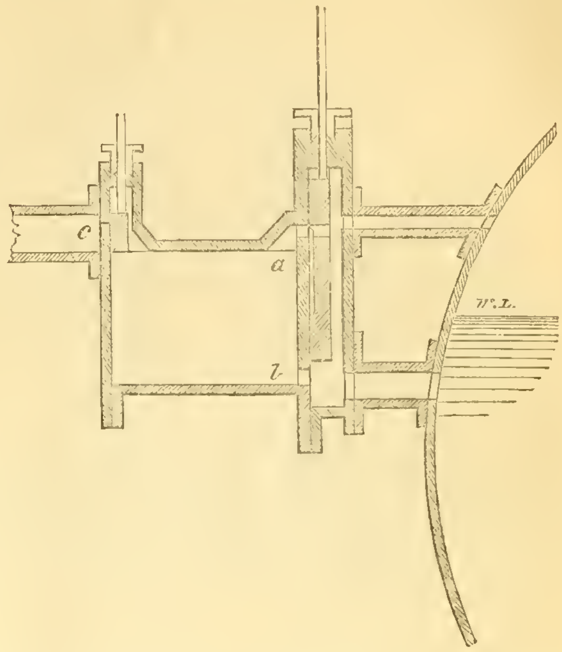
Parsonstown, Feb. 26, 1844.

An attempt is to be made this session to extend the patent law from fourteen to twenty-one years. It is indeed to be regretted that, whereas the copyright of authors dates from publication, when profit is supposed immediately to commence, the copyright of inventors expires too frequently before a profit can be realised.

SUPPLY OF WATER TO BOILERS.

Sir—In your *Journal* for last month there is a plan mentioned for supplying high pressure boilers with water, which I think might be effected in a more simple manner, thus:—

Let *a b c* be a small tank, placed by the side of the boiler, half above and half below the proper water level; let *a*, *b*, be ordinary slide valves connecting the tank with the boiler, *c* a valve connecting the tank with a reservoir placed above the level of the tank.



The action will be as follows:—The valves *a*, *b*, being shut, and *c* open, the tank will fill with water; then *c* being shut, *a* and *b* opened, the water will run out of the tank down to the level of the water in the boiler; the valves being again reversed, the same operation will be repeated, the steam in the tank being condensed by the admission of the cold water.

If the valves be connected with the engine, so as to be reversed at proper intervals, a self-acting and self-regulating feeder will be obtained; for it is evident the water in the boiler can never rise above the top of the tank, and if the water falls too low, a whole tank full will be admitted instead of half, thus quickly restoring the balance.

The valve *b* should be large, and the communication with the boiler not left open longer than necessary, in order to prevent the water in the tank becoming heated by the condensation of steam; a board floating loosely in the tank would prevent the steam coming in contact with the water.

An apparatus of this kind placed on the top of a locomotive would enable the boiler to be supplied by hand while the engine was standing.

I remain, Sir, your obedient servant,

Henry Carr.

Folkestone, February 8, 1844.

MAXTON'S LONG SLIDE VALVE FOR CONDENSING ENGINES.

By Mr. John Maxton, Engineer.

The advantages of this valve are,—that it may be used without a steam-chest, while it has all the advantages of a long slide valve in shortening the passages to the cylinder, it works with much less friction than the common long slide-valve, the pressure being equalized, and is much less expensive, and easier upheld, than the packed valve.

In fig. 1, the piston is represented as descending in the cylinder, the vacuum being formed under the piston by the passage A through the valve towards the condenser, the steam being admitted above the piston by the induction passage B, the steam at the same time having access to the portion of the valve below at D, which tends to press the

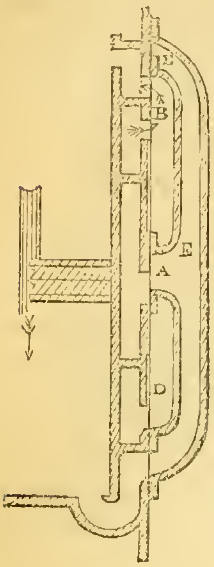


Fig. 1.

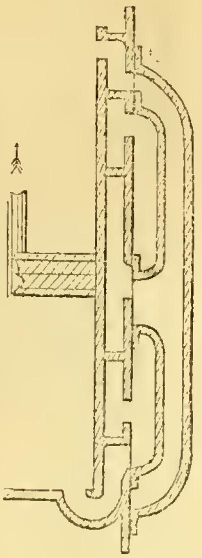


Fig. 2.

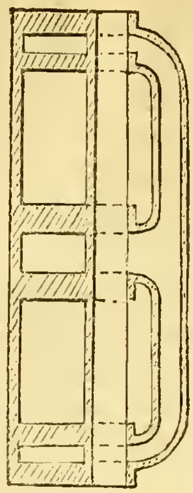


Fig. 3.

valve outwards from the cylinder, while the vacuum, acting on the inside of the valve E, draws it towards the cylinder, the valve being so proportioned that the vacuum must so far overbalance the steam, that the valve will keep close to the cylinder. In fig. 2, the piston is at half-stroke, ascending, and the position of the valve is reversed from that in fig. 1. Fig. 3 is a front view and section of the valve.

JOHN MAXTON.

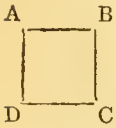
Leith Engine Works.

TUBES OF LOCOMOTIVE ENGINES.

Investigation to determine the diameter of the Tubes of a Locomotive Engine Boiler to produce a maximum effect.

IN treating this subject it appears rational to suppose that the effect of the hot air in passing through the tubes is directly in proportion to the extent of surface in contact therewith, and as the time of contact conjointly: that is, denoting the number of tubes by n, their diameter by δ, their aggregate surface by s, their united area by a, and the time of contact by t, supposing the length of the tubes constant, we shall have the following postulates.

$$t \propto a$$
$$a \propto n\,\delta^2 \qquad \text{A.}$$
$$\therefore\ t \propto n\,\delta^2 \qquad \text{B.}$$
$$s \propto n\,\delta \qquad \text{C.}$$
$$\therefore\ ts \propto n^2\,\delta^3 \text{ a maximum} \qquad \text{D.}$$



Let the parallelogram A B C D be the space which is to be occupied by the ends of the tubes, and let AB $= a$, and AD $= b$; also let the distance between the inner surfaces of two adjacent tubes be a given interval c, and because the same distance c must exist between the sides of the extreme tubes, and the ends A D, B C of the above figure, then $a-c$ must be divided into a certain number of equal parts, which will be regulated by the distance between the centres of two adjacent tubes, and let this distance be $(a-c)x$, x being a function of $(a-c)$, $\frac{a-c}{(a-c)x} = \frac{1}{x}$, the number of tubes in one horizontal row A B.

The tubes are so disposed, that the lines joining the centres of any three adjacent tubes form an equilateral triangle, consequently the vertical distance between the horizontal rows will be

$$(a-c)x\sqrt{\tfrac{3}{4}} \quad \therefore \quad \frac{b-c}{(a-c)x\sqrt{\frac{3}{4}}} = \frac{2(b-c)}{(a-c)x\sqrt{3}} =$$

the number of horizontal rows in A D, and

$$\frac{1}{x} \times \frac{2(b-c)}{(a-c)x\sqrt{3}} = \frac{2(b-c)}{(a-c)x^2\sqrt{3}} =$$

The whole number of tubes in A B C D $= n$.

Further the distance $(a-c)x$ is greater than the diameter of a tube by the interval c, therefore

$$(a-c)x - c = \text{the diameter of a tube} = \delta.$$

Let $\pi = 3{\cdot}1416$, then the aggregate circumference of all the tubes (and which may be taken to express the internal surface in consequence of the length of the tubes being constant), will be

$$\frac{2\pi(b-c)}{(a-c)\sqrt{3}} \times \frac{\{(a-c)x-c\}}{x^2} = n\,\delta \text{ or } s \qquad \text{(C)}$$

and the area of the tubes will be

$$\frac{\pi(b-c)}{2(a-c)\sqrt{3}} \cdot \frac{\{(a-c)x-c\}^2}{x^2} = n\,\delta^2, \text{ or } t \qquad \text{(A or B)}$$

Now by the postulate we have st a maximum, and substituting the values s and t as found above, we have

$$\frac{2\pi(b-c)}{(a-c)\sqrt{3}} \cdot \frac{\{(a-c)x-c\}}{x^2} \times \frac{\pi(b-c)}{2(a-c)\sqrt{3}} \cdot \frac{\{(a-c)x-c\}^2}{x^2} =$$

$$\frac{\pi^2(b-c)^2}{3(a-c)^2} \cdot \frac{\{(a-c)x-c\}^3}{x^4}, \text{ a maximum} = n^2\,\delta^3 \qquad \text{(D)}$$

All the above quantities, except x, are constants, and the second factor only contains the variable, therefore we have

$$\frac{\{(a-c)x-c\}^3}{x^4} = \text{a maximum}.$$

Differentiating and equating with zero, rejecting the denominator, we have

$$3(a-c)x^4\{(a-c)x-c\}^2\,dx - 4x^3\{(a-c)x-c\}^3\,dx = o;$$

whence $(a-c)x = 4c$.

But $(a-c)x =$ the distance between the centres of two adjacent tubes, which is therefore equal to four times the interval between their internal surfaces.

Further $(a-c)x - c = 3c =$ the diameter of a tube, which must be equal to three times the same interval.

It is obvious that the smaller c is taken, the greater will be the value of the expression $\frac{\{(a-c)x-c\}^3}{x^4}$; and, therefore, the tubes ought to be placed as near together as possible.

In order to exemplify the application of the principles herein developed, I have prepared drawings of the tubes of a locomotive engine boiler, such as are very commonly used, and also of one tubed according to the proportions just determined.

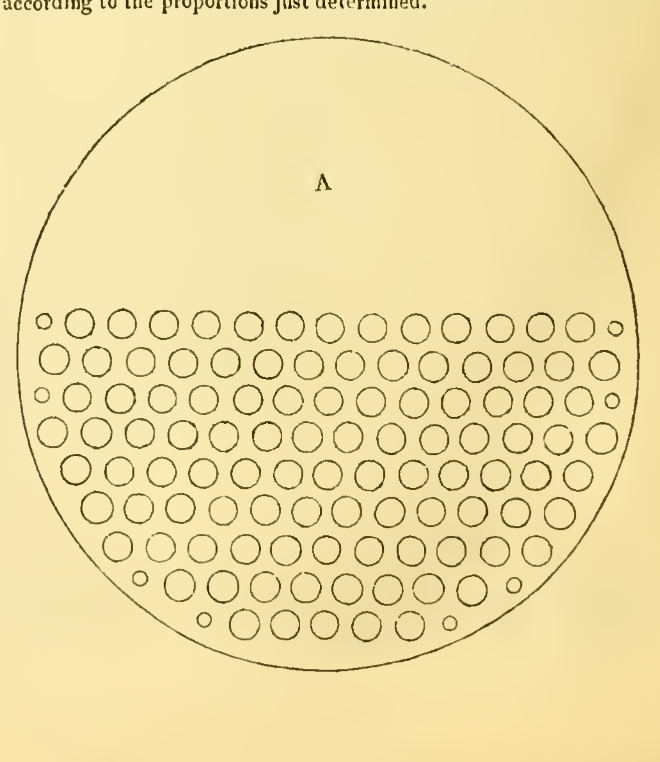
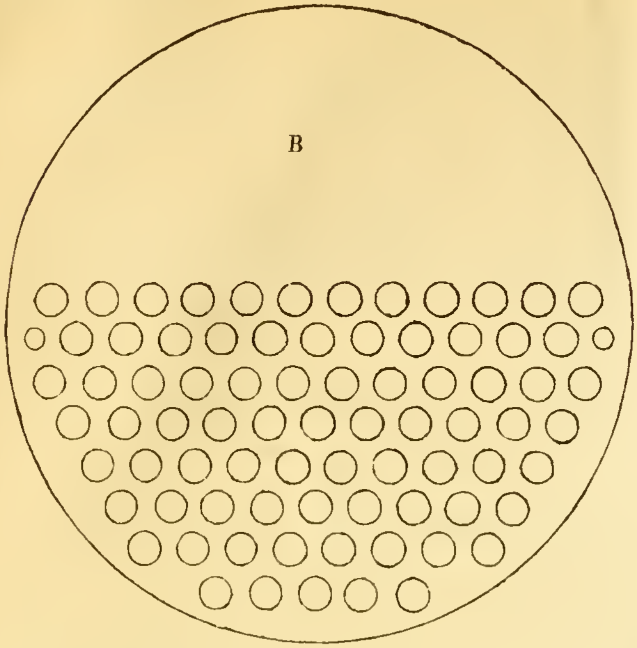
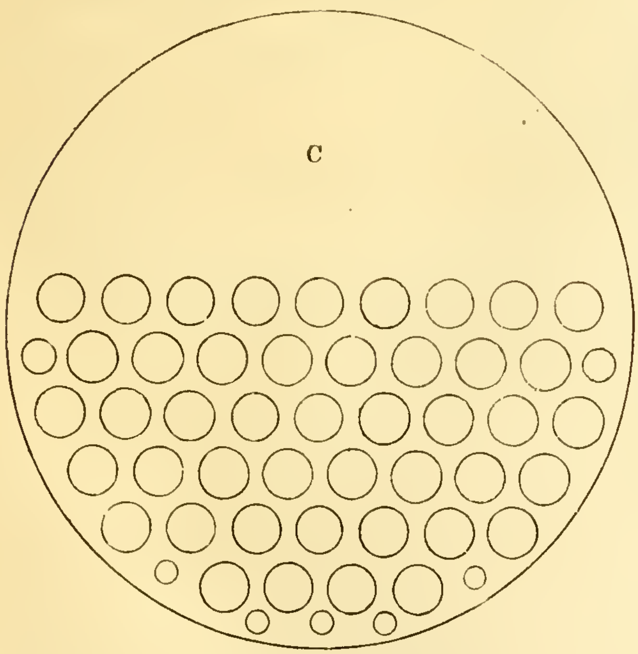


Table of the comparative evaporating power of three different methods of tubing:—



Reference to drawing		A	B	C
Number of tubes		103	78	45
Internal diameter of tubes	inches	$1\frac{5}{8}$	2	3
Distance between centres ..	,,	$2\frac{5}{8}$	3	4
Interval in tube plate ..	,,	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
Total circumference of tubes	,,	525·82	490·09	424·05
Total sectional area of tubes	,,	213·61	245·04	318·08
Product of circumference and area..		112,320	120,091	134,881

Comparison
A : C : : 100 : 120
B : C : : 100 : 112



It appears from the above, that the boiler which is tubed in the theoretic proportion is from 12 to 20 per cent. superior to the others.

Let us now determine the area of the tubes, as compared with the whole space, when the preceding theoretic ratio is adopted.

$\frac{a-c}{4c}$ = the number of tubes in one horizontal row A B.

$4c\sqrt{\frac{3}{4}} = 2c\sqrt{3}$ = the vertical distance between the horizontal rows

$\frac{b-c}{2c\sqrt{3}}$ = the number of horizontal rows in A D.

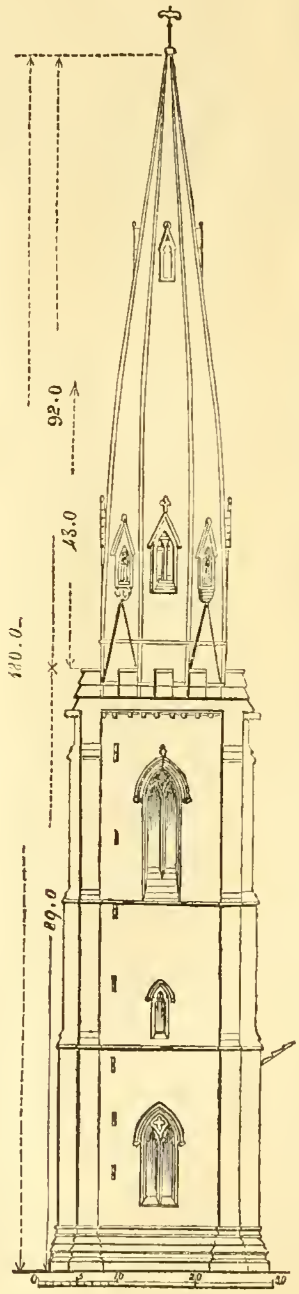
$\frac{a-c}{4c} \times \frac{b-c}{2c\sqrt{3}} = \frac{(a-c)(b-c)}{8c^2\sqrt{3}}$ = the whole number of tubes.

Diameter of a tube $= 3c$

$\therefore \frac{(a-c)(b-c)}{8c^2\sqrt{3}} \times \frac{\pi}{4}(3c)^2 = \frac{9\pi}{32\sqrt{3}} \cdot (a-c)(b-c) =$ the area of the tubes: from which it may be observed that the diameter of the tubes disappears from the expression, indicating that so long as the ratio between the diameter and interval remains the same, the aggregate area will be constant, let the actual diameter be what it may: and the value of $\frac{9\pi}{32\sqrt{3}} = 0{\cdot}51$. The area of the tubes will, therefore rather exceed the half of the space.

Manchester. Geo. W. Buck.

ENTASIS OF CHURCH SPIRES.



Sir—In a report of a recent meeting of the Royal Institute of British Architects, given in your journal of Jan. 27, I observed some remarks upon the question of entasis in spires, from which it appears, that the gentlemen who took part in the discussion had not recognised decided curved lines in any spire except that of Newark; I am happy to be able to instance, from the same district, a much finer and better developed example than the spire of that church, which, it is true, has a positive though slight entasis: the accompanying drawing, should you think it worthy of a place in your valuable *Journal*, and which is an elevation of the steeple of Gedling Church about four miles from Nottingham, will more clearly exemplify this assertion: the scale and measurements may be depended upon, as the latter were taken during some repairs at the summit of the spire. It will be perceived from this that the amount of variation or bulging from a straight line drawn from the base to the summit, is very considerable, being in the widest part not less than two feet; indeed the swell is so great as to prevent a person, standing upon the leads of the tower, seeing the weathercock, unless by leaning over the battlement: the curve extends 43 ft. from the top of the battlement, where it meets the straight lines of the rest of the spire, and forms a segment of a circle whose radius is about 270 ft.

The style of the spire is of what I should denominate the second decorated; circa 1320; and it is, perhaps, worthy of remark, that Newark is also of decorated date, although somewhat later than Gedling. It is situated at the north west angle of the nave; and consequently groups very picturesquely with the body of the church, which possesses many interesting features, and has a most exquisite early English chancel of rather unusual dimensions (50 ft. by 24 ft.): there are four niches occupying the alternate faces of the spire as indicated in the drawing; they contain male and female statues, in the attitude of prayer. One of the best preserved male figures is apparently clad in chain mail, with a low conical helmet; and wears either a jupon or cyclas, with a triangular or heater shaped shield, and a sword girt upon the thigh: this costume corresponds with the date to which I have assigned the erection of the steeple. There are also two canopied niches, containing good figures of saints, upon the western end.

The general effect of the spire is very imposing, its lofty altitude gaining additional elevation from its beautiful proportions and fine outline; which, together with the absence of all meretricious detail, and resulting simplicity of design, would, in my opinion, render it an admirable model for modern imitation.

I am, Sir, your obedient servant,

J. C. ROBINSON.

Nottingham, February 20, 1844.

MESSRS. BOULTON & WATT, ON THE STEAM ENGINE.

Through the intervention of a Correspondent we are enabled to lay before our readers a document of some importance—being not less than a copy of the instructions furnished by Messrs. Boulton & Watt to five, we are informed, of their principal agents, and superintendents, who were deputed by them to attend, in different parts of the kingdom, to the erection of the steam engines made by the firm, under the first conditions of the patent-rights granted to them.

In the history of the invention of the steam-engine, some authors have shown much laborious research, and have deemed it right to adduce as elementary discoverers, the names of Hero, Brancas, and other individuals; and have terminated this branch of their histories, with the inventions of Sir Samuel Morland, and the Marquis of Worcester. But we, ourselves, are of opinion that, in the history of the invention of the steam-engine, there are only three important elementary periods; viz., those of Savery, Newcomen, and Watt; and all of them took place within a century.

In taking a retrospect of the inventions of those eminently distinguished individuals, and of the times in which they respectively lived and brought them forward, we scarcely know to whom the greatest meed of praise is due—whether to Savery, for the invention of the steam-engine, and its first application to the arts of life; or to Newcomen, for the introduction of the cylinder, piston, beam, and pump-work generally, which still remain, as essential features of the invention; or to Watt, first for effecting the condensation of the steam in a vessel separate from the cylinder; and secondly, for his admirable contrivance of the parallel motion. For it was by this last that he was enabled to work the steam on both sides of the piston, and to reduce the action of the engine to that extraordinary precision of time and power, for which it is now universally celebrated, and by which it is adapted to the performance of the most delicate and rapid processes, even to the weaving of lace.

To James Watt, notwithstanding the profundity of his intellect and great inventive powers, much additional praise is due for his sound commercial talent; so ably aided and seconded, as it is well-known to have been, by his princely-minded partner, Mr. Boulton. And, perhaps, it was owing to this last mentioned circumstance, that the names of Messrs. Boulton & Watt spread so rapidly over the surface of the civilized world, as pre-eminently skilful mechanicians.

A document emanating from such a firm, even as a matter of history, is of some importance; but when the low state of the mechanical arts at that period is considered, and a knowledge of it is placed in juxta-position with the soundness of judgment, prudence, and foresight, displayed in the document, we cannot withhold our admiration of that commercial sagacity, by which they ensured practical success. There cannot be a question, that much of that success, and its consequence, the realization of great wealth, was produced by deep investigation of, and attention to, minute details, as thus exhibited; and it ought to convey to many of those who have embarked, or are about to embark, in the same arduous and honourable profession, a memorable lesson.

In giving the document to our readers, we shall not presume to disturb the meaning of the text, or attempt to enrich it by notes and annotations. But, at the conclusion, we shall take a retrospect of the whole, and bring the practical illustration of the steam-engine down to the present time.

TABLE OF CONTENTS.

General Directions for Building the Engine House, and Constructing some parts of the Engine.

1. Having fixed upon the proper situation of the pump in the pit, from its centre, measure out the distance to the centre of the cylinders;—that is, the length of the working beam, or great lever, and the half breadth of each of the great chains,[1] then, from the centre of the cylinder, set off all the other dimensions of the house, including the thickness of the walls. Dig out the whole grounds included, to the depth of the bottom of the cellar; so that the bottom of the cylinder may stand on a level with the natural ground of the place, or lower, if convenient. For the less height the house has above ground, so much the firmer will it be. The foundation of the walls must be laid at least two feet lower than the bottom of the cellar, unless the foundation be firm rock; and care must be taken to leave a small open drain into the pit, quite through the lowest part of the foundation of the lever wall, to let off any water that may be accidentally spilt in the engine house, or may naturally come into the cellar. If the foundation, at that depth, does not prove good, you must go down to a better, if in your reach; or make it good by a platform of wood, or piles, or both.

2. The foundation of the lever wall must be carried down lower than the bottom of the space left under the condenser cistern, to get at the screws which fix the condenser; and two short walls must be built to carry the beams under the condenser cistern. Two other slight walls must be built, one on each side, at a little distance from the cistern, to keep the earth from it, which would otherwise cause it to rot.

3. Within the house, low walls must be firmly built to carry the lower cylinder beams, so as to leave sufficient room to get to the holding down screws; and the ends of these beams must also be lodged in the wall; but the platform must not be built on them, until the house is otherwise finished.

4. The lever wall must be built in the firmest manner, and run solid, *course by course*, with thin lime mortar; and care must be taken that the lime has not been long slaked. If the house be built of stone, let the stones be long and large, and let many headers be laid through the wall; it should also be a rule, that every stone be laid on the broadest bed it has, and never set on its edge.

A course, or two, above the lintel of the door which leads to the condenser, build, in the wall, two parallel flat thin bars of iron, equally distant from each other, and from the outside and inside of the wall, and reaching the whole breadth of the lever wall. About a foot higher in the wall, lay at every four feet of the breadth of the front, other bars of the same kind, at right angles to the former course, and reaching quite through the thickness of the wall; and at each front corner lay a long bar, in the middle of the side walls, and reaching quite through the front wall. If these bars be 10 ft. or 12 ft. long, it will be sufficient. When the house is built up nearly to the bottom of the opening under the great beam, another double course of bars must be built in, as has been directed.

5. At the level of the upper cylinder beams, holes must be left in the walls for their ends, with room to move them laterally, so that the cylinder may be got in; and smaller holes must be left quite through the walls for the introduction of iron bars; which being firmly fastened to the cylinder beams at one end, and screwed at the other, or outer end, will serve, by their going through both the front and back walls, to bind the house more firmly together.

6. The spring beams, or iron bars fastened firmly to them, must reach quite through the back wall, and be keyed, or screwed up tight; and they must be firmly fastened to the lever wall on each side, either by iron bars, firm pieces of wood, or long strong stones reaching far back into the wall. They must also be bedded solidly; and the sides of the opening built in the firmest manner with wood or stone. The spring beam must always be laid eight inches, on each side, distant from the working beam, to give room for the side arches.

7. The house being finished, a wooden platform, of two and a half inch plank, must be laid on the lower cylinder beams; and the centre of the cylinder being accurately marked on it, four holes must be bored through the cylinder beams for the holding down screws; and four boxes, about seven or eight inches square, and as long as the stone platform will be deep, must be placed perpendicularly over them. Then the stone or brick platform must be built up to the level of the cylinder's bottom. It must be composed of the heaviest materials which can readily and cheaply be procured. A very solid pillar of stone or brickwork, laid in the best lime mortar, must be carried up directly under the cylinder, and must be, at least, of the diameter of the outside of the flanches; the rest of the platform may be filled up with heavy materials, bedded solidly in a mortar of clay and sand, and well beat into their places, so that they may never settle or yield.

[1] [N.B.—It may be necessary here to state, that as the instructions here given were for the first engines made and erected under the patent, they were applied to pumping only; that the engines were of the kind denominated "atmospheric," and that, as the parallel motion was not then invented, the circular motion of different parts of the beam were changed into the approximatively vertical, upward and downward, motion of the piston rod, and pump rods, by arch heads, or "arches," on the beams; and by suspending the rods to them by chains.]

8. The lever, or great working beam, is best when composed of one single log of seasoned oak, where that cannot be obtained, two may be used, or four, or more. The fewer logs it is composed of, so much the more durable will the lever be, or of so much smaller scantling may it be made. This beam must be fashioned and mounted. The diagonal stays, fastened to the arches, and on the lower log, or lower edge of the beam, will prevent the logs from sliding on one another, by the difference of the direction in which the chains act upon them, when the end of the lever is up or down. These stays must be let into the side of the beam, that the other diagonal braces may pass over them. The diagonal braces, which reach from the top of the king posts to the lower edge of the beam, are intended to prevent the logs from bending or sliding on one another. They are fastened to the beam, at their lower end, by means of a strong square bar of iron screwed at both ends, which passes through the beam, and serves to bind it together, laterally. They must nowhere else have any fixture to the beam. Their screws, at the top of the king posts, must be tightened from time to time, as required.

The gudgeon must be placed on the top of the beam, and must not be at all let into it; only the corners of the log may be taken off, to fit the saddle plate, and to prevent the saddle plate from sliding on the beam. One or two pieces of hardwood, about five inches broad, and a foot long, by three inches thick, may be let into the upper side of the beam, one inch deep, with their ends butting up against the saddle plate. They must be spiked down in their places; and both them, and the saddle plate, must be laid in a bed of tar and tallow, mixed and used boiling hot, which will prevent the wood rotting under them. A clamp of oak, four inches thick, and from four to six feet long, must be spiked on the lower side of the beam. This clamp must be rounded on the edges; its use is to prevent the beam straps from hurting or weakening the beam in that critical place. These beam straps must not be made out of thick bars, or lumps of iron; but must be made up by a number of thin or small bars welded together; and they, and all the other iron work of the beam, must be made of iron of the best quality. All the big pieces should be made up of smaller, or thin bars, in the way I have mentioned. Upon no account, whatever, let any holes be bored through the beam near the gudgeon, nor any thing else be done, which may weaken it there.

9. The arches for the plug tree and condenser pumps should be screwed to the beam by screw bolts, which should pass through the joints of the logs of the beam, if it be composed of more logs than one, and one bolt may generally pass above the beam; these bolts also serve to keep the beam together laterally; these arches should be made with a shoulder of two inches projection to rest on the upper side of the beam. The tails of the martingales of the plug tree, and the condenser pumps, must also be secured by bolts passing through the beam in some joint, if it can conveniently be done. The lower end of the king post should have a hollow in it, to fit the gudgeon on; but care should to be taken that it rests upon the gudgeon, and not upon the saddle plate. It should be contrived, that the tails of two of the great martingales should rest on the middle of each of the two logs which compose the thickness of the beam; that is, when the beam consists of four or more logs. The martingale screws should be strong, and should go quite down through the beam, as it is them that principally keep the beam together in the direction of its depth. Near these screws must be placed the keys, or pieces of hard dry wood; which, being half let into each log of the beam, prevent the logs from sliding one upon the other. These keys should never be above two inches thick; that is, one inch let into each log: they may be made in three pieces, the two outside pieces dovetail ways, and the middle one tapering; by driving up which, they are made to join themselves in their mortoises. Or they may be made of one piece, six inches broad at one end, and five at the other, so that by driving the whole in, it may check the sliding of the logs. If there are more sets of logs than two in the depth, the keys must be placed, alternately, on different sides of the martingale screws. Care must be taken, in placing the chains for the plug tree and condenser pumps, that all the heads of the chain bolts be next the beam, and that they be far enough off not to rub on the diagonal stays, or any other thing.

10. The great chains must be made of the very best Iron, and the martingales must be placed so, that the adjusting screws may lie parallel to the arches, and the upper surface of the head of the martingale be at right angles to them. The holes, in the martingales, should be quite easy for the adjusting screws; and a washer, thinned about the outer edges, should be quite easy for the adjusting screws; and a washer, thinned about the outer edges, should be put under the nuts. There should be a sufficient length of chain, to reach one link lower than the under end of the arch of the beam.

11. The cap and cross-bar, for the piston-rod, should be firm work, of good iron. The mortoise, in the cap, should be made exactly to suit the mortoise in the piston-rod; and the cutter, or forelock, to fit them both exactly; and the cutter above all things should be the very best of iron, as the whole depends on it. There is always a sufficient size given it in the drawings; so that, if it should fail, it must be the fault of the iron, or work-

manship. This cutter must be kept in its place by two cross cutters; and these again, by a thong of leather, passed through some holes in them.

12. It will seldom happen that the plug tree can be hung directly under its arch; you are to place them exactly in the places fixed by the drawings; that of the arch will always be found right in the general section; but the place of the plug tree and guide posts must be taken, by measuring from the nozzle, in the drawing of the working gear. A strong iron bracket with a stay must be fastened to the top of the plug tree, in such a direction that the point of the bracket may come directly under the arch. There must be a hole in the point of the bracket, to receive the end of an iron rod, reaching down from the chain; and the end of this rod must be screwed, for five or six inches, and have a nut on the lower side of the bracket, to adjust the height of the plug tree by.

13. There should be placed upon the spring beams, over the cylinder, two uprights, connected at top by a strong cape piece. These uprights serve to support a windlass, with a wheel and pinion; by means of which, and a pair of tackle pulley blocks hung to the cape piece, it will be easy to lift and put the cylinder, &c. in their places; and after the engine is completed, it makes it easy for the engine man to raise the cylinder lid, to pack the piston, without other assistance

The barrel of the windlass may be of oak, about six inches diameter; and must have a square gudgeon of iron driven quite through it; on one end of which, the toothed wheel must be fixed. The gudgeon may be from one and a half, to two and a half inches square, according to the size of the engine; and the wheel about two feet diameter, driven by a pinion five inches diameter; but these may be larger, or less, according to the weights commonly to be raised. It is necessary to mention to those who may look on a wheel and pinion as a superfluous expense, that there is no trusting to windlasses wrought by bars; and that many bad accidents have happened through the use of them, which obliges us absolutely to condemn them for this purpose.

14. The springs to receive, and, in some degree, to save the blow when the engine comes down too suddenly, are best made of a piece of a square dry elastic timber, reaching from the plummer blocks, to nine or ten inches beyond the catch pins; their size must be suited to that of the engine, from six inches square, to twelve, or fourteen. The ends next the catch pins must be sloped off on the under side, for four or six feet in length, according to the size of the engine; so that their points may be one inch distant from the spring beams, to which they must be bolted down, by a screw bolt at the end of the sloped part, and another at the end next the plummer blocks. The part of these springs which are struck by the catch pins, should be covered by a plate of iron, and that again by a piece of strong leather, to prevent the clattering noise they might otherwise make.

15. The utmost attention to dimensions must be observed, in constructing the masonry of the building; particularly in regard to heights; mistakes in them are productive of the worst consequences.

16. The condenser cistern must be made of best Dantzic three inch deal plank, if it can be got. If not readily to be got, any other good red deal, or oak, may be employed; but whatever kind of wood be used, be sure to cut off all the sap wood, otherwise the cistern will soon become useless. The best way of putting the cistern together is, by means of long screw bolts of iron, about three-quarters square, put through the planks edgeways, from top to bottom of the cistern. These screws may be eighteen inches distant from one another. The bottom may be put together in the same manner with screws; and then fixed down upon the beam, or beams: and be supported by so many more smaller beams, as may be necessary. If the cistern is not more than seven feet long, no uprights, on the outside, are necessary; only one, about six inches square, in each corner, in the inside; and in no cistern ought there to be any uprights on the sides next the wall. The joints of the planks should be plain joints and put together on a strip of coarse flannel, soaked with a mixture of tar and tallow, equal parts, and warm; or upon bullrushes. A large cock or a brass valve should be fixed in the bottom of the cistern, to let off the water occasionally; and a notch, about four inches deep, and eighteen inches broad, with a trough fitted to it, should be made in the upper edge of the cistern, to convey away the waste water. If surface water cannot be found to supply the injection, a small pump should be fixed, to bring up water from the main pump head into this cistern. In case the water from the pit is good, and is raised to the surface, the main pump may deliver it directly into the cistern; but if the water be subject to be muddy, or mixed with sand, &c. it will be best to put it into another cistern, to deposit some part of the matter first. If the pit water be vitriolic, or encrusting water, it becomes necessary to use every means to procure better water, otherwise it will destroy the condenser, &c.

17. In making the boiler, you should use rivets between five-eighths and three-fourths inch diameter. In the bottom, and sides, the heads of the rivets should be large, and placed next the fire, or on the outside; and in the boiler top, the heads should be placed on the inside. The rivets should be placed at two inches distance from the centre of one rivet to the centre of the other; and their centres should be about one inch distant from the edge of the plate. The edges of the plate should be evenly cut to a line, both outside and inside. It is impossible to make a boiler top truly tight, which is done otherwise. After the boiler is all put together, the edges of the plates should be thickened up; and made close by a blunt chissel, about one quarter inch thick in the edge, impelled by a hammer of three or more pounds weight; one man holding, and moving the chisel gradually, while the other strikes. All the joints, above water, should be wetted with a solution of sal ammoniac in water, or rather in urine; which, by rusting them, will help to make them steam tight. After the boiler is set, it may be dried by a small fire under it; and every joint and rivet above water, painted over with thin putty, made with whiting and linseed oil, applied with a brush. A gentle fire must be continued until the putty becomes quite hard, so as scarcely to be capable of being scratched off by the thumb nail; but care must be taken not to burn the putty, nor to leave off, until it becomes dry.

18. In building the brickwork of the boiler setting, no lime must be used where the fire or flame comes; but a mortar made of loam, and sand, and clay; but lime mortar should be used towards the outside. Pieces of old cart tyer, or other such like pieces of iron, may be laid under the chime of the boiler; between it and the bricks; which will prevent its being so soon burnt out there. The brickwork, which covers the boiler top, should be laid in the best lime; which will not hurt it there, but will preserve it. The mortar should be used thin; and the boiler top well plaistered with it; which will conduce greatly to tightness, if done some time before the engine be set to work. If your lime be not of the species which stands water, it will be well to mix some Dutch, or Italian terraso, or pan scratch from the salt works, with it; but in any case, the lime should be newly slacked. In carrying up the brickwork, round the flues, long pieces of rolled iron should be built in, in two or three courses, to prevent the brickwork from splitting. Four holes, at convenient places, should be made into the flues, large enough to admit a boy to go in, to clean them. One of them may be over the fire door; and another right behind the damper, in the backside of the chimney. This last, may be as high as the flues themselves are. These holes, when not in use, must be built up with nine inch brick work, and made perfectly air tight. Immediately above the brick work of the boiler setting, a hole must be left in the chimney, on the side next the boiler. This hole must be as wide as the chimney; and must have a sliding door fitted to it, to open it more or less, at pleasure; the use of it is to moderate the draught of the chimney, and to prevent the flame being drawn up it, before it has acted sufficiently on the boiler. A groove must be left in the brickwork, for the damper to move up and down in, easily; which should fit flat to the face of it. The damper may be made to move easily, up and down, by means of a wheel, on a beam, with a counterpoise equal to the weight of the damper. The best form of a fire door is two feet long, and one foot high, inside measure, to have leaves, made of boiler plates, hinged on the two sides, and over lapping one another, about an inch in the middle. The scantling of the frame may be three inches broad by two inches thick.

19. The gauge pipes may be fixed into the boiler top, in some convenient place; the lower end of the longest should reach within six inches of the top of the flues; and the shortest should be four inches above it. The feed pipe should reach two feet under the surface of the water in the boiler; and should have a valve, at its lower end, to prevent the water being ever forced up through it, by the steam. Its upper end should rise seven feet higher than the surface of the water in the boiler. It should be supplied with water by a pipe from the top of the hot water pump, regulated by a cock near the feed pipe.

20. If you have not land water that will naturally run into the condenser cistern, you must make a pool somewhere in the neighbourhood to receive the water from the hot water pump and reserve it for supplying the boiler and condenser cistern when the engine stands still on any occasion.

This pool must be at least forty feet long, and twenty feet wide, and to hold three feet deep of water; and pipes, or troughs, must be laid from its bottom, to the boiler feed pipe and cistern. That, at the feed pipe, must have a cock on purpose. It is meant, that the pool be simply dug in the earth; and be lined with turf, puddled; or otherwise made water tight. If no ground, within a reasonable distance, be high enough for the water to run from the bottom of the pool into the boiler, then a pool may be made o lower ground, and a hand pump be fixed up, to supply the boiler and cistere; but this ought to be avoided, if possible.

This concludes the first part of Messrs. Boulton & Watt's instructions. In our next *Journal*, we shall resume the subject, and give their "*Directions for Putting the Engine together;*" and also an engraving of the description of Engine referred to in these particulars.

Silver Mine.—We learn from Stockholm, that a silver mine, which is expected to be very productive, has been discovered near the town of Lindsberg.

AGRICULTURAL CHEMISTRY.

By Professor Brande, F.R.S., &c.

Lecture IV.—*Delivered at the Royal Institution, Feb.* 17, 1844.

(Specially reported for this Journal.)

Phosphoric acid, once considered unimportant, is requisite for most crops, but especially for wheat and grass. It is generally added to the soil in combination with lime, as bone dust, the earthy part of bone consisting almost entirely of phosphate of lime. Phosphorus, the base of phosphoric acid, is never found in a free state in nature, being obtained by distilling a mixture of phosphoric acid and charcoal. It is a pale yellow semi-transparent solid, remarkable for its easy combustibility, luminous in the dark, owing to its slowly burning. When set fire to and a tall glass jar placed over it, flakes of a beautiful white substance are collected, which is phosphoric acid, the phosphorus having combined with the oxygen of the air. These flakes will, in a short time, abstract moisture from the air, and become liquid. If this liquid be then added to a solution of lime, phosphate of lime, or bone earth, falls as a fine white insoluble powder. When bones are burned, it is this which is left as the white ash, the animal matter having been destroyed. But as phosphate of lime is soluble in acids, the animal part may be obtained in a separate state by digesting bone in weak muriatic acid; the bone remains in its original shape, but is then as flexible as cartilage, the whole of the earthy part being removed. In this state it is that bones are employed to make animal glue and portable soup. Formerly it was supposed that it was to this part that the virtue of bone manure was due; but it is found that bones are nearly as efficient after the animal part has been destroyed, as for instance, after they have been distilled for the manufacture of hartshorn, or ammonia. Since this has been clearly established there has been great demand for phosphate, search has been made to ascertain whether any large natural supply of this substance could be discovered, as it is frequently found in a mineral state. For this purpose Dr. Daubeny made a pilgrimage to Spain, and in Estramadura he found a large quantity known as Phosphnrite, from its giving off a pale blue light when heated; but as there is no water conveyance from thence, and the roads are bad, the expense would be too great. It is present in nearly every soil, and is even to be found in chalk, as the following analysis of the Brighton chalk will show.

100 *of Brighton Chalk.*

Carbonate of lime . . .	98·57
Carbonate of magnesia . . .	0·38
Phosphate of lime . . .	0·11
Oxides of iron and magnesia. . .	0·14
Alumina	0·16
Silica	0·64
	100·00

In slate, phosphoric acid sometimes exists combined with alumina, and occasionally the surface of the slate is found covered with a crystalline mass of phosphate of alumina, or wavellite, as mineralogists term it. When this disintegrates, to form a clay soil, the phosphoric acid will get diffused, and thus become one of the elements of the food of the plant. In the chalk, which is agreed by most geologists to be the debris of organic matter, the phosphoric acid has, no doubt, had its origin from the shells of come of the lower animals. An interesting observation has been made on this subject, viz., that the shelly or bony structure of the lowest animals consists wholly of carbonate of lime; that as they increase in complexity of structure, a little phosphate of lime is found, and in that of the animals highest in the scale of creation, phosphate has entirely replaced the carbonate of lime. From this fact, the absolute necessity for phosphoric acid in the soil is evident; for the growing animal, browsing in the field, is c ntinually adding phosphate of lime to his increasing bone; from whence can it come? As he eats nothing but plants, it must be in their structure, and analysis proves it to be so: then, again, as the plant derives all it contains from the earth, air, and water, it must be in one or other, and the analysis of all fertile soils shows that it is invariably present. These remarks applying to phosphoric acid, are applicable to all the inorganic constituents of animals or vegetables. But it is also requisite that they should be in a soluble state, or the plant cannot take them into its circulation, and frequent disappointment has arisen in the use of bone dust, from there having been nothing in the soil to dissolve the phosphate of lime; it is by some imagined that plants excrete from their roots acid substances to render soluble the substances around them. Experiments have been made by dissolving the phosphate in an acid previous to mixing it with the soil, and very beneficial results have been obtained. The Duke of Richmond found that a much larger crop of turnips was thus obtained, and some agriculturists have stated that one pound of bone dust mixed with acid is as efficacious as 6 lb. without. The proportions advisable are, to take 100 lb. of bones, and after breaking small, to add to them about 50 lb. of sulphuric or muriatic acid, they being the cheapest, and about three cwt. of water, which will give a solution of subphosphate of lime and free phosphoric acid. In order to get it into a convenient form for application, it is advisable to sprinkle this liquid over some substance which will absorb it, such as saw-dust; if to this be added some silicate of potash, a most fertilising agent is obtained. A manure which is now being very extensively employed in this coutry, and the demand for which is daily on the increase, viz., guano, appears to owe its qualities principally to the phosphate and other salts which it contains. It is the excrement of sea birds, and is obtained in immense quantity. The amount of inorganic matter it contains may be ascertained by burning a known weight in a silver crucible, and weighing the ash which remains.

The quantity of inorganic material requisite to be added to the soil will depend upon two things, the quantity that the plant absorbs to form part of its system, and also upon what part of the plant is removed from the field, as it has already been seen how greatly the various parts of a plant differ in the quantity of their inorganic constituents. Hence is evident the importance of ploughing in all the parts of the plant not taken to market, especially the leafy parts. It is even, in sandy soils, found advisable to burn the plants which have grown there, such as heath and furze, and to return the ashes, which, by this means, in a few years render it fit for the growth of more profitable crops. The great difference in the quantity of the salts which various plants appropriate, will be rendered very evident by the two following tables:—

Salts, &c. in 1000 of the Ash of Seed and Straw.

	Wheat.	Wheat Straw.	Barley.	Barley Straw.	Oats.	Oat Straw.	Beans.	Bean Straw.
Potash .	190	5	120	35	60	150	195	530
Soda . .	203	7	120	10	50	—	380	15
Lime . .	80	70	45	105	30	27	77	200
Magnesia .	80	10	80	15	25	5	75	67
Alumina .	20	28	10	30	5	—	15	5
Oxide of Iron	—	—	—	5	15	—	—	—
Sulphuric acid	40	10	25	20	15	15	40	10
Phosphoric acid	35	50	90	30	30	3	138	73
Silica . .	340	810	500	735	765	800	60	70
Chlorine .	10	10	10	15	5	—	·20	25

Composition of Three Soils.

Silica . .	7767	9214	8465
Alumina . .	445	149	50
Oxides of Iron .	515	308	82
Oxide of Magnesia	83	31	3
Lime . .	212	59	13
Magnesia . .	153	36	7
Potash and Soda	24	14	2
Phosphoric acid	68	6	13
Sulphuric acid .	56	1	1
Chlorine . .	4	2	3
Organic matter .	247	106	1200
	9574	9926	9839
Less .	426	74	161
	10,000	10,000	10,000

This will serve to explain why those plants which contain but few of these salts are said to form good fallow crops. It is remarkable, also, the invariable proportion in which they are present in the same plant, although grown in a different climate, and in a different soil. Sprengel analysed wheat from several districts, and found them, in this respect, exactly to resemble each other.

A question has arisen amongst vegetable physiologists whether one substance usually present in a plant, can be substituted by another, and it has been found to take place in some few instances. For instance, cases have occurred where plants which usually have one alkali present, when grown in a soil where that alkali is not present, have been found to appropriate another, but still preserving the same amount. Indeed, some plants, when growing in circumstances where they cannot obtain inorganic alkalis, will positively form organic ones, in order to carry on their functions; such is said to be the origin of the morphia, in poppies, to which organic alkali the properties of opium are due. It is well known that potatoes when stored up in a damp cellar, will throw out shoots to a very great length. Now when these are analysed, they are found to contain a vegetable alkali in great abundance, to which the name of solanine has been given, not an atom of which is ever to be found in the plant in its natural state. It has, in fact, formed this alkali from some of its other constituents, so that its germinations may proceed.

The efficacy of common salt as manure is most undoubted in many situations. To lands near the sea there cannot be any necessity for adding it, as the winds carrying the spray always give it a top dressing of salt, and those near the shore generally get too much. It is said by some to render the silica soluble, but one undoubted benefit it bestows is in killing the grubs and vermin which infest some crops to so enormous an extent. It is present in every soil. It is used in great quantities for the manufacture of soda, and distilled with sulphuric acid, yields muriatic acid.

The very large proportion of inorganic constituents that some plants contain, is occasionally rendered evident by accident. Thus hay, which contains 90 per cent of its weight, is frequently found, when a rick has caught fire, to be converted into a hard opaque glass, and a corn stack will burn to a complete flint. In the case of hay, this accident sometimes occurs, when it has been stacked before it is dry, by the heat which is evolved during the fermentation of its juices. There is a very admirable arrangement in nature for returning to the soil, every year the inorganic substances which it requires for its growth, but which it has not retained in its wood, and that is the autumnal fall of the leaf, which, as has been already seen, contains, of all other parts, by far the greatest quantity of salts. Thus they serve to go one perpetual round, now dissolved by the water in the soil, and absorbed by the roots, now flowing with the sap through every ramification of the tree, and at last forming part of the leaf, to be on the approach of winter, again deposited on the soil, to be again dissolved, absorbed, and perform the same functions; but in each circuit leaving part of itself as a permanent resident in the stem of the plant. Thus, then, we are led, by a consideration of these and other circumstances, to the only inference that can be drawn, that these inorganic constituents, in small proportion to the other parts as they may be, are nevertheless vitally essential; that no substance found in the ash of a plant can be considered as accidental but as constitutional, without every one of which be present in the soil, and in a fit state, it is useless to expect the plant to show, when the deficiency of the soil is known, what is requisite to be added, so as to make it suit each respective crop.

But it is time to pay attention to the organic part of the soil. This, which consists of the vegetable mould formed from the decay of the woody parts of the plants, is known by the name of humus. It may be traced in various stages, from the firm wood, to the yellow rotten wood, then to a brown, and lastly to a black earth, which is almost charcoal. On the banks of a stream, shaded by overhanging trees, the fallen beams may frequently be seen in the medium state, whilst at the bottom of the water, the dark brown mud is the best instance of it in its final state. When stirred it frequently gives off carbonic acid and carburetted hydrogen, arising from the decomposition of the woody fibre, or eremacausis, as it is the fashion to term it. There is no doubt that the presence of this is beneficial in the soil, though not to the extent that it was formerly considered. As it is very slightly soluble in water, it cannot yield much nourishment to the plant, and it is doubtful, except by the carbonic acid which it slowly evolves, whether it is of any other than a mechanical advantage to the soil. Indeed it is the opinion of many, that so long as the plant can get its inorganic parts from the soil, it can derive all its organic parts from the atmosphere. Vegetable matter, however, is found in all fertile soils, in the proportion of from 10 to 20 per cent. In boggy earth, it forms from 60 to 70 per cent. For the growth of rice, but little is required, for barley more, and for wheat more; about 12 per cent. is advisable. Water poured on good soil, should be very slightly coloured; if deep brown, it will be barren, possibly arising from the presence of an acid, rendering the vegetable matter soluble; this must be counteracted by lime or chalk.

Soils are classified and named according to the proportion of their principal constituents; thus some consist of pure agricultural clay, of which pipe clay is a good example, which consists of from 50 to 60 of silica, the remainder being alumina. This when stirred up with water, deposits no sand. Rivers, passing through clayey soils, carry with them an immense quantity, taking weeks to deposit the whole, and in some cases carrying it a long way out to sea. When a clayey soil contains

From	5 to 20	per cent. of sand, it is called a	strong clay.
,,	30 to 40	,, ,,	clay loam.
,,	40 to 70	,, ,,	loam.
,,	70 to 90	,, ,,	sandy loam.
	90	,, ,,	sandy soil.

When chalk is present in from 5 to 20 per cent., these are termed marls; and are sandy, loamy, or clayey, according to proportions. More than 20 per cent. forms a calcareous soil.

From 5 to 20 per cent. of humus constitutes a vegetable soil, and from that to 70 per cent. a peaty soil.

Lecture V.

Twenty years ago, when the agricultural chemist was requested to analyze a soil, he would consider he had done his duty when he had ascertained the proportions of the four earths, and the organic matter. Now, however, the case is widely different, and it has become one of the most complex operations, which can be performed only by an experienced hand, and which it is of no use for the farmer to attempt; for it is very doubtful whether, if he became an expert chemist, he would also be an expert agriculturist. Still, however, the knowledge of the use of the various tests set forth in these lectures ought to be possessed by every agriculturist, they are soon acquired, and will give very valuable information.

In order to classify soils, the usual mode of examination is as follows:—Weigh a certain quantity of soil, dry in air, then reduce it to powder, and dry it before a fire on paper, at as great a heat as the paper will bear without charring, then weigh it to ascertain the quantity of water lost; burn it in a crucible for the purpose of destroying organic matter, and again weigh it; then put in dilute muriatic acid, about 1,000 grains of the soil to a pint of water and two ounces of acid, which will dissolve the saline ingredients, dry it before a fire, and weigh it, then stir it up in a considerable quantity of water, and whilst the finest particles are suspended, pour off the water, and by this means the clay will be separated,

A soil may have every ingredient requisite for vegetation, and yet not be productive on account of its not being in a proper mechanical condition, and there are several particulars to be looked to in this respect, such as density, division, retention of water, capillary power, shrinkage, relation to heat, &c. All these demand consideration.

A soil should not be too dense, as it then offers too great a resistance to the growth of the plant, retains water too firmly, and, consequently, is always cold. The weight of a cubic foot of good soil should be from 50 to 90 lb. The state of division of a soil should be tolerably fine, though occasionally large masses are of use. It is the custom to gather off the large stones from a field, but during cold or dry winds they are of service by protecting the tender plants from the nipping of the one or the parching of the other. The state of cohesion of a soil should be between the looseness of sand and the plasticity of clay. This may be considerably modified by deep ploughing, by tilling, but particularly by draining. In very clayey lands, the best thing to do would be to add sand, but as that would be generally too expensive, the best substitute is drainage. The resistance to the plough varies very much according to the nature of the soil. It has been calculated that sand gives a resistance of about 4 lb. to the square foot, clayey ground about 8 lb., and a stiff clay about 25 lb.

Soils differ in nothing so much as their power of imbibing and retaining water. It has been found, by direct experiment, that exposed for twelve hours in damp weather, 1,000 lb. dried sandy soil gained 2 lb.; 1,000 lb. dried loam gained 21 lb.; 1,000 lb. dried clay loam gained 25 lb.; and 1,000 lb. dried pure clay gained 37 lb.

According to some experiments of Sir H. Davy, the same quantity of a barren sandy soil gained 3 lb. in twenty-four hours, whilst a fertile soil gained 18 lb. This will give some idea of the enormous quantity of moisture that would be absorbed from a moist air following a dry wind. Mr. Solly has made some experiments on increasing the imbibing power of dry soils, by adding to them some very deliquescent substance; for this purpose he used chloride of calcium with very good results, Connected with this is its retaining power. A quantity of water which would soak sand, would scarcely moisten dry clay. They have been found to vary as follows:—100 lb. of sand retained 25 lb. of water; loam, 40 lb.; chalk, 45 lb.; marl, 50 lb.; and agricultural clay, 70 lb. The moister the land, of course the more imperative it is to drain it well, as too much water keeps a soil cold, and prevents the air from getting to the plants.

Capillary attraction, or that power by which liquids crawl up small crevices, is exceedingly influential in agriculture, and is beneficial in two ways; 1st, by keeping the surface in a proper state of moisture, bringing up water from below, as fast as it evaporates above. This action may be illustrated by standing a lump of salt or other porous substance on end in a plate filled with a coloured liquid. It takes place very rapidly by using a tall glass cylinder, having a porous bottom, filled with sand. The densest chalk that can be procured will, in this way, become coloured several inches high in a few hours. In horticulture it is frequently taken advantage of by keeping a flower-pot in a saucer, into which water is poured. The second important use of capillary attraction is to bring up from the sub-soil a supply of those soluble substances of which the removal of the crops is continually depriving the soil. This may be thought but trifling, but when the immense amount of water evaporated is taken into account, it will appear far from insignificant. After a continuance of dry weather, the soil will frequently be covered with a perceptible film of the salts thus brought up, which by the first shower is diffused through the soil. In sandy lands the fertility depends upon this property. In tropical climates, where evaporation is so much greater, it is seen on a magnificent scale. In the deserts of Peru, for instance, the nitrate of soda thus annually brought to the surface is raked off, and exported in immense quantities, to be used for manufacturing, and latterly for agricultural purposes. In Africa, also, the neighbourhood of Tripoli thus furnishes a supply of a variety of carbonate of soda. These facts induce the inquiry whether it is not advisable to save the drainage waters, and after evaporating, by some means, to restore them to the soil, as doubtless they must contain these salts, which would be so beneficial to the crops.

The shrinkage of soils in dry weather seems to be in proportion to the clay or organic matter present. Clays and peats in drying shrink one-fifth of their bulk. This action is of great utility, by increasing capillary action, and by forming conduits, by which the superfluous water may run off. Of course this does not take place in sandy soils.

The absorption of heat by the soil during sunshine is very great, sometimes raising its temperature 30° or 40° over that of the air. When the air has been at 70° or 80°, the soil has been observed, during sunshine, at 100° or 120°. Black lands will rise rather higher in temperature than those of a lighter colour, but not so much so as might have been imagined; the greatest difference observed having been 10°. When a chalk was observed at 100°, a neighbouring black loam was at 110°. The difference of absorption of heat by different colours may be illustrated by placing pieces of phosphorous on three pieces of tin, one with its own surface, one coloured white, and the other coloured black, and placing a hot iron ball between them at an equal distance, to represent the sun. The phosphorus will be ignited first on the black, next on the white, and lastly on the metallic surface. Those soils which absorb the quickest, radiate the quickest, and consequently would be coldest at night.

The subject next claiming attention is the atmosphere, and which here introduces an important division of the subject; for as the soil has been considered as being the source of the inorganic part of plants, so the atmosphere is considered as yielding to the plant the whole of the organic part. Startling as this statement may appear, strong arguments will be brought forward to prove its plausibility. The composition of the atmosphere in 100 parts by measure is,

Nitrogen	77·5
Oxygen	21
Watery vapour (consisting of oxygen and hydrogen)	1.42
Carbonic acid (consisting of oxygen and carbon)	0·08
	100·
Ammonia (consisting of nitrogen and hydrogen)	a trace

These are the invariable proportions of its constituents, let the air be collected where it may, on the top of a mountain or in the depth of a valley, in Europe or in America. This extraordinary uniformity may be accounted for by the property of the diffusion of gases, by the action of currents, the earth's motion, winds, &c.

Nearly the whole of the organic part of plants is composed of the four elements, carbon, hydrogen, oxygen, and nitrogen. As all these substances can be found in the soil, that was supposed to be the source from whence the plant derived them. But recent investigations have shown that whilst vegetables impoverish the soil as regards the inorganic matter, they greatly increase the proportion of organic matter in the soil. A fir plant, growing on a dry sandy soil, is continually enriching it with humus, by the fall of its leaves and twigs. It is evident, then, that it must derive the greater part, if not all, of its wood from the air, and it is doubtful whether, for this purpose, the great bulk of the air, the nitrogen and oxygen, contribute any part, or whether it is not due to the water, carbonic acid, and ammonia, which, although present in so small a quantity, yet, as will be shown in a future lecture, is sufficient for the purpose. These may, by artificial means, be removed from the air, the water and ammonia by means of sulphuric acid, or chloride of calcium, and the carbonic acid by lime; and although the difference could not be detected in breathing or in the burning of combustibles, yet it has been destroyed as regards plants, because there is an entire absence of that which maintains vegetable growth, and without which plants cannot form their structures.

The proportion in which the nitrogen and oxygen exist in the air can be ascertained by abstracting the oxygen; this can be done by several means: if fine iron filings be powdered over the inside of a glass vessel, and this stood over water, the iron will combine with the oxygen, or become rusted, and the water will rise in the vessel to take the place of the abstracted oxygen. But it may be effected more rapidly by burning a piece of phosphorus in a portion of air confined over water; the phosphoric acid produced dissolves in water, leaving the nitrogen gas pure. If the properties of this gas be then examined, it will be found that it will neither burn nor support combustion or life, that indeed, it is totally inert. If it is wished to get oxygen gas pure, it cannot be obtained from the air, as there is no means known of removing the nitrogen. It may be procured by heating substances which contain a great quantity of it, and which will part with a portion of it readily. Such is black oxide of manganese; which is commonly employed on account of cheapness. For the sake of purity, chlorate of potash is best, or a mixture of the two. The properties of the gas thus obtained are the opposite of those of nitrogen, being very energetic, supporting combustion most vividly, and hurrying respiration to fever and death. Iron and zinc wire, heated at one end, and introduced into this gas, burned with great beauty, as do also charcoal and sulphur. Phosphorus burns with brilliancy, such that the eye can scarcely bear. From this it is evident that in the air it is the oxygen that is the acting principle, and that the nitrogen serves the office of detecting it, so as to make its action on substances immersed in it sufficiently slow.

The next and following lecture will be devoted to the consideration of the lesser, although as regards plants, the more important components of the atmosphere.

REGISTER OF PATENTS.

Under this head we propose to give abstracts of the specifications of all the most important patents as they are enrolled. If any additional information be required as to any patent, the same may be obtained by applying to Mr. LAXTON at the Office of this JOURNAL.

IMPROVED WINDOW SHUTTERS.

Archibald Horn, of Aldersgate Street. Zinc Worker, for "*Improvements in the construction of windows, and for other purposes.*"—Granted August 15, 1843; enrolled February 15, 1844.

Fig. 1.

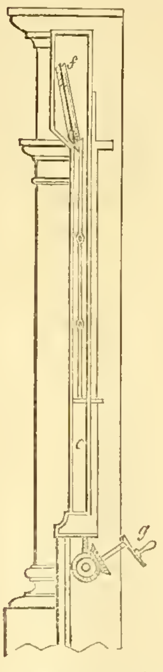
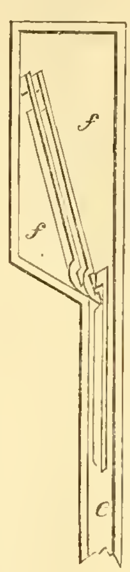
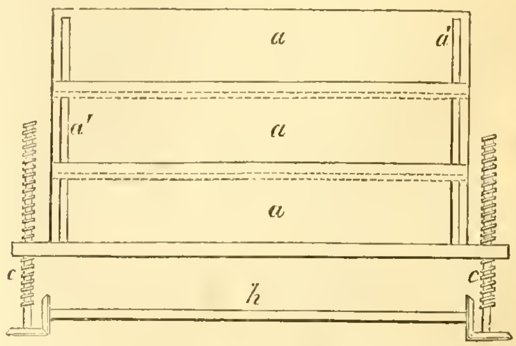


Fig. 2.



This invention consists in a novel mode of constructing shutters for closing windows and other openings, and consists in forming the shutters of thin plates of metal, strengthened at each end, and made to slide in vertical grooves at each side of the window or opening, and are successively deposited side by side in a box or chamber provided for their reception. Fig. 1, is a transverse section of a window, showing the application of this improvement; Fig. 2, is an end view of some of the plates, drawn on a large scale; Fig. 3, is a front view of the shutters, showing the method of raising them: *a, a, a*, are thin plates of metal, strengthened by means of transverse pieces of metal, *a′ a′* at each end, all of which are similar, with the exception of the lower one, which has a piece of metal, *b*, attached to its lower edge, having a female screw at each end, through which the screws, *c c*, pass. In Fig. 2, *e* is a portion of the grove, within which the ends of the plates slide, and *f f*, the box or chamber fur receiving such plates, which are su formed at their edges, or that part which forms the coupling, that as they are raised in the groove *e*, they will successively be disengaged, and each succeeding shutter will force the preceding one into the chamber *f*. It will be clearly seen, that on giving motion in one direction to the screws *c c*,

Fig. 3.



which is effected by means of a winch or handle, *g*, seen in Fig 1, which imparts motion by means of a bevel wheel to the horizontal shaft, *h*, that the metal plates or shutters, *a a*, will be raised in the groove, and the same will be disengaged successively until the whole, with the exception of the lower one, are deposited in the chamber; and on reversing the motion of the handle, the plates will be lowered, and in their descent will successively catch hold and successively draw each other down, and thereby form a plain metallic surface with lop joints. The patentee claims the mode of constructing and combining shutters in such manner, that they are successively caused to move into and out of the same grooves.

CHAIN CABLE.

JAMES BROWN, of High Street, Stepney, Middlesex, Engineer, for "*Improvements in tackle and apparatus for working and using chain cables in ships, and otherwise, and also certain improvements in tillers or rudders of ships and other vessels.*"—Granted August 16, 1843; enrolled February 16, 1844.

The first part of these improvements relates to a mode or modes of letting out, stopping, and raising chain cables; and secondly, to an improved steering apparatus. One of the improvements in the controller first described, of which Fig. 1, is a side elevation, and Fig. 2, a plan, is that the "shoe

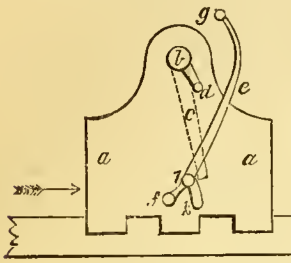


Fig. 1.

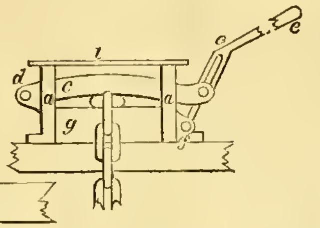


Fig. 3.

seat" or base of the frame is more deeply imbedded in the wood than is usual, and the anti-friction rollers hereafter described instead of working in fixed steps or journals in the ordinary manner, are dropped loosely in their bearings. *a a*, Figures and 2, is the framing; *b*, a shaft, supported at each end

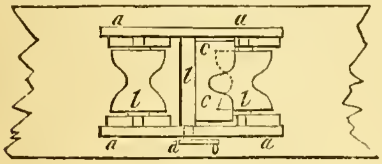


Fig. 2.

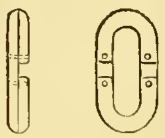


Fig. 5.

by the frame sides; *c*, is a leaf, having a slot or opening, as will be seen by the plan, and is attached to the shaft *b*; to the end of this shaft is also fixed a winch or handle, *d*, the object of which is to move or alter the position of the leaf when required; *e*, is a bent lever, moving upon its axis, *f*; this lever is connected by means of a handle, *g*, to a corresponding lever on the opposite side of the frame; *i*, is an iron roller, supported at each end by the levers *e*, and moving in a curvilinear slot *k*; it will be clearly seen, that when heaving the chain cable, the same will be allowed to pass freely in the direction of the arrow, in consequence of the leaf moving freely upon its axis, but it cannot return, on account of the end of the leaf coming against the iron roller *i*, which is shown in its elevated position, but on depressing the end of the level, the roller will be moved in the slot and away from the end of the leaf, and the cable will be at liberty to run off; *l l*, are two anti-friction rollers, which are dropped loosely in their bearings or journals.

Another modification of the above, consists in moving the iron roller by means of an eccentric. There are several other methods described for stopping and retarding chain cables, amongst which is the following, which is termed a box stopper, and is placed just over the chain funnel: *a a*, Fig. 3, is the frame firmly fixed to the deck timbers, and covered with a loose lid *b*; *c*, is a lever or nipper, attached at one end by a pin joint to the projection *d*; through the other end of this lever is passed a pin, which moves in the slot of the lever *e*; this lever is also attached in like manner to the projection *f*. The cable passes between the lever or nipper *c*, and the dead nipper *g*; thus by elevating the lever *e*, the pin of the nipper *c*, will be moved in the slot, and the same will be raised and the cable set at liberty, but on depressing the lever e, the nipper will retain the cable by one of the links, as shown. Another modification of this is shown, as being applied to the underside of the deck, which is termed an under deck controller. Fig. 4, is a sectional elevation of an apparatus for heaving the cable; *a a*, shows a portion of the frame side; *b*, a plate bolted thereon, which carries one end of an horizontal shaft *c*; upon this shaft is firmly fixed the working lever *d*, and also an arm *e*, to the extremities of which are attached one end of the connecting links *f f*, the other ends being attached to the levers *g g*, which levers work loosely upon the main axis *h*; *i i*, are two palls affixed to the levers *g g*, and taking into the ratchet wheel: it should be observed that there are two ratchet wheels and two sets of levers, this view only showing one half the machine, the section being taken through the centre. Between the ratchet wheels there is an indented wheel *k*, such indentures being made to receive each al-

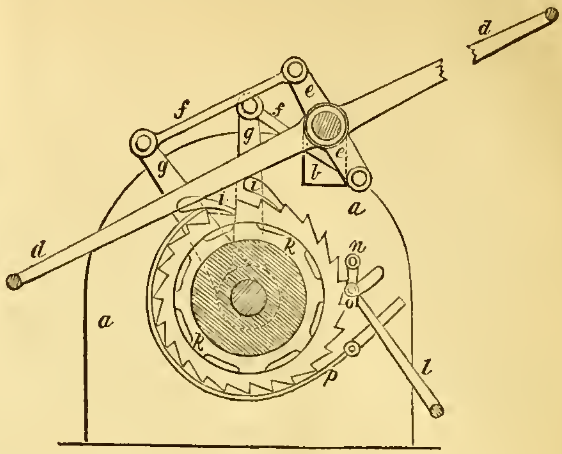


Fig. 4.

ternate link; the intermediate links of the chain pass into a groove; *l*, is a lever moving upon an axis *n*; to this lever is attached one end of cross bar *o*, which takes into the teeth of the ratchet wheels; *p*, is a friction band for retarding the motion of the barrel when letting out the cable. It will be clearly seen by the above, that on moving the ends of the lever up and down that a continuous rotary motion will be given to the barrel, and the chain will be hove in; when it is required to let out the chain it will be necessary in the first place to release the palls *i i*, after which the cross bar *o*, is released from the wheel by raising the lever *l*, which gives full liberty to the barrel.

Another improvement consists in constructing an improved link, which is intended to supersede the common shackle or swivel. Fig. 5, shows a front and edge view of one of these improved links, which are constructed in two halves or parts, each part having an opening, so that when put together, (which is effected by means of pins passing through holes in the link,) the openings are on opposite sides, and form one continuous link, which is said in the specification to have "all the strength of one continuous *solid* ring." We think if the patentee had said links or shackels, constructed as above, were something less than half the strength of a solid ring, he would have been nearer the truth, since the strength of the link is, by such opening, reduced to one half, minus the area of metal removed by drilling the holes for the reception of the pins. It will be seen that when it is required to disconnect the chains it will only be necessary to remove the pins and turn one of the parts half round, so that the two openings come together. There are other modifications of the above, which consist of hooks, the openings of which are closed by a piece of metal, so connected to the hook or hooks as to be easily removed.

The second part of the invention relates to a steering apparatus, and consists in the application of an additional pair of blocks, which are said in the specification to be attached by chains to the outer ends of the axis of the wheel, but in the drawings are shown as being attached to the end of the tiller, which is undoubtedly the proper place, the effect of which is said to cause the tiller rope to be always kept perfectly "taught" tight on the lee side. The specification sets forth twelve claims, which may be summed up in the general arrangement and combination of the parts described.

CORKING OF BOTTLES.

WILLIAM FLETCHER, of Morton House, Buckingham, clerk, for "*Securing corks in the mouths of bottles.*"—Granted Aug. 24, 1843; enrolled Feb. 24, 1844.

This invention relates to a mode of securing or fixing corks into the necks of bottles containing soda water and other aerated liquors, the mode of effecting which is as follows. Through the neck of the bottle and just below the rim there are two small holes in a right line with each other. These holes are intended to receive a metallic pin pointed at one end and turned round at the other, so as to form a ring suitable for withdrawing the pin when it is required to draw the cork of the bottle. When stopping or corking bottles containing aerated liquors, the cork is forced into the neck of the bottle in the ordinary manner; but in place of securing such cork by means of cord or wire passing round the neck of the bottle and over the cork, it is only necessary to insert the point of the pin into the small hole formed in the bottle neck, and force the same through the cork and through the hole in the opposite side of the neck, which will have the effect of holding the cork very securely in the neck of the bottle.

STEAM ENGINE, BOILER AND PROPELLER.

Peter Borrie, of Princes Square, St. George's in the East, Middlesex, engineer, and Mayer Henry, of Crutched Friars, in the City of London, merchant, for "*Improvements in steam engines, boilers, and propelling machinery.*"—Granted Aug. 3, 1843; enrolled Feb. 3, 1844.

The first improvement is for a rotary engine, and consists of a cylindrical case, within which revolves a cylinder having four longitudinal openings or recesses in its periphery, into which are fixed four sliding pistons, each opposite piston being connected together and acted on by springs. This cylinder is eccentric with the case, and turns upon its axis, which passes through the ends of the case and also through stuffing boxes. Steam is admitted at one side and near the upper part of the case, the force of which acting upon one of the pistons causes the interior cylinder to revolve, the steam escaping as the piston upon which it impinged passes the eduction port, which is on the opposite side, and in this manner the pistons are alternately acted upon, and rotary motion is obtained.

This engine differs from one for which a patent was granted June 7th, 1842, to Mr. John Woodcock, of Manchester, in this particular, that Mr. Borrie employs a double acting air-pump, which is worked from a crank fixed at one end of the main axis, and which may probably have some claim to novelty. Fig. 1, shows a section of this air-pump, which is open at both ends; *a a*, we will suppose to be the induction passages leading from the condenser, and each being provided with a valve opening inward; *b b*, are the eduction ways and which are also provided with valves opening outward; it will be clearly seen that the motion of the piston within the pump barrel *c*, will be double acting.

Fig. 1.

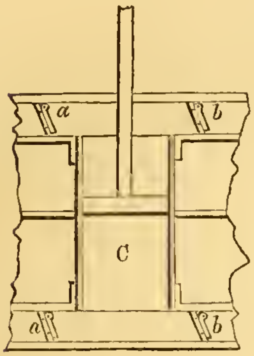
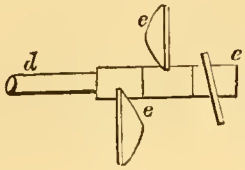


Fig. 2.



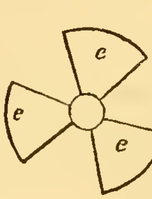


Fig. 3.

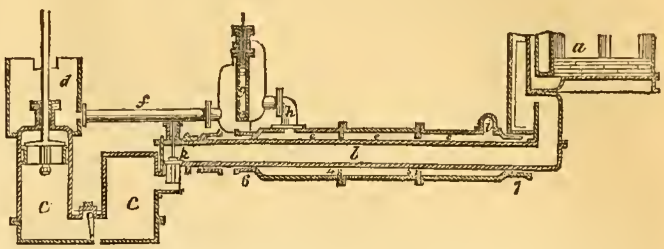
The patentee does not claim the application of this air-pump to the rotary engine as above described in particular, as the engine may be worked as a high pressure engine. The second improvement consists in the arrangement of two vibratory cylinders, inclined at an angle of about 45 degrees; three pistons of both cylinders are connected to one crank pin, from which pin is worked a double acting air-pump. The third improvement relates to tubular boilers; these boilers are constructed with a water space all around the fire he flame and heated vapours of which instead of passing from the fire box immediately through the tubes, pass underneath the tubes to the farther end of the boiler, and from thence through the tubes and to the chimney, (which is now generally done by most engineers with marine boilers.) The fourth improvement relates to a mode of disconnecting paddle wheels. And lastly to a stern propeller, of which we have given a side and end view; *d*, Fig. 2 & 3 is a shaft passing through the stern of the vessel; *e e e*, are three plates fixed on the end of the shaft, each of which are broader at the outer end, and are of a curvilinear or spiral form with regard to the axis. The patentees claim the general arrangement and combination of the several improvements described and set forth in the specification.

STEAM ENGINES AND BOILERS.

George Bennetts, of Gunnis Lake, Cornwall, civil engineer, for "*Improvements in steam engines and boilers and in generating steam.*"—Granted August 15, 1843; enrolled February 15, 1844.

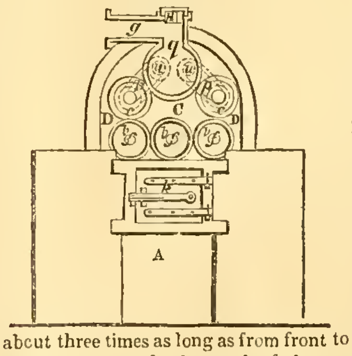
This invention relates to the construction and arrangement of certain apparatus in connexion with the engine and its boiler, for the purpose of rendering the steam which has been employed in working the engine, and is in its passage to the condenser or into the atmosphere available for heating the water, from which the steam is to be generated. And also in generating steam by injecting water in small jets into generators, which are maintained at such a temperature as to convert the water into steam on its coming into contact with the surface of the generator, whereby the cost and size of the boilers is reduced, and a saving of fuel effected. Fig. 1, is a vertical section

Fig. 1.



of parts of a condensing steam engine; *a*, is the cylinder with its piston rod, &c.; *b*, the eduction pipe; c c, the air-pump and condenser, all of which are well known; *e e e*, represents a vessel formed of three cylindrical pieces, bolted together at the flanches; at each of the places where these pieces join there is an internal projection, which is of such area as to allow only a thin sheet of water to pass at each stroke of the pump between these projections and the outside of the eduction pipe, which pipe passes through the vessel, and at the ends of the vessel where the pipe protrudes a steam tight joint is formed. This vessel should be capable of containing as much water as the engine will require to supply it with steam for eight or ten minutes; *g*, is a double acting forcing pump, connected at its eduction passage by means of the pipe *h*, to the vessel *e e e*, and at its induction passage by means of the pipe *f*, with the discharge cistern *d*; *i*, is a pipe leading from the vessel *c e e*, to the generators or boilers; *k*, is a valve, which the patentee places in pumping engines in the position shown in the drawing. This valve should be kept open during the time the engine is in motion, so as to offer no resistance to the steam in passing from the cylinder; but when the engine is at rest this valve should be closed, and the steam in the cylinder allowed to pass into the eduction pipe, where it will give out its heat to the water in the vessel *e e e*. This valve may alternately be opened and shut by any convenient means. The mode of action of this part of the invention is as follows. If the vessel *e e c*, is filled with water, and the pump *g*, set in motion, the water which it forces into the vessel at *h*, will force an equal quantity of water out of the vessel through the pipe *i*, into the generators or boilers, and the water thus forced into the vessel at *h*, will circulate through it for 8 or 10 minutes. until arriving at *i*, it is forced onwards into the generators or boilers, and during the time it has remained in the vessel *e*, will have taken up as much heat as the steam is capable of communicating, and the water entering at the part of the vessel next the condenser, is forced into a hotter position at each stroke of the pump, whilst the area of the vessel at four and five being contracted so as to allow only sufficient room for the water forced in by the pump to pass freely, prevents the water that has already passed these places from returning. By these means the steam which has been employed to work the engine will be available for raising the temperature of the water which is supplied to the boiler; and a partial condensation of steam may also be effected whereby less water than otherwise is required for condensing the steam in the condenser, and a smaller discharge pump than otherwise necessary will effectually free the engine from water and air, thus having a greater available power in the engine, at the same time economising fuel. Mr. Bennetts for this part of the invention claims the mode of using steam after it has performed its work, for the purpose of heating water when applied according to the means herein described.

Fig. 2.



The second part of this invention consists in a mode of generating steam by injecting the water upon the surface of metals raised to such a temperature as to convert such water immediately into steam. Fig. 2, is an end elevation, showing the arrangement of the generators, which will be sufficient to give an idea of this invention; A, is the furnace, from which there is a flue leading underneath the three generators marked *b b b*, and which are shown in the side elevations, (in the drawings of the specification,) as being about three times as long as from front to back of the fire place; the flue after arriving at the further end of the generators, turns upwards and joins the flue C, formed by the arrangement of generators, along which the gases and other vapours pass until they arrive at the end immediately over the front of the fire, whence they diverge and join the flue D D, whereby the gases are conducted outside the arrangement of generators, until they arrive at the further end, at which place the flue joins the chimney; *b b b, c c, q*, are the steam generators made of metal, sufficiently strong for the purpose; these generators are connected at both ends by pipes so as to form one continuous vessel; *f f f*, are three pipes, which extend as far into the interior of the generators *b b b*, as the further end of the fire place, these pipes are perforated throughout their length with a number of small holes, and are connected to a horizontal pipe (not shown in the drawing) which passes in front of the aforesaid pipes *f f f*, and extends to the water heating vessel *e e e*, Fig. 1, to which it is connected; *g*, is a pipe through which the steam is conveyed from the generators to the engine and to a safety valve.

The action of this apparatus is as follows. If the vessel *e e e*, Fig. 1, is filled with water, and the pump *g*, set in motion, the water which it forces into the vessel at *h*, will force an equal quantity of water out of the vessel through the pipe *i*, into the generators or boilers, and the water thus forced into the vessel at *h*, will circulate through it for 8 or 10 minutes, until arriving at *i*, it is forced onwards into the generators, and during the time it has remained in the vessel *e e e*, will have taken up as much heat as the steam is capable of communicating, and the water entering the generators through the perforated pipes *f f f*, will come in contact with the heated surfaces of the generators, and be thereby converted into steam, from whence it proceeds through the whole arrangement of generators to the engine. The water forced into the generators at each stroke of the pump only bears sufficient to supply the engine with one stroke of steam. The fire can be regulated by any of the well known means, care being taken not to overheat the generators, which ought never to be brought to a temperature approaching a red heat.

FURNITURE CASTORS.

John Charlton, of Birmingham, factor, for "*Improvements in castors for furniture*."—Granted August 17, 1843; enrolled February 17, 1844.

The specification, which consists of eleven skins of parchment, describes about 21 different kinds of castors for furniture, one of which consists of a cast iron socket, which may be subjected to the process of annealing, for the purpose of converting it into malleable iron, this socket is intended to receive the end of the table leg or other piece of furniture to which the castor is to be attached. Another cup or socket of brass is made to fit the external part of the iron one, so as to work loosely thereon; this latter cup is cast with two ears or projections, which support the roller in the ordinary manner, the two sockets being held together by a screw passing through the the bottom of the brass socket and screwing into the bottom of the iron one, the head of the screw being made sufficiently large to prevent the brass or external socket dropping from the iron one when the piece of furniture to which the castor is affixed is raised from the floor. There are several other modifications of this description of castor, among which there is one having its socket made in the form of half an egg. Another class or description of castor consists of a steel or iron spindle, made of a conical form at one end, which part is made to fit a conical recess formed in the underside of the socket, a hole being bored in the end of the table leg to receive such part. This spindle, which is shown in the drawing as being made in six or eight different forms, and applied to as many castors, has a collar or enlarged part in the middle, which is made to fit into a recess somewhat larger than the collar, and formed by a loose piece of metal, the edge of which is firmly fixed and held by a projecting piece on the bottom edge of the socket, the object of which is to prevent the spindle dropping out of the conical recess when the castor is lifted from the floor; and, to the lower part of the spindle is firmly rivetted the ears or projections which carry the roller. By this arrangement the weight of the piece of furniture is supported by the conical part of the spindle bearing against the socket, and that part just below the collar or enlarged part, which part fits in a hole (in the form of a bearing) bored in the centre and through the loose piece of metal, which holds the conical recess.

HYDRAULIC ENGINE.

Frederick Lipscomb, of Gloucester Place, Kentish Town, gentleman, for "*A hydrostatic engine, parts whereof are applicable to other engines and other purposes, and also improvements in railway carriages*."—Granted Aug. 17, 1843; enrolled Feb. 17, 1844.

The patentee having ascertained that the re-action produced by pressure upon a liquid is caused by the compression of the globules of air suspended in the liquid, which globules, by being compressed, have their elasticity increased in an equal ratio to their compression; and that re-action would not be produced in a liquid divested of air, constructs an engine which he denominates a hydrostatic engine.

It would only be a waste of time and room to give a descriptive account of this apparatus, and we will only remark, that if the patentee had paid a little more attention to the pressure of fluids he would not have speculated to such an extent in an engine he will eventually find incapable of moving a stroke. That part of the invention which relates to a break for retarding or stopping a train of railway carriages, consists in applying hydraulic pressure upon a liquid confined in a tube supported by guides at the end of the railway carriage; the pressure on the fluid has the effect of driving by means of a piston and intermediate gearing, the blocks or breaks against the wheels.

The next improvement consists in fixing a thin board or other material on each side of these wheels, which are wholly composed of metal, and used in the construction of railway carriages, the "sheet of wood" or other material being in size, or nearly so, to the space between the inside of the tire and the inside of the nave of the wheel, the unoccupied space between such "sheets" being filled with straw, tar, lashing, or other imperfect conductor of sound, for which the inventor claims the practical application of any of the imperfect conductors of sound in contact with such railway carriage wheels as are usually composed of metal, for the purpose of lessening the vibration of the wheel, thereby lessening the noise consequent upon vibration.

CLOTH FOR LINING WALLS.

John Collard Drake, of Elm-tree Road, St. John's Wood, Middlesex, Land Surveyor, for "*Improvements in lining walls of houses*."—Granted August 22, 1843; enrolled February 22, 1844.

This invention relates to a mode of lining walls of houses with a waterproof cloth, whereby they are rendered impervious to damp; for this purpose, the patentee prefers calico, on account of its cheapness: such fabric is to be coated on one side with a solution of india rubber, the process for making which is well known, and applied in the manner following. A number of strips of calico or other fabric, from three to four inches wide, are covered on both sides with india rubber cement or solution; these strips are affixed to the sides of the wall, by means of such cement, in parallel vertical lines, and at such distances apart, as to receive the edges of the pieces of fabric with which it is intended to line the walls. These pieces, which as above stated, are only covered with the solution on one side, are cemented to the strips already put up, with such cemented side to or next the wall, so that the plain side of the fabrics is free to receive a coat of paint; or the same may be papered in the ordinary manner. In constructing the walls of houses in the first instance, "stiles" or pieces of timber are inserted at convenient distances, and also transverse or cross pieces may be inserted, the space between being filled up with stucco or cement level with the face of the pieces of timber inserted, and to these pieces are affixed the strips of calico or other fabric, as before described. For the purpose of covering the wall according to this invention, the patentee makes use of a frame, for stretching the pieces of cloth before applying them to the walls; it consists of two bars of wood or wood and iron, or other metal, capable of being elongated by means of a screw, which connects them together; to the ends of each of these bars there is a cross piece, having a number of pins fixed in it; the ends of the cloth or other fabric are pricked or forced on to the pins, and the bar elongated by means of the screw, which causes the piece of fabric to be stretched previously to being cemented to the wall, in the manner hereinbefore described. The patentee claims the mode of lining the walls of houses, by the application of calico or other fabric coated at the back with a solution of india rubber.

BOTTLE STOPPERS.

Alexander Spears, of Glasgow, merchant, for "*Improvements on or appertaining to glass bottles proper for wine and other liquids*."—Granted Sep. 6, 1843; enrolled March 6, 1844.

This invention relates to a mode of stopping bottles containing wine or other liquid, and consists in making a screw plug or stopper of glass or earthenware, as may be required, to fit the neck of the bottle, and is effected as follows. The inside of the bottle neck is made with a female screw, into which is made to fit a screw plug or stopper, having an enlarged part or head equal in diameter to the external neck of the bottle, the head of the stopper being slightly hollowed underneath, and made to fit nicely upon the face or end of the bottle neck, which is about one-fourteenth of an inch in thickness. In bottling wine or other liquid it will be necessary to apply a little soft wax either to the end of the bottle or to the underside of the stopper, for the purpose of excluding the air, after which a strip of tin foil may be wrapped round the neck of the bottle and head of the stopper.

The specification describes certain arrangements of machinery for forming the screws within the neck of the bottle and also upon the stopper. The patentee claims the use of screw stoppers either of glass or earthenware with glass bottles, having corresponding screws in the necks thereof, and also the use of softened wax or india-rubber, which may be applied either in a semi-fluid state or in the form of a washer between the surface of the stopper and the top of the bottle; he also claims the arrangement of machinery for forming the necks of bottles and upon stoppers as described.

AN IMPROVED LAMP.

Pierre Pelletan, of Fitzroy Square, Middlesex, for "*Improvements in the production of light.*"—Granted September 6, 1843; enrolled March 6, 1844.

This invention has reference to a patent granted to Mr. Pelletan on the 2nd of May last, for improvements in the production of light, in which specification was explained the mode of producing light from volatile substances, and applied to a manner of mixing the spirit of turpentine or other less combustible matter with water, which were mixed in a generator in the proportion of from 4 to 10 of water to 1 of turpentine.

The present specification states that the above mixture will boil in a generator under atmospheric pressure at 212, (turpentine boiling at 272,) at which temperature (212) steam will be generated from the water, and will carry off with it, in passing through the turpentine, a portion of that spirit, so that the vapour which is allowed to pass through a burner is a mixture of of turpentine and water, and will burn with a bright white flame, but on attempting to increase its length will emit a large quantity of smoke, to obviate which the patentee employs a burner of peculiar construction, which forms the subject of this patent, and consists of a tube through which the steam passes to the burner; this tube has four openings at the bottom for admitting common air to be mixed with the steam; these openings can be regulated by a screw slide: the upper part of this tube is enlarged, and forms an annular space, into which the steam after passing through a perforated plate enters; it also passes through another perforated plate before leaving the burner: a current of air is admitted through four short tubes which pass in a horizontal direction through the annular space, or that part forming the burner, for the purpose of supplying the centre or middle of the flame with air, by which means a flame may be obtained as white and voluminous as may be required.

ON THE PHILOSOPHY OF VOLCANIC ACTION.

Volcanic action is the co-operative cause of numerous changes in the local disposition of the earth's surface, and in the character and qualities exposed to its influence; affecting not only those matters exposed to the direct action of heat, but also the surrounding strata. It is the minister of change, of production, and re-production: and while it insatiably devours entire beds of the earth, and amalgamates their organic and inorganic bodies as one grand result, thus obliterating for ever their former character and qualities; it gives liberty to their gaseous products, creates new and important compounds, causing matter to enter into new combinations; which, from their peculiar character and qualities, remain for after ages the unerring indicators of the magnitude and extent of its destructive powers: but, in the multiplicity of the phenomena, we must not forget, that there are limits to its extent, and that while so far as by awaking electrical action in bodies exposed to its influence, and thereby generating numerous beautiful results, it is still the humble and ineffectual imitation of that greater power, the SUN, whose universal and continuous operations give birth to the most stupendous as well as the most beautiful of natural products. Geologists, awed by the terrors of volcanic action and by the wide-spreading havoc it occasions, have in numerous instances been led to attribute to it powers of creation and disposition of matter, which it does not possess; and some of them go so far as to attribute to it the entire formations of the superficial crust of the earth, such as we now behold it, the material of every crystalline rock having, as they suppose, been elaborated within the interior, from whence it has issued in the exquisite beauty and peculiar order in which we now behold it: overlooking the simple fact that it is in the nature of volcanic action to destroy rock, which once destroyed, can never be reproduced in its primary state, its elementary constituents in decomposition and re-combination with bodies of other nature, giving results widely different from the body to which they previously belonged. We cannot shut our eyes to the almost endless diversity in the character and composition of crystalline rocks, their gradual transition into each other, the organic constitution of many of them, as proved by the configuration of their parts, as well as by their bituminous and other peculiar organic properties: nor can we doubt the evidence of our senses, when we witness in tropical regions both within and above the waters, the gradual consolidation into the crystalline body of calcarious and earthy matters uninfluenced by volcanic action and its attendant phenomena.

The high lands of South America are analogous to the low lands of the North, and exhibit the deserted bed of a primitive ocean; they are extensive *steppes*, bare and desolate, save a few saline plants; muriate of soda being comman to all of them, and also entering into combination with, and giving character to many mineral products. Enormous masses of white marble abound on the elevated savannahs of Cuba, which are principally composed of madripores, ocean marls, and the coverings of molluscous animals. Coal is found on the Peruvian heights, and the cinders ejected from some of the volcanoes evidence that abundance of this mineral exists within the lower beds: the sulphates are common in all these elevated regions, the high and dry climate is also extremely favourable for the development of electro-chemical action, as the abundance of inflammable products is favourable for the sustenance of internal fires.

The phenomena of the volcanoes in that portion of the globe vary in their nature, in conformity to the vast range through which the internal heat traverses, and also to the nature of the material: water, it is evident, being the grand essential necessary to produce intensity of action: this is sometimes abstracted from the neighbouring, or from subterranean lakes, and at other times it is supplied from the melting snows: sometimes it is abstracted from the neighbouring sea. The Jurago, being a small hill in 1760, in that year, on the 29th of September, it began to burn with furious explosions, ruining entirely the sugar works, and the neighbouring village of Guacana, and from that time continued to emit fire and burning rocks in such quantities, that the erupted matters, in six years, had formed themselves into three high mountains, nearly three miles in circumference. During the time of the first explosion, the ashes were carried as far as the city of Queretaro, 150 miles distant from the volcano; and at Valladolid, distant 60 miles from it, they were so abundant that the people were obliged to sweep their yards three or four times a day. In this exuded material we identify the well known madrepore limestone, and various kinds of felspathic rock. Humboldt, who probably never saw the historical record of this event, tells us, "that from his own observations, as well as from the testimony of those who were actual eye witnesses of the event, that a large tract of ground, from three to four square miles in extent was up-heaved, in a convex form, to the height of 550 feet, and that from the midst of this protuberance arose six conical hills, the least of them 300 feet in height, and the loftiest, Jorulla, elevated 1,600 feet above the level of the plain." To the shame of geology, this, and a silly woman's (Mrs. Maria Graham's) report of the elevation of the whole line of coast of Chili, for the extent of 100 miles by an earthquake, have been made the bases of systems of elevation, as incompatible with the operations of nature, as they are in violation of common sense. In support of this uplifting theory, Mr. Phillips observes, "Those who admit the uplifting of a whole island at once from the bed of the ocean (and who that is conversant with volcanic phenomena can question that such events have occurred) need feel no difficulty in admitting the testimony of the Indians, or the opinions of Humboldt, with respect to the fact of a mountain like Jorulla having been uplifted from the interior of the earth." This is the argument *ad absurdum;* for if the latter admission be made, the like admission may be required for elevating continents. Again, Humboldt damages the value of his statement, by adding that the whole mountain was composed of trachyte, as well as by several other similar sweeping assertions. The islands of Santarino and Sciacea were raised piecemeal by a succession of continuous and violent explosions, and many volcanic cones have been elevated in like manner.

Admitting, as geologists express it, the whole country of Quito is one volcanic hearth, still we find, that in all eruptions the ejected material is such as is palpably manifest the well-known constituents of the superficial beds of the earth. Combustion proceeding slowly through the beds formed during the eocene period, is at length awakened into action by the sudden intrusion of waters, the natural consequences follow, the generated steam and expanding gases rend the upper beds asunder, and deep-seated earthquakes extend to the distance of some hundred miles; the ejected material being the common minerals of the soil, sulphureous gases, sulphur, mud, and water, but very seldom lava; the torrents of water are generally supplied from the melted snows capping the heights of the crater. Cotopax became a volcano about the time the Spaniards arrived in Peru; an eruption occurred in 1743, which had been for some days preceded by a continual interior rumbling noise. The ignited substances that were ejected being mingled with considerable quantities of snow, which melted amidst the flames, were carried down with such rapidity that the plain from Callao to Latacunga was overflowed, and all the houses, with their wretched inhabitants, were swept away in the general and instantaneous destruction. The river Latacunga was the receptacle of this dreadful flood, till becoming swollen above its banks the torrent rolled over the adjacent country sweeping away houses and cattle: the eruption continued for several days longer, accompanied with terrible roarings of the wind rushing through the craters that had been opened. In May, 1744, the flames forced a passage through several other parts of the sides of the mountain, so that in clear nights, being reflected by the transparent ice, it exhibited a grand illumination. Mud is also ejected from some of the volcanoes of South America, and other portions of the globe, enormous beds of which after long exposure to the atmosphere become solidified as basalt; this is the distinguishing feature of the volcanoes of Java, which rarely emit lava. Vesuvius has also been known to emit torrents of mud; and, in 1755, Etna vomited forth immense quantities of salt water, with abundance of marine shells. "The volcano in the island of Tanna," says Pallas, "ejects a soft clay, of a bluish ash colour, which seems to be torn from the beds directly over the reservoir from whence the explosion proceeds: the volcanoes Skaptaa and Skaptaa Seyssel, discharge vast rivers of a muddy consistency, principally of the nature termed alluvial; and it is said that these streams in 1783 covered a space of more than 1,200 square miles; the lavas of Madeira and the Cape de Verd Islands are little other than mud, the scoriæ, ashes, tufa, &c., being such as to denote the nature of the inner beds from whence they were ejected. The island of Madeira consists of vast beds of commingled terrestrial and oceanic matters, of limestone rising from 2,000 to 3,000 feet above the level of the sea, and abounding with coral and marine shells. Where the internal fire exists among the older formations or mineral beds, the matters ejected are of analogous nature, being metallic scoriæ, fragments of crystalline rocks, &c. The volcanoes of Java, Sumatra, Sulpher Island, in the Loo Choo Archipelago, the Red Sea, Teneriffe, Vesuvius, and nearly all the great volcanoes of the earth, emit vast quantities of sulphur. During one eruption of Etna vast clouds of black sand or powder were ejected, which covered a space of fifteen square miles twelve feet thick. Lava, or streams of melted material, are occasionally ejected from the majority of the volcanoes of the earth during eruptions: this material is infinitely diversified in its nature, in conformity to the beds from whence it was abstracted; it is sometimes composed of the constituents of vegetable earths or aluminous clays, at other times it consists of lime, lime and magnesia, lime and soda, soda, lime, silica, and iron, in fact, it exhibits every possible variety, and every possible consistence, from a thin watery fluid to a ponderous molten mass, from the simplicity of chalk to the unity of compounds, which distinguish the crystalline rocks; the lava of no two volcanoes being alike. Even in the lava issued from the same volcanoes there is a marked difference. Thus Von Buch distinguishes on Vesuvius alone eighteen different kinds, and the old and new lavas of Etna are readily distinguished by their marked difference from each other. Lava is, in fact, the melted material of the inner beds, the chief constituents of which are silex, lime, chloride of sodium, alumine, and potass, which are well known substances belonging to the fossil and mineral kingdoms. Dr. Kennedy's analysis of lava from Etna is given as silica 52, alumine 19, lime 10, oxide of iron 15, soda, the constituents of oceanic soil, unmixed with aluminaries. The permanently elastic fluids given out of volcanoes are muriatic acid, sulphuretted hydrogen, sulphureous acid, and carbonic acid, the latter being chiefly given out from extinct volcanoes; all these substances are well known constituents of fossil soils, being exceedingly abundant both in their combined and their uncombined state: petroleum is also given out from some volcanoes in its unchanged state: in the Dead Sea this material is in its natural mineral state, being composed of animal matters, salts, and sulphur. "The sulphur," says Mr. Phillips, "is derived from the mutual decomposition of sulphureous and sulphuretted hydrogen, but this material is primarily derived from the decomposition of organic matter." Ammonia is evolved in abundance from many volcanoes, being a constituent of animal bodies, and a known constituent of almost all rocks.

The conditions of preservation of organic bodies are total exclusion from atmospheric and aqueous influence, but no sooner do they become exposed to the one or the other than change is the inevitable consequence, and as all change generates heat, so in changing masses the heat must not only in many cases be intense, but extensively manifest. The first effect of the waters upon these fossil beds, in which are combined all the elements of combustion, will be manifest in the earths and alkalis, which greedily abstracting the oxygen and the hydrogen thus set free by the decomposition of the water, will unite with the sulphur: again, in the decomposition of bodies thus chemically acted upon, much nitrogen gas is evolved, this being one of the chief constituents of animalized beds; and if muriate of soda be present, which it generally is, muriatic acid gas will also be given off; if the nitrogen unites in portions with hydrogen, ammonia is formed, and this gas is also evolved from the heated masses, as being one of their primary constituents: hydrogen and sulphur combining, form sulphuretted hydrogen gas, and if not recombined it evolves through the strata into the atmosphere.

The surface beds exposed to atmospheric influences soon oxygenize, but the fossils beneath the soil retain their primary conditions, or continue in a changing state, combining and re-combining for indefinite periods of time, with no other quantity of oxygen present than belongs to their primary condition, which is always insufficient to effect those permanent alterations necessary to effect the transition of metalloyds into the state of perfect metals. When we consider the nature of a fossil bed, we can readily conceive the intensity of action consequent on the accidental intrusion of water upon it. It abounds with silica, magnesium, calcium, and sodium, both of which latter alkalis are highly inflammable: sulphur is constantly generating within it, and if muriate of soda, as is the case in considerable quantities, the animal matter is partly converted into bitumen; under all circumstances it is a wonderful supporter of combustion, and if the carbonate unites with the soda, this compound acts as a flux with silica, and the accidental admission of water kindles the silica, which then burns with great intensity: again, the action of water upon potassium when this alkaline earth is present in the fossil bed, is sufficient to support combustion.

Against this theory of generated heat of combustion, it is urged that air as well as water must be present to support combustion, and in order to meet this difficulty, Sir Humphrey Davy was compelled to adopt the vague hypothesis, that the interior of the earth is cavernous, and that these caverns were natural reservoirs for the atmospheric currents supplied by apertures disposed as the surface of the earth. In all fossil and even in mineral beds vast quantities of azote exist in the latent strata, and when the heat is generated by electro-chemical excitement and increases to the heat of combustion, the electro-chemical disturbance continues to increase with the increase of heat. The accident of association, as for instance, the introduction of one of the inflammable gases produces atomic excitement in the chaotic mass, gaseous evolution of other gases, decomposition and re-combination of bodies with bodies, all of which in their expanded volume generate action and re-action accompanied by evolution of heat: it is a well-known law of chemistry, that every compound elastic fluid, and every consolidated body combines with its molecular particles a certain degree of heat pecular to itself, being capable of receiving an additional quantity of heat, without alteration of its physical condition; and, as Dr. Black expresses it, whenever a body changes its state, it either combines with caloric or separates from caloric; these phenomena are manifest in fossil beds, extensively excited compounds united by slight affinity are immediately separated, the gaseous products exchange place, disposition, and association, act and re-act upon the several bodies among which they are disposed, or with which they are brought in contact; and in the general decomposition which ensues the azote of the fixed air is extricated, contributes to assist and maintain silent combustion. We cannot conceive any locality wholly free from fixed air, it is a component of all the most ponderable rocks, it is disposed in bodies composing the earth, and it is one of the chief constituents of animal matter; we have, therefore, good grounds for believing that during the heat of combustion, azote in sufficient quantities is extricated from the strata acted upon to support, maintain, and when other causes are favourable, to extend that combustion. On the other hand, after eruptions have taken place, and the open crater is formed, a large and continuous supply of air is drawn in by this funnel: communications with the atmosphere is sometimes maintained through the medium of the funnels of extinct volcanoes: air is sometimes communicated through cavernous apertures: it is also communicated with the intruding waters which always hold a certain quantity of air in mechanical combination.

"All the phenomena," says Professor Phillips, "which are concomitant upon volcanic action, seem to admit of explanation, if we will only suppose salt water, and afterwards air, to find admittance into cavities in the interior of the earth, whence they come in contact with the metals, and the earthy or alkaline metalloyds combined with sulphur there existing." It cannot be denied that chlorine is an abundant material of the earth, even in beds the most distant from the sea, and from their elevation most assuredly not subject to the intrusion of salt water: it is also a well known fact, that all volcanoes are disposed near the sea, and where there are exceptions to this rule, as in Central Asia, they are disposed in the vicinity of the salt lakes, the relics of a former sea, and consequently an oceanic soil: salt beds, and consequently saline waters, abound in all quarters of the earth, and most particularly so in fossil soils, where chlorine abounds under numerous forms and combinations, with many bodies having little affinity, and in some beds, being manifest in its gaseous state. Again, as I have previously observed, air is always present with water, and in its latent state. and consequently when combustion is generated by the intrusion of saline waters in fossil beds, in their primary condition, the alkalis being in their uncombined state, air is liberated in sufficient quantity to sustain the internal fire. It cannot for a moment be contended, that spontaneous combustion will not be elicited from mixed bodies buried within the earth, for the artificial volcano distinctly proves that all the phenomena of volcanic action may be truly imitated.

The earth is deriving a large and continuous supply of oxygen and azote from the atmosphere, and the phenomena consequent thereon are variously manifest in different regions of the earth: in the vast expanse of deserts in Asia and Africa, the virgin soils greedily imbibe air as well as rains and dews, the oxygen entering into combination with the marine exuviæ, the hydrogen uniting with the sulphur, and escaping to the surface as sulphuretted hydrogen. This gas, so inimical to the existence of man, is continually evolved in those parts of the desert which have become covered with rank vegetation: beneath the rainless regions the sulphureous gas is principally evolved: on the other hand nitrogen readily unites with the supporters of combustion, becomes a component of many earthy bodies, and is a proximate cause of the generation of nitrates. Chlorine freely evolved unites with sulphur and phosphorus and forms an acid, and this acid is again decomposed by the uncombined alkalis, deposited as a neutral body, on or in the surface of the earth, it is the subject of incessant change, separating and recombining as local influences may determine. Chlorine and oxygen are the only gases which emit light under any circumstances: chlorine has a most powerful attraction for oxygen, decomposing water and other substances, of which hydrogen is an element, when at a red heat. If chlorine be liberated from its combinations in calcarious fossil beds, and is retained in its cavities, the phosphorous, which abounds in these beds, uniting with it, will take fire and exhibit the phenomena of spontaneous combustion; the heat thus produced, and communicated to the sulphur and iron, or other metals, or undecompounded alkaline earths, with water, the heat is strengthened and increased, and must of necessity increase, so long as the causes of effects produced are in operation. In the heat thus produced, the electric matter, in its latent state, is liberated, and intense electric action is generated, which is followed by a sequence of events favourable to the development and continuous support of combustion.

Spontaneous combustion takes place under numerous combinations. In the union of ammoniacal and muriatic acid gases, much heat is evolved: mixtures of the inflammable gases with oxygen generate heat: again, heat generated in the sulphates, combustion takes place: the nitrates and chlorates in deflagration with metallic bodies, or with sulphur, phosphorus, &c., undergo a great enlargement of volume producing light and heat: nitre, sulphur, and charcoal, present similar phenomena. Sulphuric acid decomposes marble with evolution of great heat and falling on caustic lime the heat is increased. All the materials of combustion above enumerated (except charcoal) are common to, and form the chief components of, virgin or fossil soils, and being present are capable, under favourable circumstances, of generating and supporting the heat of combustion. Hydrogen with caloric forms gas sixteen times as light as common air; insoluble in most substances, but capable of dissolving sulphur, phosphorus, carbon, oils, &c., and thus forming different species of inflammable gas: it decomposes several metallic oxides and acids with simple or known radicals: its continuous decomposition and re-production within a confined medium is considered sufficient to maintain silent combustion and evolution of heat for an indefinite period of time.

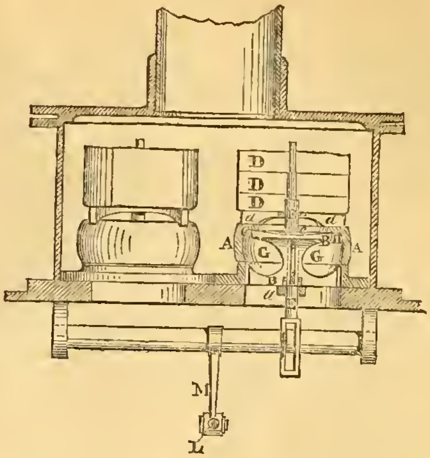
BOULTON, WATT & CO.'S NEW SAFETY VALVE.

The above sketch represents a new arrangement of safety valve, adopted by Messrs. Boulton, Watt & Co. for tubular boilers, when required to bear a load of more than 5 lb. on the square inch.

The two objects kept in view in such cases, were—1st. to diminish the size of the lead weights put upon the valve—objectionable not only on account of expense, but also of the space taken up in the valve box—without at the same time lessening the area for the escape of steam; and 2nd. to provide the means of taking off any part of the weight upon the valve, at any period of the vessel's passage, with the greatest facility.

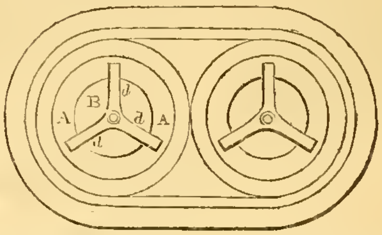
The first of these is effected by the application of the double beat or Cornish valve, in which the upper part A, rests upon the seat B by the two surfaces C C, being loaded with the weights D D D, upon the spindle E. The steam has access from the boiler to the space G G, where it increases in elasticity, till pressing upon the rim H H, its

Fig. 1.



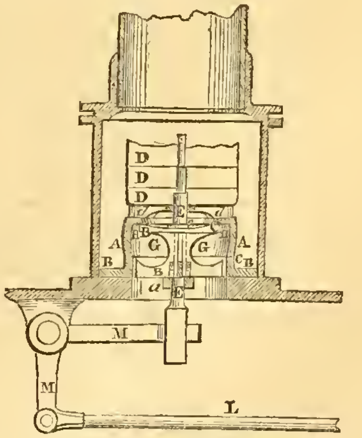
power overcomes the weight of the valve, and the part A, rises from the fixed seat B, leaving two openings for the escape of the steam at the points C C. This area is much greater than in the ordinary valve, while the part to be loaded is only the rim H H, reducing the weights to about one sixth of those otherwise necessary; *a*, is a small stuffing

Fig. 2.



box which screws into the seat B, to prevent the passage of steam round the spindle E. The sides of the rising part A, are made convex, to give a greater passage for the steam when the valve is open.

Fig. 3.



The second object, viz., taking off one-third or two-thirds of the weight when desirable, is done by the graduated spindle E, acted upon by the rod and lever L and M, which are worked by a screw handle on the front of the boiler, raising the upper, or two upper weights, and making the load 15 lb., 10 lb., or 5 lb., as may be required. If the rod L, be drawn still farther, the collar *e*, rises to the arms *d d*, and raises the valve and weights together when necessary to let the steam escape, the engines being at rest.

Feb. 20, 1844.

OBITUARY.

GEORGE MADDOX.

We have to take some reproach to ourselves for not having before spoken of one who, if scarcely known to the public as a professional man, was an honour to his profession, and most sincerely and devotedly attached to his art—to a degree that, perhaps, rather retarded than at all advanced his immediate interests, causing him to postpone all other considerations to his love of art—an enthusiasm which continued unabated to the very last.

The whole of his long life may be said to have been one uninterrupted course of study, not merely in architecture, but in art generally; therefore, long as it was, it offers very little in the shape of matter-of-fact biography, although if treated *auto-biographically*, and so as to record mental habits and their formation—feelings and opinions, the most studious and an almost recluse life, may possess a higher and even stronger interest for the few, if not for the many, than one marked by variety and adventure. The power and originality of mind were not wanting, which would have enabled the subject of our memoir to give the world a memoir of himself, fraught both with interest and instruction—most certainly the last, if only by embodying in permanent form his own opinions and views of art, and thereby becoming a valuable store of criticism.

As to what we are able here to say, it is so very slight and imperfect that it does not deserve the name of "memoir" at all, since it amounts to little more than a mere "memorandum" of the man, without even the skeleton of a biography, in regard to facts and dates.

George Maddox was a native of the town of Monmouth, where he was born in 1760, and where his father was, we believe, a builder by trade. On the expiry of the time of his apprenticeship with his father, he came up to London, where he afterwards obtained an engagement with Soane as his assistant. How long he actually continued with him, we are unable to say, but we believe for no very great length of time; certain it is that he ultimately quitted him in disgust,—which is so far from being at all surprising, that it would have been infinitely more so, had one of such independence of mind as was Maddox, tamely brooked the tyrannical temper, and the wild and wayward caprices of the other. Though this may have been a somewhat imprudent step in its consequences, there was, no doubt, enough to justify it, more especially as there is strong reason for supposing, that not temper alone, but also ungenerous conduct, on the part of Soane, caused the rupture between them; and, whether justly or unjustly, at all events the character of the latter gives strong probability to such suspicions. He was next connected with the Pantheon, in Oxford Street, and in such a manner as to be seriously involved in the pecuniary affairs of that property. About the same time a most promising prospect that was opening itself to him, was suddenly cut off by the loss of a patron in the then Duke of Cumberland, brother to George III., whose death caused the project of building an Opera House in Leicester Square to be abandoned, just as all but the final preliminaries had been arranged. The edifice was to have been upon a scale then, and even now, unprecedented in the metropolis; Grecian Ionic in style, with a magnificent portico, whose columns would have been about sixty feet high. What became of the design for it, we are unable to say; but it does not appear to have been preserved. The same is, unfortunately, the case with those of many buildings which he actually did execute, and which, although, being for the most part only private houses, and those upon a moderate scale, they were not of a kind to obtain general notice, have much in them highly deserving of attentive study, being most carefully studied themselves; and containing many original and valuable ideas, nor least of all so, in regard to detail. At any rate, a selection of some of them would have formed an instructive publication, as would likewise some of his original compositions for capitals, and other ornamental details in the Greek style; to which, for want of any other, the not particularly recommendatory epithet of "*fancy*" capitals, &c., must be applied, although they were singularly happy in idea, and true to the sentiment of Grecian prototypes,—felicitous conceptions meditated, and afterwards wrought out, *con amore*.

Enthusiastic as was his admiration of classical architecture, more especially of Grecian, Maddox was by no means an advocate for merely copying the extant examples of it, much less for treating them in the jejune, spiritless, and mechanical manner we generally find them. He was, in fact, an artist in the most comprehensive sense of the word,—perhaps to a degree that was rather prejudicial than the contrary, to his immediate interests, since he was too much wrapt up in art, to attend to *that* of making his way in the world, and pushing himself forward as he might have done, without thereby compromising his integrity.

Cheap and vulgar praise he scorned, and no doubt felt that few could appreciate his ideas. This last must certainly have been the case in regard to the architectural subjects, annually sent by him to the Society of British Artists. As pictures in oil, they were of all others almost the least calculated to attract notice in an exhibition room: "Portraits of cabbages," as he himself used to say, would have had a fairer chance of being looked at. And his required to be not only looked at, but carefully looked into, to detect all the varied beauties of detail, and the fresh and valuable ideas with which they abounded. In truth, they were quite out of their element in such miscellaneous exhibitions, more especially as there was nothing in their mere titles to call attention to them, and being generally of small size, and not of a kind to strike at first sight, they were apt to be overlooked, or else merely glanced at, by those who could have done justice to their merits.

Besides being a very superior architectural painter in oil, Mr. Maddox showed great ability with his etching-needle, and some time before his death had made considerable progress with a series of etchings, about forty in number, of groups of architectural fragments and ornaments. Unfortunately infirmity and suffering prevented his finally completing them for publication, as he intended; yet it is to be hoped that even now they will not be entirely lost to the world, but impressions of them published from the coppers as left by himself. This, we hope, will be done, if only for the sake of his widow, who, it pains us to say, has been left almost entirely without resources, since for many years previous to his death he had no other means of subsisting than teaching pupils, and occasional employment from others in making designs and drawings; occupations precarious almost at the best, and frequently interrupted of late years by severe and protracted attacks of illness. The last of which terminated in his death, Oct. 7, 1843 in the 83rd year of his age.

LUIGI CANONICA

Is another octogenarian whom art has lately lost, and still more recently, for he died at the beginning of the present year, some time in the month of February, at Milan, aged 82. Like his eminent contemporary, Luigi Cagnola, whom he survived just ten years, it was the good fortune of the Cavaliere Luigi Canonica to be employed on some of the more important *monumens* of Milan. After the celebrated *Arco della Pace*, by the former, the *Arena*, by the latter, is one of the modern architectural *lions* of that city, although it is not every English tourist—not even those among them who are architects also—that has condescended to bestow any notice on either, at least not beyond what the ordinary "Guide-book" supplies. That the "Arena" should have obtained so little of their attention, is indeed surprising, because it affords a good opportunity for comparison with ancient structures of the same kind. We meet, however, with some description of it, in a work entitled "*Notes Abroad, &c.,*" which, we may remark, deals far more largely than usual in architectural criticism, and occasionally speaks out more than rather freely in regard to some of our architects here at home.

"In the arena," says the writer, "Canonica has given us an imitation of an ancient amphitheatre, upon a still larger scale than any similar work of the Romans, it being an ellipsis of about 800 by 400 feet, dimensions that would give it a superiority even over the Colosseum. In other respects, however, it must be confessed that it falls very far short both of that and the edifice at Verona, for there are not more than eight rows of *gradini*, which do not rise above twenty feet; which want of height, together with the much greater extent of open area, causes it to assume altogether a different character, and appear little more than an inclosure surrounded by a single *præcinctio* of seats; whereas in all the ancient amphitheatres the external walls are exceedingly lofty, and consist of tiers of arcades. Here, on the contrary, there is only one series of semi-circular arches, disposed at a considerable distance from each other, with a plain square-headed doorway beneath it (each?), and the summit is finished by a balustrade. Nevertheless the whole is a work of great magnitude, and was completed within a comparatively short time." (It was commenced in 1805.) "The principal entrance is at one extremity through an arch, with two fluted Doric columns on each side of it, supporting an enriched entablature, and a pediment, filled with sculpture, placed against a podium, or low unbroken attic. This frontispiece rises much higher than the external wall, the impost of the arch itself being on a level with the top of the balustrade. There is also on one side, namely that adjoining the Piazza d' Armi, a raised loggia (*Pulvinare*) of eight Corinthian columns of red granite, containing seats for the Viceroy and his suite, with a saloon behind it, whose windows open on the piazza. This unique structure was erected by order of Buonaparte as a place of public amusement and recreation for his Milanese lieges, where they might be gratified not only by horse and foot races, for which it is exceedingly well adapted, but also aquatic exhibitions and rowing matches, as the arena can be laid completely under water in a very short time. A festival of this last-mentioned kind was given on the occasion of the birth of the King of Rome."

To this account we need merely add that, notwithstanding there are so few rows of seats, they are computed to be capable of accommodating no fewer than 30,000 spectators. We ought to observe, however, that the dimensions stated by the writer whom we have quoted, do not pretend to accuracy, we therefore give them according to what we have found them stated to be in metres; annexing, in order to afford readier means of comparison, those of some ancient ancient amphitheatres:—

Milan, Arena	780 × 380 feet
Rome, Colosseum	615 × 510 feet
Verona, Amphitheatre	450 × 360 feet
Pola, do.	436 × 346 feet
Nismes, do.	400 × 320 feet

If we have spoken somewhat at length of this work of Canonica's, we shall not do so in regard to any of his other buildings, and for a most cogent reason, having, unfortunately, no materials for description; and it has even now cost us no little trouble to ascertain the names of those we here enumerate. Among those erected by him at Milan are the *Teatro Ré*, the *Teatro Carcano*, and the *Teatro Filodrammatico;* also the *Casa Canonica* his own mansion, and the *Palazzo Belloni.*

Canonica has been spoken of with high commendation by the writer of an article in the Quarterly Review, on the "Palladian Architecture of Italy," more especially with reference to the last-mentioned structure, "the front of which," it is there said, "is, perhaps, for its size, the most beautiful of any private building in Italy. It consists of a rustic basement story, with a balustrade, on which rests a disengaged colonnade of six fluted Ionic columns, with an unbroken entablature, and above it another balustrade with statues." We also find him mentioned as the architect of three other theatres, at Brescia, Mantua, and Parma; at least the last was designed by him, though executed by Bettoli. Canonica possessed a considerable fortune, and has made some munificent bequests, leaving by his will 174,000 fr. (about £7,000) to the Primary Schools of Lombardy, and 87,000 fr. (about £3,700) to the Milan Academy of Fine Arts, the interest of which is to be devoted annually to the education and support of some young artist—architect, sculptor, or painter.

FOUNDATIONS ON SAND.

The subject of foundations on sand has latterly attracted a good deal of attention here, and particularly on account of Mr. Perring's discovery that many of the buildings in Egypt were built on such foundations. At page 80 of this volume of the *Journal* it is said, "It seems that the stony surface of the desert had been made level by a layer of fine sand, and confined by a stone platform 14 ft. 6 in. wide and 2 ft. 9 in. thick, which supported the external casing, and the pyramid (that of Dashhour) was built on upon the sand which is firm and solid." Other examples of the same kind were met with by Mr. Perring, and it seemed that the sand, when retained in its place could be depended upon. We have, therefore, thought it would be interesting, while public attention is directed to the subject, to notice what has been done on this system in France. It seems to have been first adopted, in 1822, by M. Devilliers, C.E., when employed on the canal of St. Martin, where he used it extensively. It is to be observed, however, that it is the only system employed in the Dutch colony of Surinam, and was suggested long since by Captain Rosmy but not applied.

We have no account of M. Devilliers' works, and the process seems to have remained in abeyance until 1830, when Captain Gauzence, of the French Engineers, employed it for the support of the portico of of the Guard-house of Mousserolles, at Bayonne. This plan is represented in Fig. 1, where A represents the front of the portico, B the façade of the guard-house, and C the sand foundation.

The soil was a slippery greasy clay, extending to a considerable depth, and it was at first proposed to lay down a platform of wood as a basis. Capt. Gauzence's suggestion however having been adopted, the soil was dug out to about a yard below the substructure and filled in with sand well rammed. On this were laid two courses of Ashlar masonry, and then a course of dressed stone, forming the surbase. Before finishing the columns, one of them was laden with ten tons of lead without any sensible effect being produced. The structure was finished in October, 1830, and no settlement has taken place since, though each column is computed to carry a weight of ten tons, and a wall of the same guard-house, otherwise built, has settled a good deal.

Fig. 1.

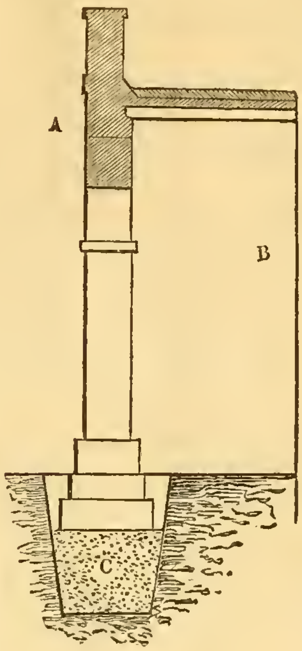


Fig. 2.

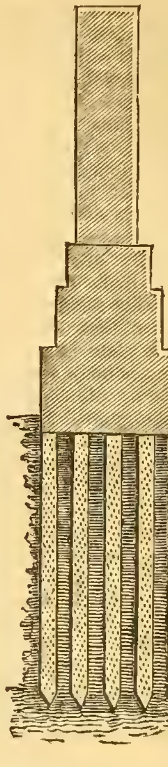


Fig. 3.

The same plan has been successfully pursued in some of the fortifications of Bayonne, where buildings had to be placed on made ground. In 1836 a sand foundation, about 2½ ft. thick, was employed, with an equally satisfactory result, for the quay wall of a small harbour on the coast of Brittany.

For the construction of the artillery arsenal at Bayonne another plan has been adopted. The soil is of the same greasy kind before described, while it is quite impossible to use wooden piles, for not only is wood very dear in the neighbourhood, but at high water a stratum of water penetrates the soil, which rapidly rots wooden piles or platforms. Colonel Durbach therefore proposed to employ what have been termed piles of sand. The forge department is surrounded by square piers united by a wall, and in fig. 2 we have a section of one of the piers, the weight of which, and of the carpentry supported, is about 35 tons.

The foundation piles are so arranged that each bears only two tons. The process adopted was to drive into the ground an ordinary wooden pile about 7 in. square and 6½ ft. long. This was then drawn out, and the hole filled with sand. The surface was then levelled, the sand well rammed in, and the masonry raised upon it. To draw the wooden mould pile, an ordinary machine was used, to which a chain was attached in the manner shown in fig. 3.

In 1833 Colonel Durbach's plan, with some modification, was employed by M. Mery, C.E., in the canal of St. Martin, at Paris, for the construction of a lateral culvert, which passed through ground of bad quality, in which a quantity of water was infiltrated. Instead of sand, which would have been washed away, sand mortar was used, made by mixing one seventh of hydraulic lime with six sevenths of sand, which soon consolidated.

With regard to the sand to be employed, it is recommended that it should be moderately fine, of equal grain, and not earthy. It must be moulded and rammed in layers of about 8 in. or 9 in. thick, which is an important point.

The theory of this process is not known, but it is supposed that the pressure is equally distributed on the sides as well as on the base. Some curious circumstances as to the pressure of sand are to be observed in connexion with blasting, where it is found to produce the most efficient tamping.

IMPROVED TWO CYLINDER ENGINE.

(With an Engraving, Plate IV.)

DESCRIPTION of a 20-horse high pressure engine, with two cylinders, in the establishment of Messrs. Geo. Forrester & Co., Liverpool.

This engine is represented in the accompanying engraving; Fig. 1, being a side elevation; Fig. 2, a ground plan; and, Fig. 3, an end view of the same.

The improvement consists in an arrangement of *two* cylinders (instead of one of double the area), which are placed side by side upon an independent foundation plate, in a horizontal position, with a space of sufficient width to allow a connecting rod to work freely between them; the piston rods of both cylinders are connected together by a cross-head at one end, from which the power of the combined cylinders is communicated directly by a long connecting rod to the crank shaft at the other. Each cylinder is provided with a separate slide valve, both valves being connected together, and worked by one valve shaft and eccentric motion. The feed pump is placed at the front end of the foundation plate, at the same level as the cylinders, and is worked directly from the main cross head of the engine, to which the pump ram is attached. Steam of 35lb. pressure is used in the boiler, and the supply is regulated by an atmospheric governor (Hick's patent), which is attached to the throttle valve, placed in the leading steam pipe to the two cylinders (as shown in the drawing).

The object of the above arrangement (as will be seen) is to lessen greatly the dimensions and weight of the engine, the length occupied being little more than half that of the ordinary engine, whilst all the working parts are rendered more accessible, and their simplicity is such as to render it both durable and easy of attention. An important feature in this arrangement is that of the crank shaft being very close in position to the seat of the cylinders, whereby the strain of the engine is confined to a very limited portion of the foundation plate, the power of the combined cylinder not being transmitted through any portion of the framing at their front end, but only through that part intervening between them and the crank shaft which is placed immediately behind them. The engine being thus perfectly self-contained requires no foundation, except a bed of brickwork or timber to raise it to the requisite height, whilst the reduced space it occupies renders the expense of the engine house, or preparation for it, comparatively small.

REVIEWS.

GEOLOGY.

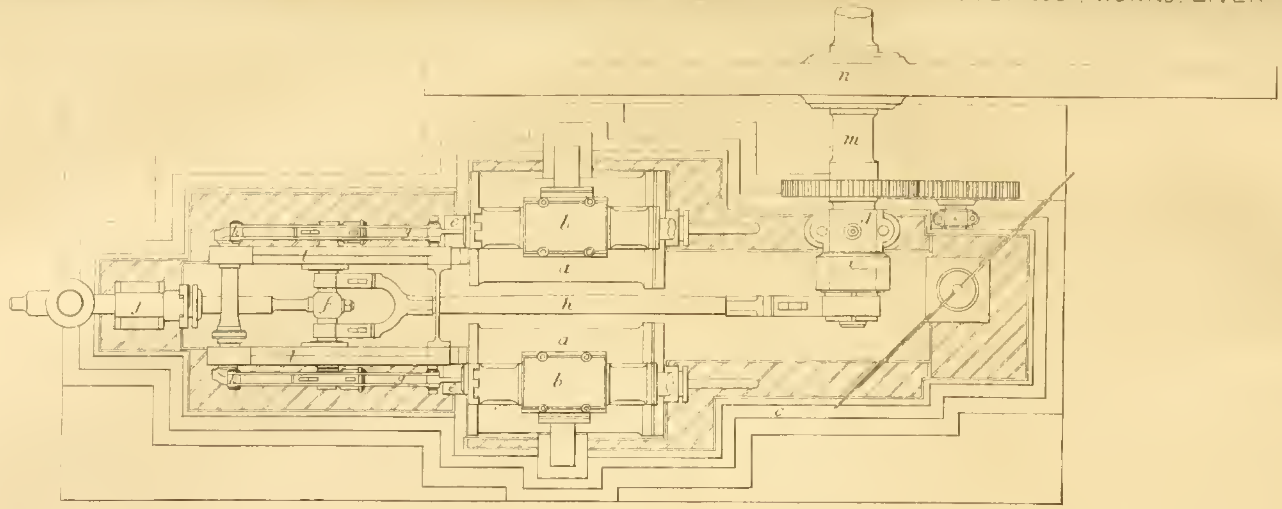
1. *Geology, introductory, descriptive and practical.* By DAVID THOMAS ANSTED, M.A., F.R.S., Professor of Geology in King's College, London. London: Van Voorst, 1844. Part I.

2. *A History of British Fossil Mammalia and Birds.* By RICHARD OWEN, F.R.S., Hunterian Professor at the Royal College of Surgeons. London: Van Voorst, 1844. Part I.

The study of geology, whatever interest it may possess for the follower of abstract science, has immediate claims upon the engineer, being intimately connected with his practical pursuits, and recognised as an imperative part of his professional course and taught in the public schools. In the design of grand works of internal communication in the drainage of the open country, in the search for water, in the industrial application of the mineral resources of a district, the engineer experiences the necessity for a well grounded acquaintance with the principles and details of geology. In the laying out of a line of canal or railway, he must ascertain what materials he has in the locality, which can be used with a due regard to economy and durability, and from inattention it has often happened that materials have been at much expense brought from a distance, which were to be found in equal abundance and perfection on the spot. It lies with the skilful engineer to point out such deposits of brick earth, lime, ballasting sand, and other mineral productions as may become a source of increasing traffic to the line. For the supply of a steam engine or factory he will frequently find a difficulty in obtaining the requisite supply of water, and he has to determine on the practicability of obtaining it from the underlying strata. He may also have to construct absorbent artesian wells, for the purpose of carrying off impurities. In the supply of water to large towns, geological knowledge is of much avail, for the engineer has not merely to avail himself of surface sources, but he must ascertain how far the supply of water is likely to be permanent, and what means exist of increasing the surface supplies. He may also be threatened with opposition as interfering with the supply of water to other purposes, and to vested interests. The question of bringing water from the Colne, so ably discussed by Mr. Robert Stephenson, was mainly one of geology, *(Civil Engineer and Architect's Journal*, Vol. VI., p. 350.) In the course of works, too, many geological questions arise, not merely as to the nature of the substrata influencing the foundations and the power of sustaining an embankment without bulging or spewing, or as to the extent of a deposit of wet sand or quicksand, but in a variety of ways. Thus in the important case of *Ranger* v. *the Great Western*, one of the allegations was that a particular rock was improperly and unfairly described, the description of Pennant stone intimating that it was a soft rock, whereas it was a hard rock, and that the trial pits on one of the sections were unfair, because they did not show the substratum of hard rock, and of which no mention was made in the specification, whereas it ought to have been known to the engineers that such a substratum was to be found within a certain depth, and that thereby the contractor was misled. In this specific instance judgment was given in favour of the engineer; but it shows how much care it behoves the practitioner to employ. Indeed the geological features often influence a contract; bricks are directed to be made on the spot; thus Mr. F. W. Simms, C.E., had the superintendence of a tunnel, constructed on the South Eastern Railway, through a difficult geological formation, and at the same time he had the direction of large brick works in which he introduced several valuable improvements, *(Civil Engineer and Architect's Journal*, Vol. VI., p. 348.) The use of stone upon the line requires a good deal of consideration, and also the use of any material for embankments, or ballasting. The danger of mixing some soils is well known, witness the case which occurred some time ago of pyrites taking fire on the London and Birmingham Railway, and embankment, sleepers, and rails being seriously injured. The use of light sand employed on the Croydon Railway for some time until gravel could be reached, was found highly inconvenient for ballasting, the passengers complaining much of the quantity blown into the carriages, and the maintenance of the line being very troublesome. An intimate acquaintance with the different strata is in fact of the greatest importance, one material will stand with one batter, one with another, and so on, and an engineer removed from one geological district to another, will often find himself at a loss, when he attempts to avail himself of his previous experience in his new locality. Thus a northern engineer will frequently not duly allow for the nature of the chalk and London clay formations of the southern districts. Tunnels are projected in the chalk as a homogeneous and compact mass, and fissures are met with, and springs of water. The London clay, too, presents the greatest difficulties, and baffles all calculation; works may stand very well for two or three years, or for longer periods, then they swell with water, extensive and sudden slips take place, and there are no means of stopping them. It cannot be said that the slips on the Croydon Railway are yet remedied; and certainly Mr. Gibbs was as little to blame for their occurrence, as Mr. Cubitt is for not having been able yet to check them, although so much of the clay has been removed, and large buttresses of gravel have been substituted. So at last the London clay has begun to show its character in the Camden Town cutting of the London and Birmingham Railway, and Mr. Watson's ingenious plan of draining (described at pages 49 and 61 of the present volume) has been obliged to be adopted as the only efficient means of checking the evil, though strong retaining walls strengthened by iron girders, present a barrier sufficient to contain any other material. The treatment of slips has become a new branch of engineering, requiring a most skilful application of the various modes and appliances of draining, while as yet the means of so constructing the original works as to prevent slips is far from being in a satisfactory state. The engineer avails himself of previous experience, he finds works standing in several localities with a certain batter, and yet his own works may crumble to the ground, though he has faithfully followed the exemplar. One element with regard to the slope, at which any material will stand, has, in our opinion, been passed over, and that is the height. It may happen that clay or chalk may stand very well with a certain batter at 20 ft. high, and yet that it may not stand with the same batter at 40 ft., 60 ft., or 80 ft. We think it very likely that a law prevails modifying such results, and it would be very desirable to have the subject investigated.

We need scarcely allude to the advantages which an engineer will derive from his geological knowledge in laying out any grand line of works, the adoption of such a course as to avail himself of the natural passes and levels, and not to come in contact with the natural difficulties. So too with regard to many operations; thus the grand experiment of Mr. Cubitt in removing large quantities of the Dover chalk

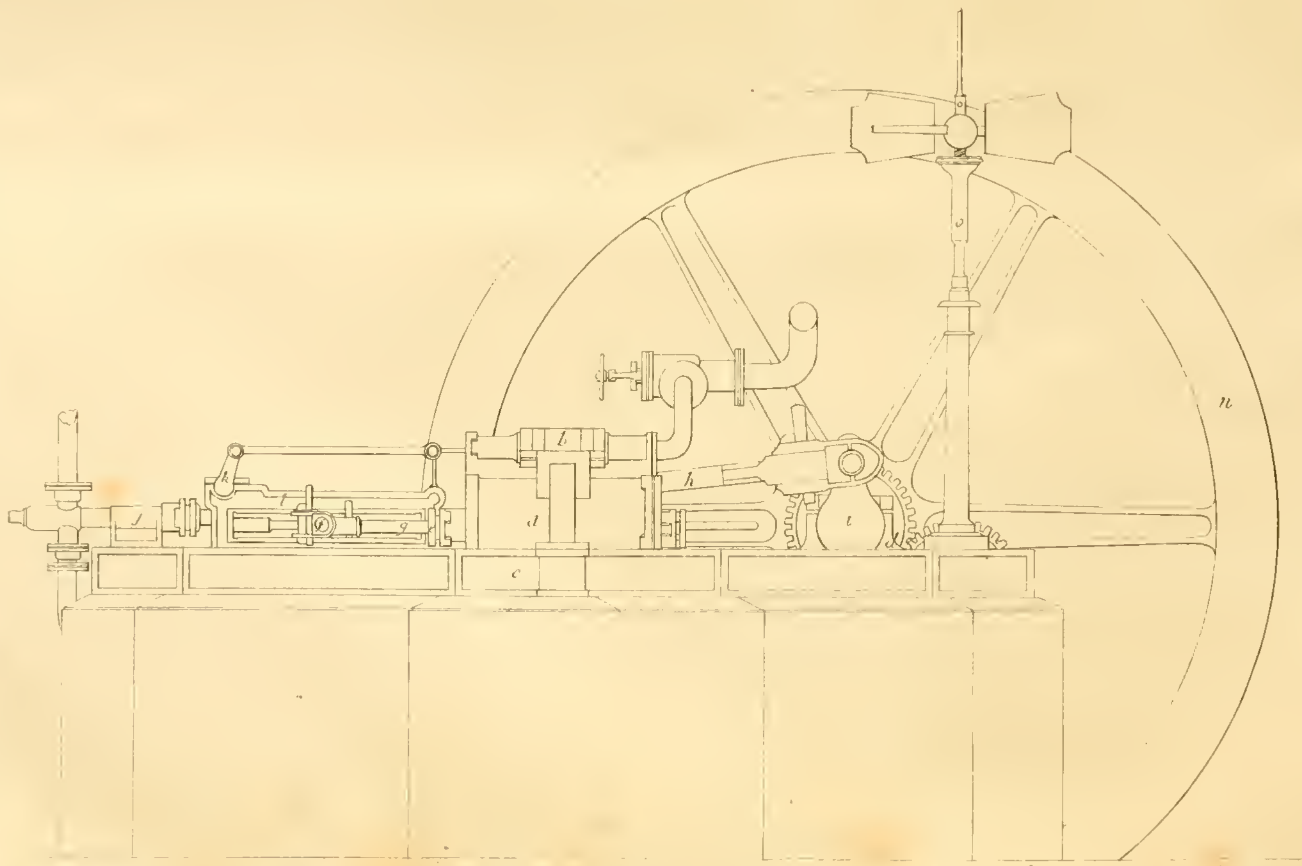
TWENTY HORSE HIGH PRESSURE ENGINE with TWO CYLINDERS at MESSRS. C. FORRESTER & Co's WORKS, LIVERPOOL. *Illustrative of their Improv'd Double Cylinder Marine Engine*



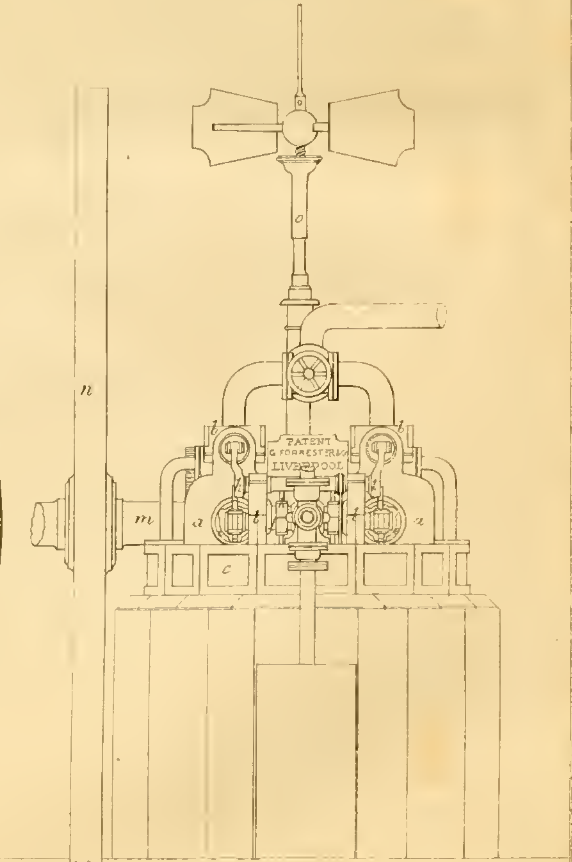
GROUND PLAN

REFERENCES

- aa Cylinders
- bb Slide valves
- c Foundation plates
- d Crank shaft pedestal
- ee Stuffing boxes
- f Connecting cross head
- gg Piston rods
- h Connecting rod
- i Crank
- j Feed pumps
- kk Valve levers
- ll Guides for cross head
- m Crank shaft
- n Fly Wheel
- o Governor



SIDE ELEVATION



END ELEVATION

rocks by gunpowder remains a subject of controversy; for although he has undoubtedly removed the material in an economical manner, it may be very much doubted whether he has not so shaken the remaining rock, and so extended its fissures, as to threaten him in subsequent years with serious slips, which may be productive of much embarrassment. So also the application of the artesian well system requires caution, for by want of care the well may be carried down to a limited reservoir only, when any other well being carried down to the same natural tank will diminish the supply to the previous well, and require both to be carried to a greater depth. The theory of artesian wells is satisfactorily established, but its application is in many cases matter of great controversy, as in the instance of the Trafalgar Square well, and it is necessary that the engineer should be well instructed so as efficiently to conduct his operation, and satisfactorily to defend its propriety. We may remark here *en passant* that the progress of the artesian well system is one of deep interest to the engineer, and with regard to which many valuable experiments are going on: thus at Naples the supply of water from the exterior is scanty and expensive, and a well is being bored in the King's garden to try for water at a lower depth: so too in the desert of Egypt a similar experiment is contemplated by the Pasha, the result of which will have an important bearing, and if successful, will alleviate one of the great difficulties of the Indian transit. An acquaintance with the inferior strata of water is indeed of the greatest value, for it will sometimes happen that water will abound below, which cannot be retained on a sandy surface, or it may exist in a state of greater purity, filtered through loose strata, while on the surface, it may be so mixed with extraneous matters as to be unfit for use. A better acquaintance with this subject may lead to some relief of the great droughts suffered by some districts of Australia, and which materially impede the progress of our colonies there. To return to the railway and canal engineer, it will sometimes happen that in cuttings he will come on deposits of septaria, which are extensively used in the manufacture of Roman cement, or on coprolites, which have been pointed out as a copious source of manure, and likely to be so employed, or he may come on some calcareous formation, the qualities of which being duly ascertained may be of great value for agricultural purposes or in the composition of cements.

In mining the possibility of reaching coal or ironstone is often left to the investigation of the engineer, and the educated engineer will not do now what was formerly done, bore for coal in the tertiary deposits. He has, too, as we have before observed, to make himself well acquainted with the geological character of the district in which he is engaged, and he has thus the opportunity of ascertaining its mineral resources, and of suggesting the necessary means of exploitation. The opening of the coal and lime works by the Messrs. Stephenson on the line of railway in Derbyshire, has not only been a means of affording great benefit to the district, but of bringing in considerable profit to the projectors. An investigation into the supply of ironstone, the presence of the requisite flux, and the accessibility to fuel is requisite to determine the formation and establishment of an iron work, and its successful prosecution. Indeed, various are the occasions on which geological skill will be found one of the most valuable attainments of the engineer.

In hydraulic works this knowledge is indispensable, one coast differs from another, rivers from rivers, and a well grounded acquaintance with the natural operations going on in the locality and elsewhere must be the chief guide to the engineer. Here the *vis medicatrix naturæ* is of the greatest utility, nature cannot be contended with, she must be humoured, and her powers turned to account. The most elaborate piers and jetties may be erected, but if the backwater be poured in at right angles to the tide, a deposit must take place. So too, an ill considered disposition will make a costly harbour a mere shingle trap, and the extension of piers and jetties only results in the carrying of the bar further out out to sea. Here, too, is a department where much is to be studied and much is to be done, at present it decidedly remains the domain of empiric practice, and harbour is made after harbour, and hundreds of thousands spent after hundreds of thousands only to result in failure. A careful examination of results would show a most lamentable condition of this branch of engineering science, for few indeed are the works which have proved effectual. This, too, must be the case so long as Mr. A. or Mr. B. is directed to improve Mudport Harbour, in the teeth of his repeated failures, for here a man is not tried by the efficacy of his cure but by the polish of the instruments he has employed in maiming or destroying his patient. His harbour is barred in a calm, and inaccessible in a gale, but what matters that, his north pier is an admirable specimen of constructive skill, his pier wall is faultless, and his lock gates magnificent, and so he goes on, and people talk about back water, scouring power and shingle, and when they have bothered their own heads and other person's, there is an end of the matter. So long as your engineer can employ a ballast engine, and dredge away the obtrusion, he gets one or two feet more water, and people are satisfied, not considering that he has applied a mere palliative and not removed the evil. The only remedy we can suggest under the circumstances, is to leave the design of harbour works open to public competition. The result we think would be to give the young engineer an excitement to study this branch, to give due effect to local experience, and to bring nautical knowledge to bear, while the public would feel much more deeply interested, the plans would be judged by a much more jealous tribunal than they now are, a great degree of valuable information would be obtained, and the basis laid for the scientific pursuit of hydraulic engineering; as it is, we consider, the grand defect undoubtedly to be an ill acquaintance with natural operations, and an inattention to the proper application of natural resources.

We may make the same remarks with regard to embanking, which as a scientific study, is in its infancy. Some thousand acres have been recovered on the Lincolnshire coast, but it has been by brute force rather than otherwise, and the means of applying natural resources to the recovery of the numerous available sites on our coasts have been totally neglected, though nothing would be more easy than the reclamation of very large districts, if adequately treated. We shall have occasion, in alluding to the force of water, and the amount of solid matter held in suspension, to show what an immense power is available if properly directed. We may remark with regard to any hydraulic construction, that careful study is required, the contour of nearly every coast varies, and consequently the set of the currents, which form the chief disturbing forces. This will be recognised at once, if we compare the eastern coasts of England with the west or with the south. Each has its peculiarities; and it is quite absurd to set an engineer at work in one locality, even on the ground of his success in another. How differently do the tides and currents set in the straits of Dover to what they do elsewhere: then again look at the tidal current acting in St. George's Channel, where at one end it has a broad entrance, and at the other is confined within the narrow space between Port Partrick and Donaghadee. How different is this from the long line of current sweeping for several hundred miles along the east coast.

Were there no other motive for the study of geology by the engineer, yet the unique opportunities he has for making new discoveries ought alone to incite him. In the bowels of the earth extraordinary phenomena meet his eye first, unexpected faults, slips, and novel fossils; in his cuttings and in his tunnels, he has the means of perceiving the order and superposition of strata, their depth, their extent, and the organic remains which characterise them, and under circumstances which other geologists vainly seek. It is with pride we point to many engineers, who have availed themselves of these opportunities, as the collection of railway sections in the Museum of Economic Geology will show, and who have rendered great service by many valuable discoveries and important communications.

With so many members of the profession devoting themselves to colonial pursuits we cannot too strongly recommend to young men the importance of geology. As the medical man is called on in the colonies to find supplies of drugs and medicines, by the use and substitution of local plants, so the colonial surveyor has to discover adequate materials, and to point out the resources of the district in which he is employed. By such exertions his value to the community of which he is a member, and his importance are enhanced, and by well directed investigation he may much increase the produce of the colony, and find many advantageous means of investment on his own account. The discovery of coal in a colony is recognized, as a most valuable service, and its exploitation, either immediately or indirectly, gives employment to the engineer, increases his professional income, and affords a permanent source of occupation.

We have now before us two works produced by Mr. Van Voorst, a circumstance, which to those who know his publications, will be alone a sufficient recommendation. Each work appears in parts. Mr. Ansted is Professor of Geology at King's College, and he gives abundant proof in every page of his qualification for the task he has undertaken. The arrangement of his work, and his treatment of the subject rather differ from the course usually pursued, but they are such as to give the student a clear and well grounded acquaintance with the study. Mr. Ansted carefully eschews all theory at the commencement, and begins his description of the strata with the palæozoic, instead of with the tertiary, as is frequently the case. His style is simple, and his great endeavour is to give the learner a clear idea of what is before him. It is a book written, not as such works too often are written, for the learned man, but for students, in which the writer enters as it were into the mind of his reader, anticipates his difficulties, and by making himself acquainted with them is more easily able to remove them. This is the great skill in the art of teaching, as in all persuasive arts, to think not of yourself and your own ideas, but how you can best communicate the subject to those whom you are addressing. The mere inculcation of a fact is nothing, you must make the student apprehend it and comprehend it. In attaining this end, we think Professor Ansted has well succeeded, and he has produced a work, which of all those which have appeared, is best calculated to be of service to the learner. We must not, however, be misunderstood, this is no cram book, no creation of paste and scissors, the anything good enough for the public; but carefully elaborated, every fact duly weighed, the knowledge and experience of the author brought to bear, and the latest researches recorded, even to the current period.

Professor Owen is an authority in every department of comparative anatomy, known for his close and ingenious research, the extent of his discoveries, the originality of his views, and the keenness of his discrimination. Those who heard his masterly paper before the Geological Society on Koch's Missourian, can well appreciate his powers, the skill with which he disarticulated the skeleton, showed its true character, and reconstructed it as the Mastodon. It did certainly appear extraordinary that men of science should not have recognised the false articulation, when the posterior extremities were made to join on to the *caudal vertebræ;* the turning of the tusks upwards, and the raising of the skeleton on the fore legs were shown to be characteristics impossible and false. His paper on the Amphitherium in the work before us is no less admirable. The British Fossil Mammalia are arranged not according to any geological peculiarities, but according to their natural classification, beginning with the Quadrumans, and we have perused this first part with deep interest, and strongly recommend it to all who are desirous of making themselves acquainted with this important branch of geology, so necessary for the accurate discrimination of strata, and so valuable in its bearing on the higher branches of the science.

We can scarcely conclude these remarks better than by extracting the preliminary observations of Professor Ansted on the power of water.

"It requires but little study to discover that every one of the most common and daily operations of nature is concerned more or less in the formation of stratified rocks. Every shower of rain that falls in a hilly or mountainous district, every brook or river that pursues its course through a greater or less extent of country to the sea, or is swallowed up before reaching the sea in some mightier stream than its own, every lake or pool that receives the waters of a river loaded with the particles of muddy soil over which it has passed, and pours forth at its opposite extremity a transparent stream cleared of impurities, every wave that dashes against a projecting rock on the sea coast, or washes into a hollow bay, tearing and grinding away the solid cliff:—each one of these, together with other not less powerful though less frequently recurring agents, is concerned in the formation of new strata, and in effecting changes in the physical conformation of the globe scarcely less remarkable than those with which the geologist has to deal, and which will hereafter be described. A few instances of the actual extent of the effect thus produced will form a useful and interesting introduction to a description of geological facts analogous to them.

"Of the many constantly recurring phenomena, which, owing to their perfect and undeviating regularity, attract but little notice from the casual observer, there is none perhaps more remarkable than the quantity of solid matter held for a time in mechanical suspension in the water of rivers and brought down to be deposited at the mouth of the stream, or spread over the bed of the ocean. The vast amount of mud thus conveyed by running water is occasionally seen in the extensive deltas, or tracts of swampy land, at the mouths of great rivers, such as the Rhine, the Po, the Nile, the Ganges, &c.; in each of which cases the river divides into so many channels before reaching the sea, that its actual character and apparent magnitude is completely lost.

"The origin of these vast deposits of rich alluvial soil must be sought for entirely in mud brought from the high lands or the plains through which the river passes, and held in suspension so long as the water is in rapid motion, but which sinks to the bottom when the current is checked. To obtain some notion of the actual quantity of solid matter thus continually brought down from the high land to the sea, an experiment was made some years ago by Mr. Leonard Horner, on the waters of the Rhine, the calculations founded on which possess considerable interest. Mr. Horner found that in the month of August, when the river was unusually low, one cubic foot of water taken fairly from near the middle of the river, near Bonn, supplied rather more than 21 grains of solid matter, and that in the month of November, when the water was turbid, about 35 grains of residuum were obtained. Now, taking the average of these two observations, and considering the Rhine at Bonn to be 1,200 feet wide, to have a mean depth of 15 feet, and to run with a mean velocity of 2½ miles per hour, it appears that nearly 400 tons of solid matter would pass down the stream per hour; and that in the course of one year, between seven and eight thousand millions of tons would be carried along, the greater part of which must be deposited in Holland before reaching the sea, in consequence of the slow and meandering course of the river through that flat alluvial country. In the course of 2,000 years, the Rhine may thus have brought down enough material to form a stratum one yard thick, extending over an area more than 36 miles square.

"But the delta of the Ganges far surpasses in magnitude that of any European river; and is on the whole, perhaps, the most extensive and remarkable of all those at present forming of which we have any accurate data. The head of this gigantic delta commences at a distance of 220 miles in a direct line from the sea, and the base of it is 200 miles in length; the whole triangular space occupied comprising upwards of 20,000 square miles, every part of which has been formed by deposition from the river and its tributaries.

"The quantity of mud and sand carried by the Ganges into the Bay of Bengal is however, notwithstanding the vast deposit which previously takes place, still so great, that during the rainy season when the stream is turbid, the sea does not recover its transparency even at a distance of 60 miles from the coast; and the quantity of mud held in mechanical suspension is so great, that a glass of water taken out of the river when at its height, is said to yield one part in four of mud. Calculating from the dimensions of the river and the rate of the current, Major Rennel has shown that during the flood season the weight of the mud thus brought down daily, and deposited either within the limits of the present delta, or at the mouths of the different branches, must be as much as 450 millions of tons, a quantity which is perhaps more readily understood by expressing it as equal to about 74 times the weight of the Great Pyramid of Egypt, supposing that to be a solid mass of granite.

"Another instance of a vast amount of solid matter conveyed by a river, and spread out upon the bottom of the ocean, is seen in the distribution of the sediment of the great river of the Amazons. At the point where the current formed along the coast of Africa, (a current which crosses the Atlantic to the continent of South America,) meets the stream of the Amazons, it runs at the rate of about four miles per hour. The stream of the river, however, preserves part of its original impulse, and its waters may be recognised by their muddy colour, and are not wholly mingled with those of the ocean at a distance of 300 miles from its mouth. An immense tract of swamp is being formed along the coast of Guiana by the deposit of the mud thus brought down by the Amazons, and the shallow sea along that coast is rapidly being converted into land.

"The power of water when in motion of transporting not only mud, but heavy bodies of considerable magnitude, is another point of considerable interest in geology, and one that requires to be stated in some little detail, because there are certain popular fallacies concerning the motion of heavy bodies, which tend much to confuse and mislead the judgment on this subject.

"We are accustomed to consider weight as an absolute quality of certain bodies, which we therefore call heavy. Now this quality of weight, as the word is commonly applied, is in fact only relative; and in this relative sense, a piece of wood is no more heavy when immersed in water than a balloon filled with hydrogen gas is in the air, each being lighter or of less weight than an equal quantity of the element in which it is placed, and which it displaces. In all cases, the actual weight of that quantity of the fluid which would have occupied the space filled by a solid body, must be deducted from the actual weight of the body before the relative weight,—the only part which resists motion,—can be calculated.

"Speaking accurately, therefore, bodies of all kinds are heavier in air than they are in water, and are consequently moved with greater facility in the latter, than in the former fluid. It should also be borne in mind that the power which water possesses, of transporting heavy bodies, increases in an enormous ratio with the increase of rapidity of the current; and with these considerations, we shall be able to account for, and understand statements on record, otherwise almost incredible, of the effects produced by water in rapid motion.

"As a recent instance of effects of this kind, and one occurring in our own island, I quote an account of an extensive flood, which spread simultaneously over a large tract of country, in Aberdeenshire, in the early part of August, 1829. The total length of river flooded on this occasion could not be less than between five and six hundred miles, and the whole of the river courses were marked by the destruction of bridges, roads, crops, and buildings.

"Speaking of the river Nairn, Sir T. D. Lauder relates, in a detailed account of this flood that a fragment of sandstone rock, fourteen feet long, three feet wide, and one foot thick, and which could not have weighed less than three tons, was carried down the river a distance of two hundred yards.

"A bridge over the Dee having five arches, and a waterway of two hundred and sixty feet, which was built of granite, and had stood uninjured for twenty years, was carried away by the flood, and the whole mass disappeared from the bed of the river.

"'The river Don,' says Mr. Farquharson, describing the effects of the same flood, 'has, upon my premises, forced a mass of four or five hundred tons of stones, many of them weighing as much as two or three cwt., up an inclined plane, rising six feet in eight or ten yards, and left them in a rectangular heap, about three feet deep on flat ground.'

"The gradual wearing away of solid rocks, by the action of water passing over them, is another cause constantly tending to destroy existing inequalities of the surface, and deposit the materials in beds at the bottom of the sea. In one instance on record, a torrent of hard blue lava, ejected from one of the craters near the summit of Mount Etna, had crossed the channel of the Simeto, the largest of the Sicilian rivers, and had not only occupied the channel, but crossing to the opposite side of the valley, had accumulated there in a rocky mass. The date of this eruption is supposed to be 1603; and, at any rate, it is one of the most modern of those of Mount Etna; but now, after the lapse of little more than two centuries, the river has cut a passage for itself through the lava from fifty to one hundred feet wide, and in some parts from forty to fifty feet deep.

"But the power of marine currents, and the ceaseless dash of the waves of the ocean, are much more striking in their effects than the quiet action of a river. As instances of this, the condition of the various promontories of chalk, on the south coast of England, and the opposite coast of Normandy, is too well known to require more than a passing allusion; but on the northern and more exposed shores, both of the main land and the western Islands of Scotland, this power is exhibited on an extremely grand scale. In what is called the Grind of the Navir, in the Shetland Isles, the sea is constantly widening a passage it has cut for itself, through cliffs of the hardest porphyry, tearing down huge fragments of rock, and depositing them at a considerable distance. In this way, from time to time, islands have been separated from the main land, and the islands themselves split, as it were, into shreds; until at last even these bare bones, the skeleton of what was one land, have also been swept away, the last victims to the restless violence of moving water.

"The ordinary force of marine currents is also, under some circumstances, very remarkably shown. During the erection of the well-known Bell Rock lighthouse, at the mouth of the Tay, six large blocks of granite, which had been landed on the reef of the Bell Rock at low water, were, on one occasion, removed by the force of the sea as the tide rose, and thrown over a ledge to the distance of twelve or fifteen paces; an anchor weighing about twenty-two hundred weight being, on the same occasion, thrown upon the rock.

"Along the whole of the eastern coast of England the waves are ceaselessly occupied in washing away the different projecting headlands that stretch into the sea. In various places in Yorkshire, Norfolk, and Suffolk, houses, churches, and even whole villages, are, from time to time, swallowed up, and the advance of the sea is sometimes extremely rapid. At Sherringham, in Norfolk, a house was built in 1805 at the distance of fifty yards from the cliff, which, however, has receded so rapidly, that in the year 1829, after the lapse of less than a quarter of a century, there remained only a very small garden between the house and the sea, as much as seventeen yards of cliff having been swept away in the course of the five last years only. In the harbour of the same port (Sherringham) there is now at one point a depth of twenty feet of water, where, less than fifty years ago, there stood a cliff fifty feet high; and a little further to the south, where the cliffs are composed of alternating strata of clay, gravel, loam, and sand, large tracts of land are not unfrequently swallowed up by the sea, being undermined by the waves, or by springs of water rising and penetrating between the beds. Many other extensive landslips have occurred, from time to time, on the south coast of England, and also on the western coast, where the county of Cheshire has suffered a loss of many acres of land between the Mersey and the Dee, by the gradual advance of the sea upon the abrupt low cliffs of red clay and sand."

Illustrations of Baptismal Fonts. London: Van Voorst. Parts II., III., and IV.

We were pleased with the first number of this work, but we are still more gratified with its progress. Now that ecclesiastical architecture is carried out in its details, that it is considered not enough to design the shell of a church, but it is required that its parts and its fittings should be in some degree appropriate, great convenience will be felt in having accessible manuals for study and reference. Mr. Weale has done much good in publishing so many examples of stained glass, brasses have been taken up by the Camden Society, and fonts by the present publisher. Pulpits, moreover, will be found not unworthy of notice; abroad, especially in Holland and in Belgium, many beautiful specimens of carved pulpits exist, which may be advantageously studied here. Indeed a record of the many admirable specimens of carving in wood and in metal would be highly valuable, as for instance, Grinling Gibbons' works, which, we believe, have never yet been published, though recognized on all hands as masterpieces of art. In London, especially, we have many admirable specimens of this artist, which, with the growing taste for ornament, might be advantageously studied.

Of course in a work on baptismal fonts, the delineations are the grand thing, description amounts but to little, and we are consequently restricted in our notice of the work. We can but describe its general character, which seems to be that of careful and accurate delineation, at the same time that a highly artistical effect is produced, and the result is a work valuable for reference, and ornamental in the library. We are glad to see that it is in contemplation to give a classed index at the end of the work, so that the several specimens of Norman, Early English, and Decorated may be bound together, and more conveniently referred to. The publisher has also very prudently given a list of those gentlemen who have communicated drawings, which is very long, and we regret to see includes the names of only four architects. The metropolis has only contributed one architect, and we think this, to some extent, a reflection on the profession, for it is to be supposed that in the course of their studies they must necessarily have examined the many admirable works of antiquity in their several neighbourhoods, and have formed drawings of them. This argues but little for the love of art, and zeal for diffusing knowledge, existing among the great body of architects. The amateurs far out-number the architects, and the clergy are upwards of thirty in number, showing a laudable zeal for the promotion of art, and for the honour of the edifices in which they respectively officiate. In fact, the number of ladies who have contributed drawings seems to be about as large as that of architects, while the drawings communicated by the ladies are much more numerous. This is not creditable to the architects, and we hope it will be remedied. Indeed if any charge can be rightly laid to the door of the architects we fear it is that of a want of public spirit. They are never forthcoming on any great occasion, they give nothing to the public they can avoid, and publish little of any value. The greatest jealousy exists as to communicating accounts of their works and designs, and notorious examples frequently occur of public servants setting the public voice at defiance, and refusing to submit their designs for important edifices to open and candid scrutiny. The publishers complain that the architects, though a richer body, do not subscribe adequately to professional works, but that they are beaten hollow by the engineers, in the proportion of three to one. It is also to be observed that at the Royal Institute of British Architects the greatest deficiency of original papers is evident, and the managers are obliged to get up papers on antiquities, and on books published by other people. The most valuable papers in their "Transactions" are by Professor Willis, and other laymen. Yet, under such circumstances, a morbid jealousy of the acquirements and interference of amateurs, and of the criticism of the press, exists on the part of many members of the architectural profession, when it is evident that there are small grounds for the assumption of professional superiority, and that it is of the greatest importance that the public voice should be brought to bear as an excitement to exertion. It may, too, be safely pronounced that the majority of works treating of architectural antiquities have emanated from laymen. In what other profession can such a state of affairs be found? Surely not in engineering, in medicine, at the bar, but all going unequivocally to prove a want of disposition on the part of architects to comply with their responsibilities as members of a noble and enlightened profession. We say this with no desire of offence, but because we feel the facts strongly, and are desirous of seeing a remedy applied to such a state of affairs by the vigorous exertions of the profession. The architectural profession is in a serious position, the public voice has virtually proclaimed it inefficient in the performance of its public duties, and has required a greater originality of design, and a more intellectual treatment of details. A spirit is abroad among the clergy, and among the educated and intelligent of the community, which exacts much more intellectual labour than architects have been accustomed to afford, and it becomes them to comply with the reasonable demands of the public

It should be recollected that Michael Angelo, Philibert de l'Orme, and Sir Christopher Wren, not to enumerate other names, were not originally architects by profession, and yet they have produced works, which whatever technical defects they may possess, yet by their originality they have obtained fame in all times. As it is, the movement for the restoration of Gothic architecture has been entirely extra-professional, the great zeal manifested for it now is by the clergy, and in this, as in other departments, it is but a short step from the theory of the amateur to his practical exertions. If the architects once teach the public that their professional title is but a name, farewell to all their glory, and we cannot say that such a result is either impossible or far distant. One thing is very evident, that architects, as was observed at the Institute on a recent occasion, are behind the age, and they must bestir themselves strenuously.

To return to the "Illustrations of Fonts," we are pleased to find such a long list of drawings already received, promising a valuable and extensive series, and also that the editor has formed a considerable list of fonts lying in a desecrated state, and also of those once desecrated, but now restored, the publication of which is promised in a forthcoming number. We strongly suspect that the editor is a clergyman, for the vigour and energy he displays are not characteristic of the architectural profession. We are pleased to find noticed in the numbers already published so many instances of the restoration of desecrated fonts, showing a laudable and energetic spirit on the part of the clergy. Indeed it appears that the clergy have been most earnest in affording information, whenever applied to.

The number of Norman fonts is considerable, several of them from Cornwall, which we believe are rather later in date than is generally assigned to the Norman period, for Cornwall was much behind the Saxon parts of the Island. At Keysoe, in Bedfordshire is an early English font having an ancient inscription as follows:—

" +TRESTVI :KEPARHIC IPASSERVI
PVRLEAL MEWAREL PRIEV : KE
DEVPARSA GRACEVE RREYMERCILIFACE AM.

which forms a distich running thus in modern French:—

Restez ; qui par ici passerez
Pour l'âme de Warel priez :
Que Dieu par sa grace
Vraie / or Voir } merci lui fasse. Amen."

Now we are inclined to give a different reading of the last line. It is tolerably evident that it cannot be either VRAIE or VOIR, neither agree with the sense or the orthography. The word is VEURREY, and it is probably some irregular inflexion of the verb *vouloir*, perhaps *voudra, veuillera, or veuillerait*, contracted to VEURREY. The two latter lines according to us would read—

" Que Dieu par sa grace
Voudra merci lui fasse."

A Hand-Book for Plain and Ornamental Mapping, and Engineering Drawing, used by Surveyors and Civil and Mechanical Engineers. By Benjamin P. Wilme. Part V.

We have before had occasion to allude to the utility of this work, and are glad to see that Mr. Wilme continues his labours so usefully; we must, however, remark that we do not approve of the colouring in every instance as adopted by Mr. Wilme; for example, in one of the plates, stone ashlaring is shown of a tint usually introduced for brick-work; again, we must observe, that sufficient pains have not been taken with the plate of "Signs used in Mapping," many of them are drawn very carelessly; this should not be the case with a work that is professedly to be an examplar of reference.

PROPOSED SUPPLY OF WATER AND RAILWAY AT BERLIN.

(From the Allgemeine Preuszische Zeitung.)

Since railways have been conducted through mountains and over deep valleys, proposals for gigantic works have been listened to with less doubt and astonishment. A project is now spoken of for Berlin, which, if completed, would be one of the most magnificent hitherto possessed by any capital.

It is well known that Berlin is not yet provided with water-works like London, Paris, and other cities, for the purpose of extinguishing fires, cleansing the streets and other objects. It has been found, after many enquiries, that those arrangements which have been adopted in places where nature supplies water from elevations, cannot serve as models for our flat country. Subterranean conduits are nothing more than the gradual extension of works separately undertaken and executed without regard to the future. In places where a perfect system for the supply of water has to be established at once, to its whole extent, aqueducts give a more perfect means of conduction than pipes, which always occasion a continual disturbance of the pavement of the streets. Aqueducts, however, would be too expensive for Berlin if they were not at the same time directed to another and more important purpose, viz., the introduction of railways into the city. At Paris a circular road is intended to be formed round the city, for the purpose of connecting the different lines of railway. For Berlin it is proposed to introduce, instead of a circular line of rails, a system of viaducts, passing through the centre of the town, where, by crossing each other, they will connect the termini of different roads. This mode of uniting our railways will have many advantages over the circular plan, which would interfere with the outlets from the town. Luggage cars will, by this arrangement, be dispatched between Leipzig, Breslau and the Baltic, without being unloaded at Berlin. These railways within the town will, however, besides the principal object of their adoption, supply the place of cabs and omnibusses, like the Blackwall and Greenwich railways of London;—they will connect the distant parts of the town with each other, and lessen the distance to the centre. The small stations, which will have to be constructed for each of these railways, as near the centre as possible, and to an equal height with the viaducts, and according to the models of the Blackwall, Greenwich, and Eastern Counties railways of London, will cover a considerable portion of the building expenses, as the lower parts of these structures will be used for waiting rooms, workshops, meal and corn halls, and other purposes. For the completion of this grand design, the railway viaducts will also be aqueducts, for the supply, in any direction between the different parts of the town, of high-service water for extinguishing fires, watering the streets, &c. The viaducts will rise with the common gradients of 1 in 100, or, supposing wooden rails to be employed, of 1 in 20. The required height will be gained after their entrance upon the waste lands in the town, and they will be maintained at the height necessary for the supply of the water, which will be raised by steam engines from the river or from wells. The water may be further distributed from the aqueducts through stone pipes, which, from the cheapness of the material, may be placed on both sides of the street; and as there will be little necessity for repair, there will be few occasions to interrupt the traffic. A greater width will be required for the railway viaducts than for the aqueducts, and this surplus space will save the necessity of constructing large reservoirs for the head of water, the formation of which would be very expensive in the absence of high grounds.

But Berlin, with the slight fall of its site, wants a greater quantity of water, for the purpose of cleansing its streets, than cities with a considerable descent. This will be economically supplied by using the water raised by a steam power of 1000 horse, in its descent, for the purpose of machinery in manufactures and workshops, an arrangement which we cannot now more minutely describe. Thus the intended works will unite a complete supply of water, the shortest possible connexion of the railways terminating in Berlin, an omnibus communication with the different parts of the town, and a distribution of steam power similar to the supply of gas or water.

GEOLOGICAL SUBMARINE RESEARCHES.

At the Royal Institution, Feb. 23, Professor Forbes gave a lecture *"On the light thrown on Geology by Submarine Researches."* Having alluded to the researches of two Italian naturalists, Donati and Soldani, who dredged the Adriatic about the middle of the last century, Prof. Forbes entered on the important inferences which he had derived from similar investigations in the Irish Channel, and in the Archipelago. His first conclusion was, that marine animals and plants are grouped, according to their species, at particular depths in the sea, each species having a range of depth appropriated to itself. Prof. Forbes illustrated this assertion by a diagram, indicating the plants and animals respectively inhabiting what he termed the *littoral* zone, which extends immediately from the coast—the *laminarian* zone, where the broad-leaved fuci are most abundant—the *coralline*, in which there is an assemblage of mollusca, especially bivalves and corals, and the *deep sea coral*, so called because in it only we find examples of large corals on the British shores. Prof. Forbes next alluded to the fact of the number of species diminishing according to depth, so that by gaining an accurate knowledge of the Fauna and Flora, appropriated to various sea-bottoms, the naturalists can infer their depth—no plants are found below 100 fathoms, and the probable zero of animal life is at 300 fathoms. Sedimentary deposits below this depth are consequently destitute of organic matter. This circumstance bids the geologist to be cautious in inferring that any stratum was formed before the creation of animals, on no other account than that it is devoid of organic remains: he should rather conclude from such deficiency, that the stratum was deposited in very deep water—Prof. Forbes next remarked that British species are found throughout the zones of depth in the Mediterranean Sea; but that in that sea, the proportion of northern testacea in the lower zones greatly exceeds that in the upper, so that there is a representation of climates, or parallels of latitude, in depth. The fourth proposition advanced by the Professor, was, that all varieties of sea-bottom are not equally capable of maintaining animal life. The sandy parts are usually the desert ones. Hence the scarcity of fossils in sand-stone: though traces of worms (which inhabit the sand) are found in ancient sand-stones. As each animal is not able to live, except on its own locality, those marine animals, as the scallop, which are gregarious, deteriorating the ground when they increase beyond a certain extent, die; then the place becomes silted up, the ground changes, and another race occupies it. This fact explains the phenomena of distribution of organic remains in rocks—*i. e.* their being grouped together in separate strata, fossilliferous strata alternating with those which are free from organic remains.—Prof. Forbes proceeded to observe, that such animals as are common to many zones of depth, are those which have the greatest horizontal range in space, and are generally those which are present in the tertiary deposits; and thus it is that the most generally-distributed fossils are such as are found in the greatest number of formations; because these are necessarily the most independent of destroying influences. But, on the other hand, as the elevation or depression of strata to a very small extent would destroy the species peculiar to any zone, or to the zone above or beneath it, it becomes an important inquiry how this destruction is compensated. In dealing with this question, Prof. Forbes announced a most important law in zoology, one altogether new to ourselves—viz. *That the mollusca migrate.* He discovered by his own observation, that this is the case even with the limpets, the most fixed of all species. This migration occurs in their egg-state, when the ova are strung together, and floated over the ocean, from shore to shore. In the larva state they are swimmers. In fact, they commence their life in a form closely analogous to that which is permanent among the pteropods. But, though in this state they can live in any zone, they cannot arrive at perfection except in the peculiar zone to which they are adapted. This accounts for the very imperfect shells of prematurely dying mollusca being found at a low depth. Professor Forbes concluded his communication by noticing its bearings on the views of the most eminent geologists of our time. 1st. With regard to Mr. Lyell's principle of distinguishing tertiary strata by the per-centage of recent species in each. This is confirmed by Prof. Forbes's investigations; only in using Mr. Lyell's criterion, the element of depth, which gives climatal character in living animals, must be taken into account. 2nd. Prof. Forbes next noticed that Sir H. De la Beche had hypothetically anticipated, what his researches established, the representations of climates and depth, ten years ago. 3rd. He lastly ascribed to Viscount d'Archiac and M. de Verneuil, the credit of having announced (what he had observed and mentioned in the course of his communication) that species which are found in a great number of localities, and in very distant countries, are always those which have lived during the formation of several successive systems.

SULPHATE OF BARYTES.

A correspondent of the *Athenæum* observes that there is a beautiful white' as all artists know, made from the earth called Barytes. The pigment is called "constant" or "permanent white." If the "quick," or "setting," properties of lime, are not essential to the art of fresco painting, or stuccos and washes in house decoration, I would suggest the use of the sulphate of barytes instead. It is, in itself, a most brilliant white, and from the experience of artists, is known to mix with most colours, without altering their properties. It may not be generally known, that this earth (in the sulphates) is found in large veins in different parts of the county of Montgomery, and is thrown out in large quantities by the miners in the lead mines. It is found, also, in Shropshire (bordering on Montgomeryshire) in the hills called Stiperstones, in a mine called Snailback. It is a mineral which was considered of little use in the county of Montgomery till the last few years, when a person, of the name of Maguiness, rented a vein of the sulphate of barytes, and converted old flour mills, at Pool Quay, (in Welshpool) into mills for grinding this beautiful mineral, which is of a dazzling white when ground. It is put in barrels, and shipped in great quantities for America, where it is used in the composition of china. This sulphate of barytes is indestructible, uninfluenced by damp, foul air, time or light, and seems to be a substance, both from its durability and extreme beauty, peculiarly fitted for house decorations, when the vehicle is not oil. The carbonate of barytes is, as all chemists know, of a most poisonous nature, but the sulphate, being insoluble, is perfectly harmless. It has been used, since Mr. Wedgewood first applied it, in the composition of china, but it seems a pity that such a beautiful substance should be applied solely to that use and the pigment used by artists, if it can be applied more generally in paintings, where water and size are the vehicles, and in house decorations. The New Houses of Parliament will afford scope for its use, if these suggestions prove practicable.

The annual exhibition of the works of art was opened at Paris on Friday the 15th instant. The catalogue comprises 2423 articles, or 826 more than in 1843—namely, 1808 paintings and pictures, 348 miniatures, water colours, paintings on porcelain, &c.; 24 works of architecture, 133 of sculpture, 89 engravings, and 21 lithographs.

ST. STEPHEN'S CATHEDRAL, VIENNA.

In the *Journal* of last January we gave an abstract of a paper by Mr. Higgins, read at the Royal Institute of British Architects, on the recent restoration of the spire of St. Stephen, at Vienna *(the Dom-Kirche)*, respecting which a correspondent of the *Athenæum* has forwarded the following communication:—

"As some recent interest about the *Dom-Kirche* of Vienna seems to have been created among both your readers and writers, perhaps a few notes, taken on the spot, and before the 'cast-iron' restoration, will prove acceptable also; they pretend to no other merit than those advantages may give them, for I had no intention of printing my pocket-book, when filling it with such brief, hurried, and meagre memoranda. The Great Tower of St. Stephen's is steeple-capt, very high and noble, but the top leans much from its original position; it is carried up by canopies and pinnacles, the former on an outer plane of decoration, like net-work hung over the spire itself: the crocketting (as usual throughout German Gothic) is inelegant, has a *larded* look, and reminds one of holdfasts instead of ornaments. *Mem.* crockets should never appear stuck on but growing out of, what supports them. The west front is Lombardesque in character, being decorated with small animals—a phase of Byzantine, or rather Romanesque; its portal (the 'Giant's Gate') consists of several round-headed arches under a pointed one, but this last perhaps altered from circular, and all sustained by slender columns, which, as well as the superincumbent arches, are wrought over with lozenge reticulation, or platted over with reeds, not with zigzag nor any other peculiar Norman or Saxon embellisment. The east end has a double apse, one part of which forms the choir, and both parts are polygonal in ground plan. The choir is battlemented with trefoil arcs, the nave with a parapet of flowing open-work. Buttresses run *through* the cornice quite round the church, and rise into crocketted pinnacles, many of which are now deficient. The nave has several gables on its sides, now filled up, except one of beautiful tracery. The roof is tiled in lozenges and letters, made by diversified colours—another German techtonic fashion that should become English too, as our monotonous red roofs present the ugliest bird's-eye view possible. Correspondent to the great steeple-tower at S.E. stands an intended but unfinished duplicate at N.W.; besides these there are two smaller towers, octagon, and set over gable ends, which appear on the west front. North and south of these towers run the aisles, exhibiting a much more modern character, as the towers themselves have a Normanesque air. Thus two lines of corbelling (a table supported by trefoil arcs with bosses for corbel-heads) adorn the lowermost story, while above these are three plainer lines (the common Norman table on small arcs without any heads beneath them). Outside the church, at its base, some curious tombs, like rectangular mantel-pieces of reeded mouldings, which another triad of reeds, but curvilinear, interpenetrates, where it meets their jambs and crosses, arch-wise or *rhumb*-wise, their lintels. Interpenetration could not well push its preposterous ingenuity further; Nuremburg doorways often present similar examples of it—to be avoided. St. Stephen's Cathedral is neither whitewashed nor painted within, but impressive from gloom, and the fine, soft chiaroscuro produced by darkness stamping itself in visible masses upon the grey columns and walls, yet leaving portions of both to dawn here and there through it. Sundry additions of varied Gothic, such as chapels, screens, &c. enrich the effect. Transept narrow and short; chancel of deep-tinted wood, well carved, and harmonizes well with the edifice, both as respects character and colour. The columns all massive, composed of numerous rounds and hollows, rise picturesquely from altars at their basement (*these*, however, are low-classic). Except in the choir, whose nave and aisles have the same height, this church does not bear out Mr. Whewell's assertion that it exemplifies a late system of Gothic vaulting, for the nave is highest elsewhere, though but by a little; generally, the interior has neither the elevation, lightness, nor openness he attributes to edifices thus constructed; it has his last characteristic indeed—absence of a clerestory. The choir exhibits plain diagonal ribs on its roof, all the rest of the church complex intersections. With regard to the windows they *had* mixed geometrical and flowing traceries; those in the body have now modern sashes and square panes: those in the side chapels of the apses are mostly built up, but some retain their old rich painted glass, very splendid, yet very sombre."

THE ISTHMUS OF PANAMA.

Mr. Wheelwright lately read a paper at the Geographical Society showing how an easy line of communication might be made between the Atlantic and Pacific Oceans, over the Isthmus of Panama.

Mr. Wheelwright, from his long residence in that part of the world, was perfectly acquainted with the country. After discussing some of the routes that had been proposed as lines of communication, whether by canal or otherwise, between the Atlantic and Pacific, Mr. Wheelwright gives the decided preference to the line between Chagres and Panama, the line in fact which had been explored and described by Colonel Lloyd. The Chagres river cannot easily be ascended by sailing vessels for various reasons, but properly constructed steamers of six or seven hundred tons burden may cross the bar to ascend as far as the confluence of the Trinidad, at all times and seasons. From a height, at the junction of the Trinidad, the line pointed out by Lloyd is distinctly seen to be free from any continuous heights, and from another elevation at Gorgona, on the Chagres, the line, which runs about five miles to the westward of the latter town, is again seen to be uninterrupted but by small isolated hills. The road from Gorgona to Panama, good in the dry season, is muddy after the rains, though always practicable, and an omnibus might be driven along it by merely clearing away the trees. This road passes over the head waters of streams flowing into the two oceans, and such is the level, that the traveller cannot perceive any division between them. The level nature of the ground thus established, Mr. Wheelwright is of opinion that, whatever ulterior plan may be decided upon, a road should first be constructed as near the level line as possible, both with a view to future labours, which such a road would great facilitate, and for the purpose of an immediate intercourse between the two oceans. This road should commence at the junction of the Trinidad with Chagres, to which place the steamers would ascend without stopping at Chagres: thus no risk from climate would be incurred, and the whole detention on the Isthmus would not exceed a few hours—goods could be transported with celerity and easily at a trifling expense. Excellent timber, and a most useful liana are abundant, as are also provisions, which are cheap: labour is likewise cheap, and coal, when wanted, is found in great abundance, and of good quality, extending across the Isthmus from Boca del Toro to St. David.

RAILWAYS.

RESOLUTIONS ORDERED BY THE HOUSE OF COMMONS TO BE PRINTED, MARCH 4, 1844.

Ordered, 1. That in each case where bills are now pending to authorize the construction of new lines of railway, competing with one another, such bills be respectively referred to one committee.

2. That the committees for the consideration of such bills be specially constituted.

3. That bills now pending to authorize the construction of new lines of railway, which will compete with existing railways, be in like manner referred to committees specially constituted.

4. That such committees be composed of five members, to be nominated by the Committee of Selection, who shall sign a declaration that their constituents have no local interest, and that they themselves have no personal interest, in the bill or bills referred to them, and that they will not vote on any question which may arise without having duly heard and attended to the evidence relating thereto; and that three shall be a quorum.

5. That a select committee be appointed to consider which of the pending railway bills shall be deemed competing bills, according to the foregoing resolutions.

6. That such select committee be composed of five members, of whom three shall be a quorum, and that the committee have power to send for persons, papers, and records.

7. That such of the standing orders as relate to the composition of the committees on private bills and the orders consequent thereon, be suspended, so far as regards competing railway bills pending in the course of the present session.

J. H. LEY, Cl. Dom. Com.

CARRINGTON BRIDGE, NOTTINGHAM.

SIR,—In your last paper, No. 84, page 90, there are some observations on this bridge referring to the flatness of the arch in the cast iron ribs, which have a versed sine of 5 ft. in a span of 70 = 1 in 14; the arch is stated, by the writer, to be the flattest he is aware of.

I beg, therefore, to inquire of you, or such of your readers as may be able to answer the question, what is the span and versed sine of the cast iron bridge over the river at Boston, Lincolnshire. It is now upwards of 30 years since I saw it, but (judging only from memory of the latter, and from the drawing given in your *Journal* of the former) I think Boston bridge must be the flatter of the two, but I believe it it not so large a span. But of Boston bridge some of the ribs were fractured when I saw it, and when I fancy it had not been long erected.

I am, Sir, your obedient servant,
A SUBSCRIBER.

March 2, 1844.

STEAM NAVIGATION.

Mr. Blake, the master builder at Portsmouth Dock-yard, is ordered by the Admiralty to prepare plans for constructing another 50-gun frigate, of the same tonnage (2,000) and dimensions as that already ordered to be laid down here. They are to be named the *Leander* and *Shannon*.

The *Prometheus* steamer, Lieutenant Pasco, arrived at Devonport on the 11th March, from her voyage with the *Penelope*. She was disabled in one of her boilers before she reached Madeira, where she remained six days. Soon after she left Madeira for this port her other boiler became damaged. On the 17th March she arrived at Portsmouth. She will proceed to Woolwich to be repaired.

The *Vulture* first class steam-frigate was undocked at Sheerness on the 13th March, and now remains in the basin.

The *Dædalus*, 42, a frigate of the old school, same dimensions as the *Penelope*, was ordered from Sheerness to Woolwich to be cut down to a flush-deck corvette, to mount 18 32-pounders, of 56 cwt.

The *Penelope*, 22, Captain W. Jones, left Lisbon on the 5th March for the coast of Africa. Every letter received from her officers and crew brings fresh complaints of the miserable discomforts experienced by them, and pronounces her an utter failure as a first-rate steam frigate.

The coating of the bottom of the *Shannon* frigate, at Sheerness, with the marine glue is just completed.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

March 4.—WILLIAM TITE, Esq., V.P., in the chair.

A paper was read "*On the Architectural Nomenclature of the Middle Ages,*" by the Rev. R. WILLIS. This paper is a portion of a work on which Professor Willis has been for some time engaged, and in which he proposes to ascertain the architectural terms of the middle ages, and to trace the origin of many technical words in use at the present day. The Itinerary of William of Worcester contains many examples of such terms as were in use in the fifteenth century, especially in a detailed description of the churches of St. Stephen and St. Mary Redcliff, at Bristol—but although this document has long been in print, nobody hitherto appears to have thought of comparing the descriptions with the existing buildings—a process to which they have been submitted by Professor Willis with satisfactory results, the coincidence being found perfect. By this means, the names of several mouldings have been fixed beyond a doubt. With regard to the terms applied to the members of classical architecture in the present day, few are found of classical origin in any language in Europe, the architects and writers of the Renaissance having generally applied the terms in common use, with the exception of Alberti, who affected to call everything by a new name, and invented for himself a Latin nomenclature which has never been adopted. Of the Vitruvian terms, few have been retained, since his early translators, being for the most part practical men, and writing for practical men, having naturally made use of their own mediæval words, applying them to the classical mouldings. In fact, the names of mouldings to be picked out of Vitruvius, who has not written expressly on the subject, are neither complete nor very intelligible, and a distinction is to be made between the names he applies to mouldings derived from their form, and those which are due to their place or mode of combination. These terms Professor Willis calls the *sectional* and *functional* names, and much obscurity has rested upon the words used by Vitruvius from inattention to this point. The nomenclature in use in England at the present day is of a very mixed character, and has arisen from the different media, Italian, French, or Dutch, through which a knowledge of the great masters reached us during the seventeenth century.

March 18.—E. B. LAMB, Esq., in the Chair.

The following papers were read—

1. "*Some observations connected with Hampton Court Bridge, and the adjacent parts of the River Thames,*" by C. PARKER, Esq., Fellow. It appears, that as late as the year 1750 there was no communication between Hampton Court and the opposite bank, except by a ferry; for we learn, by an act of parliament about that date, that J. Clark, who possessed the manor of East Moulsey (from the reign of Charles II.) was empowered to erect a bridge across the river, from East Moulsey to Hampton Court. The bridge was erected from the designs of S. Stephens, by B. Ludgator, and was opened in December, 1753. That bridge, however, did remain up long; for having been built too slight to stand, or to resist the concussion of the passing craft, it was subsequently taken down. On its removal, the present bridge was erected, and although it has been repaired several times, the original form of its construction is still preserved. It is built of oak, supported by ten piers of the same material; the length is about 350 feet, and the breadth 18 feet. In 1841, it appeared that material alterations had been made in the current of the river, by the construction of Moulsey Lock, about the year 1817, and subsequently (about 1833) the construction of two wooden embankments, projecting from the north bank of the river, by which the width of the stream was reduced one-half. These obstructions had caused such an alteration in the direction of the current and the rapidity of the stream, as to occasion, not only a disruption of the banks and the bed of the river, but likewise much injury to the bridge itself, from the craft being frequently driven with violence against the piers. Extensive repairs were in consequence found necessary. The main piles were strengthened

with additional ones, the decayed portions were removed, and the whole bound together with wrought-iron chain-bars. Proper precautions were taken to retain the chalk in the piers, and the gravel of the platform was reduced in thickness 18 inches, in order to lighten the superincumbent weight; and the structure, though still presenting a somewhat disjointed and sunken appearance, is now firm and compact.

2. "*On the Chancel of Ringwood Church, Hants*," by Mr. F. J. Francis. This chancel, 50 feet long and 22 feet broad, is (as appeared from the drawings exhibited) a fine specimen of the early pointed style; and, although, like the rest of the church, it has suffered from continued neglect, spoliation, and bad taste, enough remains to prove, that the ancient builders had bestowed on it no ordinary portion of ingenuity and skill. The peculiar feature is the number of windows which it contains, there being a series of eight lofty, narrow lancet windows on each side, with deep splays, some of which bear traces of painted decorations, with a fine triple lancet at the east end, making a total of nineteen. The peculiar features of the style are well carried out in all the details. The caps and bases of the slender Purbeck pillars, which separate the splays of the window at the east end, are in the purest taste; indications of similar pillars are to be found between the windows on the north and south side.

THE ROYAL SCOTTISH SOCIETY OF ARTS.

February 12.—Professor Traill, M.D., F.R.S.E., President in the chair.

The following communications were made:—

1. (Part II.) *Observations on, and Improvements proposed in, the Ventilating and Warming of Factories.* By Robert Ritchie, Esq., C.E. Mr. Ritchie continued his exposition of the modes in use for warming and ventilating factories. He showed the diversity of opinion which exists on the subject of ventilation, some being in favour of an *upward*, and others in favour of *downward*, withdrawal of the vitiated air. He also showed, from the opinions of many scientific men, the advantages, as regards salubrity, to be derived from not separating the *ventilating* from the *warming* process, &c.

2. *Account of a Cheap and Portable Self-Register-Tide-Gauge.* Invented by John Wood, Esq., of Port-Glasgow. Communicated by John Scott Russell, M.A., F.R.S.E., C.E. One of these tide-gauges and examples of its work were shown. This is a very beautiful, simple, cheap, and portable tide-gauge. It can be packed in a box of about two feet square, costs about 2*l.* only, and registers by a pencil on a cylinder of paper the total rise and fall of the tide for a month at a time. By a simple addition, costing only 20*s.* more, where there is a clock at hand, it can be made to register the state of the tide at every period of time. The machine was much admired for its simplicity and cheapness, and was referred to a committee.

3. *On the Naphtha or Camphine Lamp, and its expense compared with other sources of Light.* By Andrew Fyfe, M.D., F.R.S.E. The lamp was exhibited. After describing the construction of the lamp, Dr. Fyfe alluded to the nature of the oil used, which he said seemed to be a preparation of turpentine, if not turpentine itself, and then afterwards to the comparative expense. From different trials he had made, comparing its light with that of gas, he found that the expense would be as about three to one, compared to that of an equal light from the gas as supplied to Edinburgh. Of course, if the gas were more expensive, or the quality inferior, then the comparative expense of the lamp would be less. As compared to lamps with common oil, the expense was as about three to five for whale oil, and as about three to eight for sperm oil. Accordingly, though the lamp was more expensive than gas, yet, in those places where gas could not be got, the lamp was much more economical than lamps with sperm or even with common oil.

4. *Account and Description of a Self-Registering Dynamometric Apparatus*, constructed in Paris for the Hydraulic Experiments of Mr. Scott Russell, by M. Morin, Chef de Bataillon of Artillery. With diagrams of its work, and some account of its results. By Mr. Scott Russell. The apparatus was exhibited. It is a very scientific and expensive apparatus, requiring the greatest care in its construction, as the springs, on bending, show on the register equal strains in equal spaces traversed by the pencil. It is particularly useful in hydraulic and railway experiments, registering correctly the strains and forces at all parts of the voyage or journey. It has several very beautiful adaptations and adjustments, and requires little attention from the engineer observing. The whole work is carefully recorded on a roll of paper which is taken off and preserved at the end of the journey.

5. *Autographic Apparatus for obtaining accurate Drawings of the Forms of Surfaces or Double Curvature;* with Autographic Projections and Drawings, illustrated by Practical Examples. By Mr. Scott Russell. Referred to a Committee.

February 26.—Mungo Ponton, Esq., F.R.S.E., in the Chair.

The following communications were made:—

1. (Part III.) Observations on, and Improvements proposed in the *Ventilating and Warming of Factories.* By Robert Ritchie, Esq., F.R.S.S.A., Civil Engineer, Edinburgh. In this part of his paper Mr, Ritchie stated the general principles upon which all approved modes of warming and ventilation must proceed; and in particular the combination of the two, so that the air of the chamber shall not only be warmed, but a constant influx of pure warm air, and the extraction of the vitiated air, shall be effectually secured, in order that the health of the operatives in large factories may be promoted.

2. Description, with a Drawing, of a *new Method of constructing the Dwellings of the Poorer Classes,* in order to ensure a more comfortable home, and better ventilation. By Mr. Anthony Bower. In this paper it is proposed to construct the dwellings of cast-iron as being cheaper than stone or brick, and to ventilate them by a common double concentric shaft or chimney, into the centre portion of which the fire flues are carried, and into the outer portion are carried the ventilation flues—the beams supporting the floors being cast hollow, and the ventilation going on through them. He proposes to make the tops of the houses flat, to allow of drying clothes thereon, and he collects the rain water in cisterns at the roofs for washing the clothes.

3. Description and Drawing of a Water-Meter. By William Fraser.

4. On a *Reversing Locomotive Steam-Engine*, with Reversing Box, and Pivot Valve. By Mr. Daniel Erskine. A Working Model in German Silver was exhibited in action. This was a very beautiful application of Mr. Erskine's reversing box and pivot valve to the locomotive steam-engine. The reversing was performed in the most simple and instantaneous manner, by moving a handle. The model was exceedingly well executed by Mr. Erskine's own hands, and did its duty well, either on a straight or circular railway.

ROYAL INSTITUTION.

March 1.—Mr. Fownes delivered a lecture "*On the Chemical History of Sugar.*"—After a slight description of the properties and distinctive characters of the more important of the sweet principles of the vegetable kingdom, the lecturer proceeded to discuss the subject of the practical manufacture of raw and refined sugar from the juice of the cane. The sugar-cane itself, originally a native of India or China, was introduced into Sicily, by the way of Egypt and Syria, at a period antecedent to the Crusades. It was carried, in 1420, by the Portuguese to Madeira, and subsequently, by the same people and the Spaniards, to Brazil and to the West India Islands. The process of sugar making in the British West India colonies has probably undergone but little change for two centuries or more, except in the improvement of the machinery for crushing the ripe canes and extracting the juice. he tempering with lime, clarifying by heat, and quick evaporation in a series of open pans, still remain. Under the most favourable circumstances a large quantity of molasses is always produced; and as we know from the experiments of M. Peligot that nothing but crystallizable sugar exists in the juice of the cane, this production of treacle must be ascribed to an alteration of the sugar from the high temperature of the liquid in the open pans towards the termination of the boiling. The excellent plan now adopted by the refiners of the raw or Muscovado sugar, for concentrating their purified and bleached syrup by evaporation in vessels from which the air is exhausted, patented in 1813 by the Hon. C. E. Howard, was then described and illustrated, and its adoption in the sugar islands, for concentrating to the necessary degree the clarified cane juice, strongly recommended. Under this system the product of sugar would be greatly increased, and its quality much improved, while little uncrystallizable syrup would be produced. This is, however, but a part, although an essential one, of the improvement of which the sugar cultivation and manufacture are susceptible. The East India sugars are made in part from the juice of a palm; the crude product, or *jaggery*, is subjected to a kind of refining process before exportation. These sugars are softer and less crystalline, and inferior in sweetness to those of the West Indies. The cause of the latter fact is to be sought for in the quantity of *grape sugar* they contain, which, indeed, is found more or less in every sample of raw sugar, having been produced in the first boiling at the expense of the crystallizable portion. For the purpose of detecting the presence of the grape sugar recourse may be had to a beautiful experiment of Trommer, described in the "Annalen der Chemie und Pharmacie," for 1841, p. 360. The sugar to be examined is dissolved in water, mixed with a solution of sulphate of copper, and then a large excess of caustic potash added. The blue precipitate at first thrown down is re-dissolved with intense purplish-blue colour by the excess of alkali. So far, both cane and grape-sugar behave alike; but on heating the liquid to the boiling point, the cane sugar solution undergoes but little change, while that containing the grape sugar yields a copious precipitate of brilliant red suboxide of copper. It was suggested that this experiment might possibly be put into a form applicable to the *assay* of sugars, in which the proportion of grape sugar—that is, worthless sugar—should be inferred from the quantity of suboxide of copper produced from a given weight of the sample. The cheaper kinds of raw sugar, chiefly consumed by the poor, are sometimes cruelly adulterated by an intentional admixture of grape sugar, manufactured on a large scale for the purpose from potato-starch. This is a fraud which should be suppressed.

INSTITUTION OF CIVIL ENGINEERS.

March 5.—The President in the Chair.

The first paper read was a description by Mr. J. T. Syme, *of the bridge over the river Whitadder, at Allanton.* This bridge, which was executed at he expense of Miss Boswall, of Blackadder, from the designs of Messrs.

Stevenson & Sons, of Edinburgh, consists of two arches of 75 ft. span each, with a versed sine of 11 ft. 6 in., the centre pier being 32 ft. 1 in. long and 10 ft. in breadth, making the distance between the faces of the abutments 160 ft.; it was constructed of soft red sandstone, and the abutments were built up solid, the greater part of the masonry being ashlar; the total cost of the bridge was stated to be £6058.

An account of the building of *Wellington Bridge, over the river Aire*, at Leeds, by Mr. J. Temperley, was also read. This bridge was executed from the designs of the late Mr. Rennie about 20 years since; it crosses the river where it is 100 ft. wide and 6 ft. deep; it consists of a segmental arch of 100 ft. span, with a versed sine of 15 ft., constructed of stone from the quarries of Bramley Fall, which are about four miles from the bridge; the abutments are built in radiating courses, external faces, which are horizontal, the whole being well bonded together: the total quantity of masonry is 80,000 cubic feet. The method of forming the foundations, as well as of the coffer-dams, and centre was given in detail, and it was stated that the total cost of the bridge was only £7250.

Mr. G. Rennie made some clear and consise remarks on the ancient arches, of which traces have been discovered, by the recent researches of travellers; alluding to Perring's account of ancient arches discovered at Thebes, the bricks of which bore the name of Sesostris, which would carry back the knowledge of the arch to a period of upwards of 3000 years. He noticed also the size of the stone lintel among the Greeks—the etruscan arches found in Italy, and also the more modern but very bold arches still remaining in Italy, Portugal and Spain.

A paper by Mr. F. Nash was then read describing *a new kind of girder*, composed of a number of diagonal bars of wrought iron abutting against each other, with cast iron transoms; these latter supporting the pressure and the former the tension. This mode of construction has been recently introduced in France; and the paper after describing a number of preliminary experiments on small girders, gave the details of the proofs, to which four girders placed side by side with a bearing of 74 ft. 8 in. had been subjected, by order of Mons. Teste, the Minister of Public Works, Paris. From this it appeared, that with a load of 62 tons, the deflexion in the centre was $1\frac{3}{16}$ in., and that the girders resumed their original position on the weight being removed, after bearing it for a month. In order to test the effect of a sudden shock, a cart loaded with $4\frac{1}{2}$ tons of iron was caused to break down suddenly in the centre of the bridge, without producing any prejudicial effect beyond crushing the flooring planks. The weight of these four girders was stated to be $20\frac{1}{4}$ tons.

March 12.—The President in the Chair.

The discussion upon the knowledge of the properties of the arch possessed by the ancients was renewed, on the presentation by Mr. Page of drawings of two arches standing near some Cyclopæan remains at Cape Crio, (Cnidus). There was no positive evidence of the date of these arches, but from their being built without mortar, and the massiveness of their construction, it was agreed that they were probably of the same period as the Cyclopæan work among which they were situated.

The failure of the *Pont de Boverie, at Liège*, which sunk so much and cracked on the piers to such an extent as to oblige it to be taken down, was fully explained by Mr. Rennie, who presented a drawing of it. Mr. B. Green also exhibited a design for the proposed stone bridge of eight circular arches for connecting Gateshead with Newcastle-upon-Tyne, at a high level. He also exhibited some beautiful specimens of ornamental bricks, made by Mr. Barnes, of Newcastle.

The first paper read was an "*Account of the harbour of Pulteney Town*," (Wick, Caithness, N. B.) This harbour, which was designed by Mr. Telford for the British Fisheries Society in 1803, and for which the first part of the works was executed between 1865 and 1811, by Mr. Burn, at an expense of £16,400. The success of the herring fishery, and the consequent increase of the shipping frequenting the port, rendered a more extensive harbour essential, and in 1823, other plans, which received the approval of Mr. Telford, were carried into effect by Mr. Bremner. The various extensions of the works were given in great detail, with the ingenious methods employed in their execution, as also the account of the devastation caused by the sudden inroad of the sea upon the unfinished work of the pier, when 100 ft. in length of the pier head was swept away in one tide, besides doing much damage to the other parts of the works. The ruined works were secured for the remainder of that year by binding them together with chain cables, and in the succeeding summer the works were completed, and have stood so ever since. Some interesting observations were made as to the relative action of the waves upon long and short slopes of the sea faces of piers, and the author's experience evidently leads him to prefer a slope of about one to one for works which are exposed to a heavy sea.

The various ingenious methods adopted by the author for conquering the difficulties before him, excited great interest, which was kept up by the next paper, also by Mr. Bremner; it was a "*Description of casks used in floating large stones for building sea walls in deep water.*" These casks, which were strongly built of fir staves, hooped externally with iron, and supported inside by radiating bars, like the spokes of a wheel, were used instead of crane barges, for conveying stones of 30 to 40 tons weight, for securing the foot of the sea walls of Banff Harbour, which had failed. Two of these casks, of 445 ft. cube each, were used to convey stones of 30 tons weight, by passing the two chain cables, which were wound round them, through the eyes of the leweses which were fixed in the stone at low water, at which time the chains being hauled down tight, when the tide flowed, the buoyancy of the casks floated the stones, and they were towed by a boat over the place where the stone was to be deposited—the lashing being cut away, the casks were let go, and the stone fell into its seat. This method was found to succeed perfectly in weather that would have destroyed any crane barges, and the works of Banff Harbour were thus secured from further degradation, and were subsequently entirely restored at a comparatively small cost. The drawings and enlarged diagrams gave fully the details of this method of working.

A model of Farani's railway switch was exhibited, and its self-acting motion, in guiding the carriages into the sidings or on the main lines, as required, was shown by the inventor. These switches were stated to have been used on the Grand Junction Railway for some considerable time.

March 19.—The President in the Chair.

In the recapitulation of the conversation of the meeting of March 12th, there were read some interesting remarks by Colonel Leafe, on the knowledge possessed by the Greeks of the properties of the arch: he contended that numerous examples still existed of their having used it, but from the solidity of their constructions, the nature of the materials they employed, and the architectural character of the edifices, which were chiefly temples, the arch was evidently less employed than among the Romans, who used different and less solid materials.

A description was then read "*of the formation of the Town-lands of Musselburgh, on the Firth of Forth*," by Mr. James Hay. This was a curious instance of an extensive tract of nearly 400 acres of land, being formed by an alluvial deposit, in about 300 years. The river Esk, when swollen by rain, is stated to bring down quantities of the detritus from the hills, which, with the soil washed from the banks of the low lands, is arrested when it meets the tide, and is thrown upon the beach; this, being mingled with large boulder stones, become fixed; the sand is blown over it by the heavy north winds, to which the shore is exposed, and thus this large tract has been formed. The diagrams showed the several lines of high water at various dates, and that nearly the entire town is built upon land thus recovered from the sea without the aid of art.

The next paper read was "*a description of an hydraulic traversing frame at the Bristol terminus of the Great Western Railway*, by Mr. A. J. Dodson, Assoc. Inst. C.E. The action of this machine, the object of which is to transport the railway carriages from the arrival side of the terminus, to the departure side, or to any one of several intermediate lines, was thus described: an opening being made in the train, the apparatus is pushed on to the line of rails, and the carriage required to be moved, is run over it when the frame is quite down, it being then sufficiently low to allow the carriages to pass freely over. As soon as the carriage is brought directly over the apparatus, a man works a pump, acting upon four hydraulic presses, which raise the frame until both sides are in contact with the axles of the carriage wheels, and raise the flanges of the wheel clear of the rails; the whole apparatus, with the carriage suspended upon it, is then easily transported to any of the lines of rails, when, by unscrewing a stopper, which allows the water to flow back from the presses into its cistern, the carriage is lowered on to the rails, and the apparatus is rolled over ready for re-commencing the operation, the whole transit not having occupied more than one minute and a half. The action of the apparatus (which was made by Mr. Napier, York Road) was stated to be very satisfactory, and its cost to have been about £220.

An account was then read *of the Landslip in the Ashley cutting on the Great Western Railway*, by Mr. J. G. Thomson, Grad. Inst. C.E. The cutting, which was described, is situated about five miles on the London side of Bath; it was made through a mass of detritus from the neighbouring highlands, consisting of sand, oolitic gravel, vegetable matter, and stones of the great oolite, lying upon the blue lias clay and marl. The whole district was extraordinarily full of water, and appeared to have defied all attempts to drain it; this accumulation of water softened the clay, turning portions into soft silt, and when, by cutting away a portion of the foot, which was situated on a slope, the support was taken away, the whole mass was set in motion, and every attempt to resist it was fruitless. The details of the attempts at driving water headings, sinking pits, which collapsed and were obliged to be filled up with stones and fagots, and all the other engineering devices that were adopted, were given with great minuteness, and when being aided by some well executed drawings, gave an interesting account of a good specimen of one of the difficulties to be encountered by the railway engineer, in the ordinary course of his labours.

The paper was an example of that which has been so frequently insisted upon at the meetings of the Institution, namely, the advantage to the civil engineer of a knowledge of geology, by which his progress would be safely made under such circumstances.

March 26.—The PRESIDENT in the Chair.

The paper read was by Mr. C. H. Gregory, engineer of the London and Croydon Railway; it treated of "railway cuttings and embankments, with an account of some 'slips' in the London clay." An outline was given of the general principles which regulate the formation of railway cuttings and embankments, illustrating the manner in which these works are affected by the geological character of the earths employed, or that were cut through. The paper then gave a detailed history of some heavy slips in the London clay, which had occurred under the observation of the author, on the London and Croydon Railway, and described the means adopted for clearing the railway from the immense masses of clay with which it was covered, to a depth of 10 to 12 feet, and for enabling the passenger trains to run without hindrance, during the time of repairing the damage. The cause of these slips was then fully considered, and it appeared evident that in nearly every case they proceeded from the combined action of air and water, the latter entering in rainy seasons by the cracks formed by the drying action of the former, until the mass of upper yellow clay being detached, moved by its own weight, and sliding upon the blue clay, the surface of which was rendered semi-fluid by the percolated water, was precipitated into the cutting. The means adopted for preventing the recurrence of such events were fully considered, particularly the introduction of gravel buttresses and rivetments through and at the foot of the slips, a system which had been perfectly successful.

In the discussion which ensued the means adopted were generally approved; many instances were given of the use of similar gravel buttresses on other railways; the importance of extensive surface drainage and of freeing from water the slopes and embankments, was insisted on; the interesting question of the 'creep,' or presumed rising of the floor of old mines was examined, and it was contended that, in almost all cases, it was the roof, or upper rocks that sunk down. The case of the village of Wallsend was instanced, which place had been sunk vertically between 16 and 24 inches, in consequence of the excavation of the coal from beneath it, by the mines under the direction of the late Mr. Buddle.

The further discussion of the question was adjourned until the next meeting, April 2, when the monthly ballot for members was announced to take place, and the following papers will be read:—

"Account of the Railway from Amsterdam to Rotterdam, and of the principal works upon it." By Le Chevalier F. W. Conrad, M. Inst. C.E., translated from the French, by C. Manby, Secretary.

"Description of the Piling Machine used at Montrose Harbour Works." By G. T. Page, Assoc. Inst. C.E.

"Account of a series of experiments on the comparative strength of solid and hollow axles." By C. Geech.

EDGE'S WATER-METER.

Read at the Society of Arts, March 20, 1844.

Fig. 1.

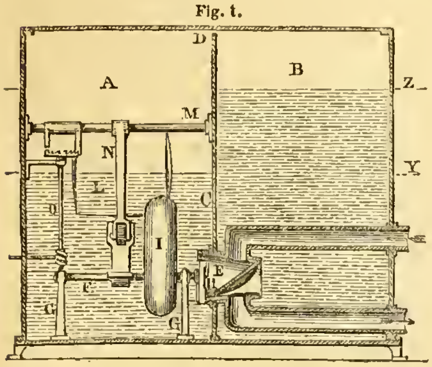
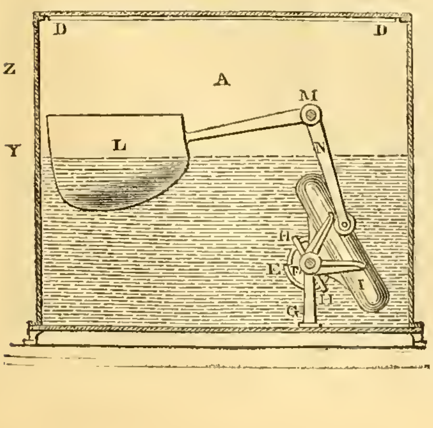


Fig. 2.



For many years past the want of a machine to measure liquids, while being transmitted through tubes, seems to have occupied public attention, and more recently water companies, and practical engineers, have become desirous of the existence of such an instrument; the former to ascertain the quantity of water supplied, (more particularly to their large consumers,) the latter to ascertain the amount of water passed into their steam boilers, and by inference the amount of steam generated, the comparative advantages of different fuels, and the attention of the engineer to his duty.

It was with a view to supply the wants of the two latter classes, that the present machine was invented; although there is no doubt that if modified in a particular way, it would as effectually answer the purposes of the former. Before entering upon a description of this machine, it may be as well remarked that several others for the same purposes have been from time to time brought before the public, without much success; these however are liable to one of two very important faults, either that they cannot measure liquids while acted upon by pressure, or that they will measure any air which may pass through them, as if it were liquid. These objections are entirely overcome by the present arrangement, and also, it is believed, a greater degree of accuracy and simplicity is obtained. The annexed engravings show the meter for the measurement of water, for which purpose it is now being tested in several parts of England, and also at Mr. Edge's manufactory, Great Peter-street, Westminster.

Fig. 1 is a sectional elevation showing the chambers A and B, and the machinery therein.

Fig. 2 is a section of chamber A, taken at right angles to Fig. 1.

The outer casing is rectangular, and is made of cast iron; this however may be varied to zinc or tin plate if the pressure of the liquid be not too great. This case is divided in the middle by a partition C, thereby forming two chambers A and B, communicating through the slit D in the top of the partition C. In the partition C there is a four way cock E, the larger end of which opens into chamber A, and the smaller into chamber B; the water is conducted to and from this cock by means of tubes, shown by arrows passing through chamber B. This cock transmits the liquid to and from the chambers A and B, in the same manner as the slide valve conveys the steam, to and from the cylinder of the steam engine. Parallel with the centre of the cock E, is a spindle F working in the upright standards G G; this spindle carries a driver H, which acts upon projections on the plug of the cock E, and it also carries a metal cylinder I, hermetically sealed, in which is a heavy metal ball K, less in diameter than the cylinder, so that it may roll freely in it. In the upper part of chamber A, there is a float L working upon the axis M, which carries a pendant arm N, having upon the end of it a friction pulley. As the float rises and falls by the action of the water, this arm vibrates, and acting alternately upon the inner sides of the two teeth on the spindle F, causes the lower end of the cylinder I, (in which is the metal ball) to be raised, the ball rolls to the opposite end of the cylinder; and by its weight moves the spindle F suddenly round, which motion is communicated to the plug of the cock E, thereby causing a change of inlet and outlet.

The action of the meter is as follows. The water enters the inlet pipe, and (from the peculiar position of the plug of the cock) passes into the chamber A, until it has risen to the dotted line Z, the float will by this time have been raised to its highest position, and the pendant arm N will have raised the lower end of the cylinder I by its action upon one of the teeth on the spindle F. The ball will then suddenly roll to the other end of the cylinder, causing the spindle to move round, which motion is conveyed to the plug of the cock, and its position being reversed, the water then passes into the chamber B through the four way cock. Now the air which was in chamber B and the upper part of chamber A, becomes compressed, and its expansive force acting upon the surface of the water in A, expels it through the outlet by the four way cock, until the water falls to the dotted line Y Y, when the float will also have fallen, and by its action upon one of the teeth on the end of the spindle, have raised the opposite end of the tube, causing the metal ball to roll to the other end, which force being conveyed to the plug of the cock by the driver, suddenly moves it into its original position. The water will again rise into the chamber A, and acting on the compressed air expel the water from B, through the four way cock. Thus each chamber receives and discharges distinct portions of water; the pressure exerted to fill the one, being communicated by a column of air to discharge that in the other. Each stroke being equal to the area of the chamber A, from dotted line to dotted line, (minus the bulk of the float and other machinery in that part of the chamber). It may here be remarked that the bulk of chamber B has nothing to do with the measurement; for B can only receive as much water as A discharges, and can only discharge as much as is received by A. The only exception to this rule, is when an additional pressure takes place, at this time a longer stroke is given, which is again repaid by a short one, which exactly compensates for it when the pressure is removed.

Upon the axis M, there are two teeth taking into a crown wheel, similar to a clock escapement; thus the vibrations of the axis M, give rotary motion to the upright spindle O; from thence to the counting apparatus which is of a novel description.

WESTMINSTER BRIDGE CONTROVERSY.

Mr. Barry has brought forward a new design for a Westminster Bridge. The structure proposed is to be of iron, and of five arches, the old bridge having thirteen arches. The design is made to harmonise in style with the Palace of Westminster, and has a very light appearance. Mr. Barry proposes to improve the navigation, to give greater waterway, and greater roadway, while the expense is estimated at £185,000, and it is supposed the cost of repairing the old bridge will be double the sum, and the property of the Bridge Commissioners is considered to be ample for securing the outlay, thus making no demand on the public purse. The span of the proposed arches is, centre arch 160 ft., two second arches 157 ft. each, and two end arches 133 ft. each. The roadway is much lower and much broader. The breadth of the river will be considerably curtailed by the embankment, a space equal to two arches of the old bridge being taken in at each end. The plan of a temporary timber bridge to carry the traffic during the removal of the old bridge and erection of the new is shown.

MARINE BOILERS.

Sir—As a subscriber and careful reader of your highly respectable and well conducted *Journal* from its commencement, I have, in conjunction with many others, derived much pleasure and considerable advantage from the manner in which many subjects of science and art have been treated; but nothing has pleased me more than the plan you have adopted in the number for this present month, (viz., page 90 and plate III,) of giving working drawings and particulars of marine engines and boilers, and I sincerely trust nothing will intervene to hinder your carrying out a plan so important to every one connected with practical mechanics and commerce.

The specimen of boiler you have given is certainly a good one and will, I have no doubt, if generally adopted, be found very superior to those of ordinary construction; but with all due deference to your judgment and sources of information, there are several bad parts, or rather some that might, in my estimation, be improved. In the first place, I do not approve of the straight sides which you have adopted, because they are in practice found to be very weak, and hence must be *heavily* stayed, to prevent the change of form and liability to leakage from the fluctuation of pressure to which they are subjected. To remedy this defect I would make the shell slightly curved in all directions, which could be made to occupy a mere fraction of more space, and would, from their improved or arched form, prevent that vibration that I complain of. The next point I would call your attention to, is the uptake from the furnace at the back end of the boilers, where the water is permitted to go direct up between the outer and uptake shells without any external fire doors, and in the event of bursting one or more of the iron tubes, which is often the case, (at least in railway locomotives, the tubes being only soldered, except for a short distance behind their insertion plate, where they are welded,) how could you stop the leak at the back end without extinguishing your fires? Now had you introduced a fire or tube door at the back end, same as front, you could with ease plug the burst tube or tubes up at once, and hence the only difference in the working of the boilers would be the loss of the heating surface of the said tube or tubes. There are other minor points that might, in my estimation, be improved, such as the curving the furnace tops and bottoms, &c.; but I must not trespass further upon your notice, as all these, and perhaps more, will readily occur to the practical man: yet however valueless these remarks may be in themselves, if every one who was capable of correcting the mistakes that occur in mechanical works would condescend to do so, they would lead to that interchange of thought which by rubbing against each other produces the sparks of excellence.

I am, Sir,
Your most obedient servant,
J. H. S. C.

Newcastle-on-Tyne, March 11th, 1844.

[Our correspondent is evidently a locomotive engineer, accustomed to steam of very high-pressures, and consequently spherical and cylindrical boilers. It is not intended that steam of a higher density than 10 lb. per square inch should be used in the boilers delineated in our last number, which pressure would not affect their form if they were stayed in any tolerably efficient way, and which would not be so heavy as the additional plate, water and space, which would be necessary if shaped in accordance with the suggestions of J. H. S. C. The "*fraction* of additional space," required by curvilinear shelled boilers, is not so small as he thinks; we could illustrate this, but it would be too lengthy for a note. We do not understand what he means by the "vibration" of rectangular boilers. Doors in the back uptake, for the removal of defective tubes would not be safe for marine boilers, the heat would be so intense as to seriously affect the safety of the vessel, and the most effective surface would be decreased. Nor do we see the necessity of it, for we are not acquainted with the failure of a single tube in any marine boilers of this description. The tops of the furnaces are made elliptical, the bottoms nearly square, to admit as large a portion of atmospheric air to the grates as possible, for it is not always convenient to raise the gates to get the required area. In courtesy we answer the questions put to us, although the remarks of our correspondent will sound strange in the ears of marine engineers.—Editor.]

VULCANIAN ARCHITECTURE.

(From the Athenæum.)

A paper on the restoration of St. Stephen's Spire, Vienna, read at the Institution of British Architects, (see the *Journal* for January last), has even a more than architectural interest; it serves to illustrate the progress of human knowledge, and to show how compatible is a vast deal of movement with very little advancement. There may be progressions in various provinces, but retrogressions in perhaps as many others; and the sum of the former, *minus* the amount of the latter, would exhibit zero for the surplus oftener than most people imagine. Human knowledge, if thus considered, will appear to expand somewhat like a gridiron pendulum, whose alternate bars contract while their companions lengthen, so that the whole remains, a prodigious time, of the selfsame dimensions. Human intellect, again, if it does march, marches at about the pace of my Uncle Toby, putting one foot before the other without advancing an inch. Contrary to Swift's maxim, we hold that a specimen brick *may*, by times, tell no little of the structure from which it was taken; and we think the one above, taken from the Temple of Architecture, tells a lamentable tale respecting its present condition. It reveals rather more than a Babylonian tile does of Belus's Tower, and in far less cryptic characters. The imperial architects, it would appear, have raised St. Stephen's dilapidated spire to its ancient stupendous height, not by means of lawful masons' work, but blacksmiths'—they have *restored* the pyramidal part (above one-third of the whole altitude) not with stone, but iron! Exquisite and appropriate finish—just as Samoyeds might tip the imperial sceptre, if they got hold of it, with a fish bone! Barbarians—so our super-civilized contemporaries call them—built up that epitome of the sublime and beautiful—to which Cleopatra's Needle *was* a needle—than whose topmost stone no loftier above earth's surface did mortal hand ever lay (except what said barbarians posited also); yet modern "progressives," either through want of genius, pure artistic taste, masonic power, or—the fatalest among all defalcations—want of *inspiring will*, tremble at a like attempt, and instead of a proper apex, put upon the stone frustrum of the tower an enormous iron fool's cap—fit emblem of their deserts who ordained it! This forging a steeple implies, we allow, some progress in the arts, but a retrogression too, far greater, because in a nobler province. The sun of mental enlightenment, we suspect, about which flatterers of themselves along with their age, hold such stentorian discourses, gets almost as many new spots, year by year, as it gets rid of: it shone, perhaps, throughout the "Dark Ages" pretty much as it does at present, save that our metaphorical Dan Sol "tricks his beams" a little better. Spirits of the Old Free Masons, hear this—a foundry for Gothic Architecture! Spires to be cast like lamp-posts: pinnacles, canopies, crockets, finials—all the delicate and decorative details of your exquisite style to be made per pattern, and moulded per gross, like cheap stoves, irons, fenders, snuffer-dishes, inkstands, metal buttons, and brads! Ready made cathedrals will no doubt soon be ordered from the mine's mouth for European cities, like palaces for Timbuctoo! Vulcan, the god of blacksmiths, will become the god of architects: England, above all other lands, bids fair to make his anvil her chief altar, and, as the Lipari Isle of yore, to resound his name and his hammer throughout her subterranean dominions—

> Vulcani domus, et Vulcania nomine tellus,
> Huc tunc Ignipotens cælo descendet ab alto!

We do not, by these remarks, mean any impeachment against the merits of iron applied to common domestic, or even public structures, nor, indeed, to divers *un*common, where the more heterogeneous the materials the more suitable they would be: but we would denounce with the force of an interdict, if possible, the adoption of this illegitimate substance in superior edifices, as radically subversive of true architecture—professionally and nationally disgraceful. Let us, therefore, enter our humble caveat against the Vulcanian School being commended for imitation among our countrymen. Some connoisseurs might deem an iron or a leaden, or a wooden, yea, a leathern steeple on Westminster Abbey middle tower better than none, and the mongrel addition to St. Stephen's, at Vienna, may stand excused by such an alternative; nevertheless, a vicious principle once admitted, furnishes a precedent to be followed when its origin has been forgotten, because mankind has a natural leaning towards the corrupt in fine art, as well as in morals. The school abovesaid does not count its sole disciples amongst the successors of the *Huns*, nor confine itself to the Carpathian wizards of the Danube; even those learned martinettes, the Prussians, sanction it; even their heaven-born *baumeister*, Schinkel, entered himself a pupil! Berlin iron-work having obtained great vogue for its quincaillerie and brittle bijouterie, insect-brooches, and animalculous breast-pins, ladies' clasps, purses, filagree trinkets, puppet statues, and chimney-piece articles of virtù—being proper enough, too, perhaps, for coarse or concealed masses of construction—was brought into most abusive use for prominent architectural features—nay, whole national edifices. The *Kreuberg Denkmal*, by Schinkel himself, and Luther's canopied shrine, at Wittenberg, are examples. We consider this pseudo-masonic system only another version of imitation stone work; as to principle, not one jot above lath-and-plaster edification: a system brought about among architects by modern middle-class taste—by the self-same low-minded satisfaction with surface effects which gazes enraptured at mock-marble and scagliola columns, "compo" entablatures, *papier-mâché* balustrades, and similar factitious substitutes—which loves them better than the genuine materials, because more applicable to profuse bedizenment, and easier distorted into novel monstrosities. Found, if needful, a new kind of architecture upon the native character of iron, such as its essence can pervade, its attributes warrant, its powers embrace; let some forgetive brain, in Falstaff's sense hammer out a solid, sterling system of Vulcanian Architecture, and we shall praise it; but none of your hybrid abortions, begot between metallurgy and masonry, that cohere still worse than the brass and clay of Nebuchadnezzar's image! It may be said, what imports the substance, so as the appearance is agreeable? how should molecular constitution of parts affect their integral masses, whose forms and proportions are alone very important? A reply seems almostl superfluous; yet we give it. Besides that bad faith, when appearances do not fulfil their promises, always offends a well-regulated mind—besides that the inward or thorough worth of materials enriches the spectator's imagination—besides that their untractableness overcome enhances his pleasure, as the quantum of skill, toil, and time employed upon all productions augments their value—besides this, we are much disposed to maintain that there exists a bond, indissoluble though indefinable, between beauty of end and legitimacy of means—that the nature of the constructive material suggests, demands, nay, often *commands* the style of construction; and that, if the former become debased, the latter will degenerate also. We are persuaded the PARTHENON could never have arisen had the Greeks built their temples of cast iron; no, nor the beautiful Tripod Monument, had their Corinthian capitals been moulded out of the very nicest potter's clay in the Ceramicus, and their columns been the very best stock-brick, covered over with plaster of *Paros!* No more, we affirm, than the Phidian Minerva could have sprung from "Coade's Stone," as the customary stuff of sculpture, or little wooden lozenges given birth to the rude grandeur of the Appian Way, and such specimens of cyclopean road-making. Such things we will admit possible when beavers can build another Waterloo Bridge with Thames mud and their tails! Augustus, it was said, found Rome brick, and left her marble; yet see how the inveterate use of brick debased the Roman style of architecture, until the native properties of that material absorbed those of the finer one, and brought forth a style (the arcaded) favourable to their full development. The spirit of the material, as it were, transfuses itself throughout the creations therefrom: the meanness of a material enters into the soul of the artist; understanding by meanness—not commonness (for Grecian and Etruscan fictile vases of most refined elegance are often mere earthenware), but—poor and pitiful mis-adaptedness to the given purpose; this it is which would render an El Dorado, though built of ingots, or Aladdin's palace, though walled with gems, mean architecturally beside a simple Greek fane, whose blocks begot its massive character; and which, on the other hand, permits a Gothic church of grey stone or rubble itself, to rival Pentelic temples. We shall, perhaps, have the Vulcanians cite King Solomon as patronizing cast metal pillars. What then? Were either Jews or Gentiles enjoined brazen architecture thereby? Must architects, till the pillars of the world give way, bow down before the brazen images of *Jachin* and *Boaz?* Had these enormous objects no loftier aim, no deeper, where all was symbolic? Briefly—how much does any one know about them?

But hypothesis, reasonable or fanciful, aside, it is amongst the plainest principles of art, we submit, that every material should be made to do its own work, and not the work of another, unless their qualities have a close similitude. Tempera may sometimes do the work of fresco, oils of either; yet, perhaps, we might date and deduce the downfall of painting from what many persons derive its perfection—Van Eyck's discovery—the substitution of a smooth and luscious medium, whose appropriate productions are small, elegant, and epicurean, for simple water or *size*, best adapted to the most gigantic efforts, the sublimest and severest trials of the pencil. We would push this principle farther and contend that no material, while doing its lawful work, should be made to *seem* as if doing the work of another. Real art rejects all such artifices—virile taste despises all such puerilities. Even when the imitation is unintended, its existence proves either the imitator's faint perception of distinct principles, or his feeble hand, which fails to obey his clear convictions. Look at Henry the Seventh's Chapel; observe its numberless minute, slim, canelike mouldings, its lath-and-rafter-like ribs and braces, its bird-cage delicacy of screen-work, its panelled surfaces throughout—little distinguishable from *panel*, indeed—does it not seem rather a colossal specimen of joiner's craft than anything else?—a carved, morticed, and dovetailed construction of box-wood than a structure of stone? Dexterous, we grant, polydedalean (if you please so to call it) in mechanism, fanciful as a frost-work palace in effect; but cast your eyes on the Abbey Choir next it, and behold what a mere bijou, an architectural trinket, it looks compared with the massive grandeur of this! This proclaims itself at once, genuine masonry, and thus far, if no farther, much excels its florid neighbour whose embattlements and enrichments might pass for petrified carpentry. A coral grove may be curious, precious, and beauteous; yet all amateurs (but old children, who still cling to their corals) would prefer an oak forest. The Abbey Choir, we sometimes imagine, turns a huge shoulder of contempt upon the little fretted and frittered appendage behind it, perchance acknowledging about the same relationship to it which Fingal's Cave does to the mermaiden of Staffa's stalactite grotto. Indeed, the Lancet, or Early English style, under this view, surpasses, we think, the Decorated (by many persons deemed the perfectionated) Gothic, as well as the Florid, or decadent. For, beyond dispute, those double-curved and contorted outlines—those ramified cusped and tressured foliations—those antler-spread traceries, make stone pretend to be what it is not—a flexous substance, make it ape live timber, molten ore, or some pliable compost. Now, though we may consider stone ductile or plastic in statuary and decorative details of architecture, yet, where it forms a principal feature, and marks an architectural style, it should have itself a pure architectural character; it should resemble mason-work, should pronounce itself *stone*, and suggest no adventitious substitute. Thus, a crocket or a corbel may imitate a leaf or a lion's head, because a positive leaf or lion's head stuck upon the place would not de-characterize the edifice; but a window or a parapet should not, strictly speaking, weave its mullions like a vegetable branch, nor twist its bars like iron-work, unless the edifice be built of timber or metal. Even were the Greek Corinthian capital taken from a flower-pot, we see that the core is a stone cylinder, and does not pretend to be a stem of acanthus. These remarks are submitted for a very different purpose from that of disparaging the Decorated Gothic, which we admire and revere: but the true and strict laws of art demand our veneration still more. They, alone, ever and anon dunned into the ear, will fright the isle out of her improprieties, if this be possible. She finds licenses enough placarded on every church-wall, through the whole breadth of its flank and length of its steeple: "plenary indulgence" for unchasteness in architecture! absolution without either confession or repentance!

Akin to the above principle is another, sinned against as with a cart-rope, with the very loosest libertinage, ever since the "Renaissance," or it might rather be called the *Decadence*, of pure architecture, seeing that the pointed style is pure architecture, on its own picturesque grounds. But this aforesaid transgression, like an original sin, vitiates a whole species of techtonic productions, though it may leave a certain divine spirit about them still,—we mean Italian edifices. More or less throughout these, pillars, entablatures, and pediments are made to perform the part of mere decoration, instead of staminal and horizontal support, and protective shelter, their true business. A colonnade along the entire front of a house supports what?—a cornice! And what does the cornice support?—*sparrows*. Tiers of little portico-façades, called windows, adorning the same front, what do their pediments protect?—spiders beneath their eaves, migninionette boxes in their balconies, bytimes also glaziers and chambermaids who stand outside to mend the panes or clean them! Yet this at best elegant debasement of the Classic style entitles its professors to pronounce the Pointed "barbarous," and to boast their wonderful progress beyond the architects of the Middle Ages. Again, let us inquire, did the gods ever commit such gross acts of artistical bad faith as the Italian school,—disguising, under a thin surface of cut stone, masses of quite a different nature, almost always of a comparatively worthless one, which yet constitute the veritable erections? Excuse this as we may, it must be denominated mongrel architecture. Some of the very grandest efforts in modern constructive art are obnoxious to that name. St. Paul's cupola, despite its many merits, is a much less genuine production than Salisbury steeple; whilst its outward appearance bespeaks a "Pantheon hung in the air," what sublime elements compose it? Timber and lead! The whole dome, exterior and interior, consists of no less than four distinct materials,—stone, brick, wood, and metal,—thus being a specimen of mason's, bricklayer's, carpenter's, and plumber's work, mixt together share and share alike, rather than what it seems and ought to be, part of a masonic edifice. So far forth, it can just as little call itself a legitimate feature, as the iron palisade which fences (we wish it could screen!) that accumulation of architectural absurdities—Buckingham Palace. Wren was no "Goth"—his Westminster Abbey towers attest this!—but he ranks amongst the very greatest modern architects; he wrote well too on his art, yet asperses a skill he attempted to rival and failed to reach—the power of "spiring-up," with an "affectation of height and grandeur."* St. Bride's steeple became unsafe, though it had never been half the height of Strasburg Cathedral, nor stood half the time! Bow's, somewhat about St. Bride's altitute, may stand better,—perhaps much because it employs both within and without Gothic props and principles.

We return from our not altogether irrelevant digression, and repeat—iron should no more pretend to supplant or represent the beautiful stone-work of pointed edifices, than stone the reticulations and convolutions of chain-work. Frivolous minds or very green experience alone can relish either. Certain Neapolitan statues by one Corradini, a popular sculptor (that is, stone-carver), which exhibit their forms under nets or veils wrought upon the solid marble, our travelled gentlemen and ladies pronounce miracles—and such they are—miracles of the vilest taste and paltriest ingenuity. Cast-iron architecture, Classic or Gothic, is still worse, because no miracle, good or bad, at all; it goes to destroy the art, as a *fine* art, and will do it if patronized, by substituting machine productions for man's immediate handiwork. Let us assure ourselves of this,—whatever removes the artist's own hand from his material, removes his *spirit* from it also, and just to the same distance. Many mechanic helps between it and him will prove just so many artistic obstacles; his manufactures will augment, but deteriorate. Of the architect at least well may it be sung,

> Ay me what perils do environ
> The man that meddles with cold iron!

We have been more serious upon this matter than perchance it deserves; indeed, why should we care much about domes or spires, when Heaven's stupendous cupola stands for ever above our heads, when those numberless crag-pinnacled steeples, built by the Supreme Architect, from the Spitze-horn down to Derbyshire Peak, are within sight of eye or of mind? These will suffice, let man do what he may! But we have said all we have said, because Truth is the greatest of all utilities, being useful even where it illumines perishable, unimportant objects, as its virtue remains in the soul!

* V. Parentalia. These "senseless artificers" (he thus stigmatizes them elsewhere) never like him built a prodigious and prodigal second story as a mere mask to smuggle in foreign conveniences. Such are the concealed flying buttresses which support St. Paul's spine and haunch.

GREAT WESTERN STEAM SHIP COMPANY.

The last meeting of the shareholders of this company seems to have been regarded by the directors with some misgivings, for, contrary to the usual practice of respectable companies, the press were excluded. It is not unnatural that the directors should have been so desirous to keep their proceedings in the background, for a most unsatisfactory tale does their report relate. It is a supplement to the many similar narratives by them of arrangements misconceived, of reckless and meddling experiments, of serious and embarrassing failures, and of vexatious delay. The *Great Western* having been slightly injured in one of her recent voyages, affords an eligible opportunity to Mr. Experimenter Guppy to alter her paddle-wheels, and try some of his new views upon her, although she is acknowledged by the directors as having, with her ordinary paddles, proved the fastest ocean steamer. Had the company a number of boats, a lucrative traffic, and large dividends, so far from disapproving of any experiment of the kind, we should have considered it highly laudable, we should have praised the public spirit of the directors, and awaited with complacency the failure or success. Here, however, is a company with only one boat running, the success of the company a matter of doubt, and so far from the managers doing what is safe, "letting well alone," they are rushing heedlessly and recklessly into experiments, which may turn out well, but which just as likely may end in loss to the company. On such grounds we see these proceedings with regret, for we have no confidence in the management.

As to "the Great Postponed"—we beg pardon—the "*Great Britain*," she is not forthcoming yet, and her advertised days of starting cannot be complied with, fur ludicrous to detail, this "*monstrum, horrendum, informe* (we believe we may add, in compliment to the board), *ingens, cui lumen adæptum*," this mighty whale among the minnows, cannot get through the lock-gates. We beg to recommend for the figure head Sterne's starling, if prepared with a Guppyan profile, and a profuse repetition of the motto, "I can't get out." Anything so extremely preposterous, so ridiculous to every one but the poor shareholders, has scarcely ever been known, but it is avowed by the directors that they built the vessel without making themselves duly acquainted with the dimensions of the gates, subsequently calculating on the Dock Trustees allowing them to pull down one side of the gates to let her out. This the Dock Trustees refuse to do, although the company are willing to go to an expense of £300 for the purpose. Nay, the Directors have gone so far as to offer a thousand pounds towards the permanent enlargement of the dock-gates, and even this has been refused. The conclusion is, that the way now proposed for getting her out is to construct three or four iron pots or tanks to be put under her keel, by which it is expected she will be raised some three or four feet! and so to be carried through the gates on stilts. We should not, however, be surprised, at the rate the company are going on, if like other *detenus*, she were only got out of custody by being whitewashed, for management so careless, and expenditure so profuse, we have rarely ever witnessed. In addition to this, there is another mess with the Dock Trustees, for through miscalculation, the water in the dock had to be lowered eight feet, in order to allow "the Great Postponed" to be floated. The trustees claim some £800 compensation, and the directors resist, so that a snug law suit is likely to be manufactured on this score. As to the conduct of the Dock Trustees, we cannot speak in favour either of its immediate or ultimate policy. A parcel of Bristol hogs could hardly have done more to injure the city than have these trustees, they exacted dues from the *Great Western* when she could not get through the gates, and though they received £2,500 dues upon her, besides those upon her cargoes, they were not satisfied till they drove her permanently to Liverpool. Indeed all that the enterprize of a few energetic individuals has projected and done for the city of Bristol promises to be destroyed by the pigheadedness of its inhabitants. Bristol now occupies a very low rank in the list of ports, in consequence of the disadvantages she labours under in not being able to supply a return. The Great Western Cotton Works, which would have had the effect of locating an important manufacture on the spot, have not been adequately supported, the Great Western Steam-Ship Company have been driven away, and their yard is to be shut up, and thus the only chance Bristol had for retrieval, by becoming a great steam port, has been irretrievably destroyed. Indeed, even as to the trade she has, it is likely before long to be seriously affected, for the Great Western Railway Company cannot afford to lose traffic if the people of Bristol can, and they will undoubtedly promote docks at Pill and elsewhere, to which all the Irish, and Welsh, and Somerset steam tonnage will be removed, and which will have superior facilities for the conduct of all traffic. So much for greediness.

Meanwhile, however we contemplate the proceedings of the directors, they inspire us with equal distrust of their prudence and capacity. At first they were to have trunk engines, then they altered them; first they adopt a particular system of screw, and then they alter it. The worst of it, however, is, that they are already engaged in making the screw, while they have been making trials elsewhere, in consequence of which they are going to change the form again, of course at great expense and with great delay. The next thing we suppose will be to do away with the absurdity of straps for working the screw, and to substitute cog-wheel gear, and next the incumbrous flue boilers will have to be exchanged for tubular boilers. "Never ending, still beginning," the whole performances impress us with the idea that they can be meant for nothing but to provide snug berths for some parties who want such provision.

The directors also ask the shareholders to arm them with the power of retaining the yard and workshops, and tendering for Government and other contracts. Whatever may be our views with regard to the general policy of such a measure, we must say that the directors have made out no case for such confidence to be reposed in them, and the shareholders can only anticipate a profuse expenditure, a great deal of meddling and bungling, and a great delay in getting returns, if any should ever be forthcoming. Who, too, will trust parties with contracts who have not as yet shown that they have practical experience on the subject, and who have *pro tanto* failed in everything they have undertaken?

A general meeting of the proprietors of the above company was held on Thursday, March 14, at Bristol. The following is an abstract of the Directors' Report:—

"The receipts by the *Great Western* for 1843 have amounted to £33,406 0*s.* 4*d.*, and the expenditure has been only £25,573 4*s.* 3*d.*; the receipts for 1842 having been only £30,830 8*s.* 2*d.*, while the expenditure was £28,615 7*s.* 1*d.* To the improved state of things in the United States much of this is to be attributed, a good deal to the close attention to expenditure; but your directors believe still more to the circumstance of Liverpool having been altogether the rendezvous for your business on this side the Atlantic."

The report then states that the *Great Western's* last winter voyage to New York, by way of Madeira, had been rendered unprofitable, the carelessness of the New York pilot having allowed her to touch the ground, in consequence of which that vessel had to be surveyed and repaired at her Majesty's dock-yard at Pater, at an outlay of £606, in addition to which it was calculated that a loss of £1,500, in passengers, had been sustained by the unavoidable delay, and change in the times of sailing. She had been subsequently docked in Bristol, and "thoroughly examined," when, according to the directors, it was "impossible to over rate her condition." The pilot at New York had been suspended on the representation of the company, and the underwriters at Lloyd's had signally marked their sense of Captain Hosken's merit in bringing home the vessel. "The *Great Western* has run nearly 240,000 miles, at a higher average speed than had been attained by any other sea-going steamer—10¾ miles per hour." In September last the company's engineer reported that the boilers, which had done duty for six years, might, at an outlay of £1,000, be made to last for one, or, at most, two seasons longer. Under these circumstances the directors thought it better to have new boilers, the estimate for which is £3,000, which are now being rapidly put up on board, are known by the name of tubular, and require only half the space of the old ones, by which the stowage of the ship, for either coals.

or cargo, has been increased to the extent of upwards of 200 tons. She is also to have new paddle-wheels, which are nearly finished, and in progress of fitting in place. The directors observe:—

"Mr. Ashton, the well-known shipbroker and auctioneer, was employed to effect a sale of your works, either by private contract or by auction, and your directors regret to announce ineffectually. The time is now fast approaching when they will be closed, unless parties come forward to take them off your hands. Situated as your premises are, with water-side frontage, ample space for building, a graving dock of the first-class, and in other respects a more convenient engineering and ship-building establishment than any in the kingdom, your directors long since expected that they should be able to communicate to you that the mechanics and other able hands, who before their establishment were many of them strangers to Bristol, would not have had occasion to turn their backs upon the city; they still trust these hopes may be realized, and that the time will not arrive when it will be advisable to sell the tools and the materials piecemeal. Your directors have, on more than one occasion, suggested to you the good effects to be anticipated from your arming them with authority to tender for Government vessels, or otherwise to work for the public. The opportunities have been numerous, and if they had been authorised to have accepted some of them, Bristol, they think, would by this time have become a steam-ship building port of the first class, and your establishment, in all probability, in a flourishing condition, instead of being, as it has a prospect of being, on your hands, subject to an outlay for rent, taxes, and maintenance, of not less than £400 per annum."

Prince Albert's visit and the undocking of the *Great Britain* are then briefly alluded to, it being stated that "the whole of the expenses of that auspicious occasion were defrayed from the fund arising from the sale of tickets, or from visitors to the works." The report then goes on to state that, "for the purpose of opening the bank fronting the dock in the most inexpensive way," the Great Western Steam-ship Company had obtained the permission of the Dock Company to lower the water in the float six feet. Circumstances, however, had rendered it necessary to lower the water "considerably below the six feet asked for;" and on the 13th December, nearly six months after the event, the Dock Company made a claim for £312 17*s.* 10*d.* for damage done to the ship *Augusta* in consequence of the lowering of the water. The payment of this sum had been resisted, and the "not acceding to this demand, the directors have reason to fear, has operated injuriously upon the consent of the dock board to the passage of the *Great Britain* through the locks." The report then goes on to speak of the *Great Britain.*

"The size of your ship *Great Britain* was not finally settled until the year 1839. At your annual meeting, in 1840, her dimensions were made known to you, and a model was laid before you. Before, however, the final settlement of her power and capacity, deputations from the public bodies had been for months sitting in committee, with the view of arriving at some conclusive recommendation to the city, by and through which it was anticipated that the trade of the port would be relieved by arrangements with the Dock Company, and its locks thrown open for the ingress and egress of a larger class of steam vessels than those which are of necessity, your directors believe, confined to Bristol only; and one of the resolutions which were reported to your town council on that occasion as the result of the indefatigable exertions of the gentlemen composing that Committee was, 'that it is essential to the trade of the port that the entrance to the floating harbour should be made wider'—at the same time your consulting engineer, Mr. Brunel, was employed by the council to survey the harbour and rivers, and did, after completing the same, hand in estimates for widening the old locks, or forming a new one. The *Great Britain's* beam and form were a good deal affected by the width of the locks, which were supposed to be 45 feet nearly all the way up and down; on measuring, however, your engineers have since found they are much narrower, even at the average high water mark. The great buoyancy of iron ships is such, that to gain draft of water, which in then as well as in the present state of knowledge of ship-building was supposed to be necessary to give stability and the other qualities necessary for a sea-going steamer, the usual form of steam-ship building had to be abandoned, and the breadth towards the bottom considerably contracted; capacity, conseqently, had to be looked for above rather than below the water line. This and other considerable advantages led to the adoption of the form in which the *Great Britain* is built, her widest part being far above the line of flotation; and they have great pleasure in stating that she has been visited by most of the eminent ship-builders and engineers of this and the neighbouring kingdoms, and her construction and form not merely highly approved of, but greatly admired. About the middle of the year 1841, your engineers reported to your directors that a great saving would follow putting the boilers on board in dock, and at the same time they were informed that it was not likely the ship would be allowed to occupy nearly a whole side of Cumberland basin for so long a time, as it was then discovered would be necessary to complete her equipment; and in 1842 your directors reported to you that the most economical way of getting the machinery on board would be through an aperture in her side while in the dock, by which the necessity of floating her would be avoided. Your directors were fully aware that by this decision they would have to seek the consent of the dock directors for a temporary removal of two or three of the upper courses of stones of the lock, and the unshipping of the gates of either one or both sides for a few days, which they were assured by your consulting engineer, who acted in the same capacity for the dock directors, would be a matter comparatively inexpensive in execution, without risk, easy of accomplishment, and in no way likely to inconvenience the trade of the port."

The report then proceeds to detail the unsuccessful negotiations with the Dock Company, respecting the facilities afforded for getting the *Great Britain* into and out of Cumberland basin; the directors observing, that they had not anticipated such a termination to the negotiations, more especially as "the actual dues on the *Great Western*, received by the Dock Company, have amounted to £2,500, while those upon her several cargoes, which the directors have no means of computing, must have been considerable." The consequence of this want of agreement between the two companies is that, instead of getting the *Great Britain* into Cumberland basin on the 21st inst., and out of it for Kingroad on the 4th April, it is "the painful duty" of the directors to inform the Steam-Ship Company, that they anticipate so much delay from the plan which they are now driven to adopt, that they think it will be impossible to keep the advertised dates of the sailings of the *Great Britain.* The Report then goes on to state:—

"The expenses for experiments on the *Archimedes* have been reported to you. Your directors regret that she was taken away before they were completed. A three-armed screw made for her at your works, was tried by Mr. Guppy, on the French man-of-war *Napoleon*, a vessel of more than double the power of the *Archimedes*, and with it a high speed was attained; and your directors believe with a screw of proper size on a similar plan, she is at this moment admitted to be the fastest man-of-war afloat. Your consulting engineer's services have been engaged by the Lords of the Admiralty to report upon screws, and for this purpose her Majesty's ship *Rattler*, of 800 tons and 200 H.P., has been placed at his disposal. Her experiments have been frequently attended by one or other of your officials, as were also experiments, three years ago, upon her Majesty's ship *Polyphemus*, a sister vessel, with paddle wheels. In her a speed of nine knots was attained in Southampton water. The late results of the *Rattler* have been nine and a half, better than half a knot over the speed of the *Polyphemus*, as well as of another sister vessel of the same power, and in the same place with paddle-wheels—her Majesty's ship *Prometheus* in the Thames. Your directors have been induced to dwell upon this subject, not merely in consequence of its importance, but because of garbled statements of speeches in the House upon the navy estimates, or of assertions not founded on the real facts of the case, having led many of the proprietors to seek for information at your office. Your consulting engineer and Mr. Smith, the patentee, are acting with the most perfect understanding, and the speed of the *Rattler* has been improved with every alteration of the screw, the principle, your directors believe, remaining the same. Your directors greatly regret that it became necessary to put the *Great Britain's* screw in hand before the experiments in the *Rattler* were concluded. They will not quit this subject without reminding you that it has never been asserted that a higher rate of speed is expected to be attained in perfectly smooth water, with a screw than with paddles; but that it has numerous advantages over the paddle for long voyages on the ocean, and that the averages are likely to be better; and as certain authorities have asked what the speed of the *Rattler* is or what about 11 statute miles per hour is to 15 or 16, or even more, which is reported to have been attained by fast boats on the Thames, the Hudson, and other rivers; you are to recollect that the power in her Majesty's ships is seldom more than one horse to four tons, while in the fast river boats it is about as one to two tons, or even less, and that few, if any of them, would be safe at sea in bad weather, from the slightness of build and disproportion of weights. The *Elberfelt*, recently caught crossing the Channel, is a case in point. If your directors are rightly informed she was built for the Elbe, of iron one-eighth thick, and did not draw two feet of water. The accounts of the company are appended to the report, and after reserving the sum of £430 13*s.* for the reduction of the preliminary expenses of the company, and £767 in reduction of stock, a dividend has been declared of 2*l.* 10*s.* per share, or 7½ per cent. on the original cost, or 9½ per cent. on the reduced cost of the *Great Western*, which will become payable on the 15th inst., free of income tax, leaving a balance of £1,511 9*s.* 1*d.* to be carried to the reserved fund, making the amount, with interest, £13,139 3*s.* 4*d.* in reduction of the original cost of the *Great Western.*

Subjoined to the report is a statement of accounts, in which the following is given as the

COST OF THE "GREAT BRITAIN."

	£	s.	d.
Hull, engines, and boilers . . .	£66,790	3	10
Fittings	8,908	13	8
Masts, rigging, boats, pumps, cables, and stores .	2,110	9	4
General expenditure, including screw experiments	19,344	17	6
	£97,154	4	4

THE PROPOSED NEW BUILDING ACT.

We have now in the House of Commons another bill "*For better Regulating the Building of the Metropolitan Districts, and to provide for the Drainage thereof.*" The bill that we noticed last year, and which was read a second time in the House of Commons last session, proved an abortion. The present bill appears to have been got up with great labour and care, and with some few alterations may prove acceptable; the principal fault is, the bill is too verbose; however, we are not disposed to be too nice, knowing the difficulties the framers must have had to contend with; we shall for the present only give an outline of the bill, with a few extracts of the most important parts.

It is proposed to extend the building act district the same as in last years' bill (see *Journal*, Vol. VI., p. 214), and it is also proposed to empower her Majesty in Council to extend it to any place within 12 miles of Charing Cross.

It is proposed to alter the mode of rating the building into classes as set forth in Schedule C hereafter shown; the third and sixth class of buildings are to be erected under the joint supervision of the district surveyor and the official referees.

Power is to be given to the Commissioners of Works and Buildings (heretofore called Commissioners of Woods and Forests) upon the recommendation of the official referees to modify any of the rules prescribed by the act.

Two architects are to be appointed by the Home Secretary of State to act as official referees, with a salary of £1000. each, to whom are to be referred many important duties; in fact, they may be considered as judges: it is therefore essentially necessary that they should not be allowed to practise as architects privately, and that a clause ought to be inserted to that effect; and we think the importance of the office demands that both the referees and also the registrar (another officer to be appointed with a salary of £1000.) should have one public office, and it would be still better, if it were part of the same building as that of the Commissioners of Works and Buildings, thus uniting all under one roof would give importance to the department.

We shall now defer making any further observations, but shall carefully watch the progress of the building, and report if any important alterations should hereafter be made. The following are the clauses to which we have referred. The numbers refer to the bill.

11. And, for the purpose of preventing the express provisions of this Act from hindering the adoption of improvements, and of providing for the adoption of expedients better adapted to accomplish the purposes thereof; be it enacted, with regard to every builing, of whatever class, so far as relates to the modification of any rules hereby prescribed, that if, in the opinion of the official referees, the rules by this Act imposed shall be inapplicable, or will defeat the objects of this Act, and that by the adoption of any modification of the rules hereby prescribed, its objects will be attained either better or as effectually, it shall be the duty of such official referees to report their opinion thereon, stating the grounds of such their opinion, to the Commissioners of Works and Buildings; and that, if on the investigation thereof it shall appear to the said commissioners that such opinion is well founded, then it shall be lawful for the said commissioners or any two of them to direct that such modification may be made as will, in their opinion, give effect to the purposes of this Act; and that although such official referees shall be of opinion that such modifications are not requisite or admissible, yet if any party interested present to the official referees a representation, setting forth the grounds whereon such modification is claimed, it shall be the duty of the official referees, and they are hereby required to report such representation, as well as their opinion thereon to the said commissioners, with the grounds of such their report and opinion and that thereupon, if the said commissioners think fit, it shall be lawful for them or any two of them to direct the official referees to make such order in the matter as may appear to them to be requisite; and that, with regard to such application, so far as relates to the payment of the costs thereof, it shall be lawful for the said commissioners to direct such official referees to make such order relative to the costs of such reference to them, as to the said commissioners shall seem fit.

75. And now, for the purpose of providing for the appointment of competent official referees to superintend the execution of this act throughout all the districts to which it is applicable, and also to determine sundry matters in question incident thereto, as well as to exercise, in certain cases, a discretion in the relaxation of the fixed rules and directions of this act, where the strict observance thereof is impracticable, or would defeat the object of this act, or would needlessly affect, with injury, the course and operation of this branch of business; be it enacted, with regard to the official referees, so far as relates to their appointment, to their qualifications, and to the tenure of their office, that it shall be lawful for her Majesty's Principal Secretary of State acting for the Home Department, and he is hereby empowered to appoint two persons, being architects, to be official referees of metropolitan buildings, and from time to time, as he shall think proper, to remove such official referees, and in their place to appoint other persons so qualified.

76. And be it enacted, with regard to such official referees, so far as relates to their functions generally, that it shall be the duty of such official referees, and they are hereby required to superintend the execution of this act, by the several district surveyors already existing, or hereby authorized to be appointed, and to perform the several matters to them respectively assigned by the provisions of this act, and to determine all questions referred to them, whether expressly by this act, or at the instance of any one or more of the parties concerned.

77. And be it enacted, with regard to the official referees, so far as relates to their jurisdiction, that if any doubt, difference or dissatisfaction, in respect of any matter within the limits of this act, arise between any parties concerned, or between any party and any surveyor, or between any two surveyors, as to any act done, or to be done, in pursuance of this act; or as to the effect of the provisions thereof; or as to the mode in which the provisions and directions of this Act are or ought to be carried into effect; and particularly as to whether the requirements implied in terms of qualification, applied to sites, to soils, to materials or to workmanship, or otherwise, and denoting good, sound, fit, proper or sufficient, are fulfilled in certain cases; or as to the district in which any building, matter or thing is to be deemed to be situate, especially in cases where such building, matter or thing is partly in one district and partly in another; or as to the expenses to be borne by the respective owners of premises parted by the same party-walls, or the proportions thereof; or as to the proportions of the expense to be borne by the occupier, or by the owners of premises, in respect of any work executed, or any other matter whatever; then it shall be lawful for any party concerned, and he is hereby entitled, to require the official referees to determine such matter, but so that such requisition be made in writing, and that it sets forth, either generally or otherwise, the matters in respect of which the determination of the official referees is required; and that the determination of such referees, or of one of such referees, with the assent of the registrar of metropolitan buildings, as to all or any of the points in difference on which such referees shall make their award, and as to the costs, charges and expenses of such reference, shall be binding on all parties to such reference.

78. And be it enacted, with regard to the official referees, so far as relates to their authority in respect of any reference to them, and to the effect of their award upon the rights and interests of the owners and occupiers of property, that it shall be lawful for such referees and they are hereby empowered to exercise all such powers as arbitrators as they would have had in case they had been appointed under an order of her Majesty's Court of Queen's Bench at Westminster; and that if such award be given in writing, and be sealed by the official seal of the registrar of metropolitan buildings, it shall be as effectual as if made under an order of reference by such court, and shall be enforced by the said court in all respects as if made under an order of such court; and that it shall be binding and conclusive against every person, body politic and corporate, including the Queen's Majesty, her heirs and successors, claiming any estate, right, title, trust, use or interest in, to or out of the said premises or any part thereof, either in possession, reversion, remainder, or expectancy, and against every other person whomsoever.

79. And be it enacted, with regard to such award, so far as relates to the effect thereof as evidence of the matter thereof, that if on the trial or hearing of any cause or matter in any court of law or equity or elsewhere, any copy of an award, signed and sealed with the seal of the said registrar, be produced, then it shall be the duty of all judges, justices, and others, and they are hereby required to receive the same as *primâ facie* evidence of the matters therein contained.

81. And be it enacted, with regard to such official referees, so far as relates to the regulation of the business of their office, that when any matter is by this Act required, directed or permitted to be done by the official referees, the same may be done by any one of them, with the assent of the registrar of metropolitan buildings, unless express provision to the contrary be made, and if done by any one of them with such assent, it shall be as valid and effectual as if done by all of them; and that, subject to such restrictions and regulations as may be made in that behalf by the Commissioners of Works and Buildings, it shall be lawful for the official referees to appoint any one of their number, under their hands and the seal of the registrar of metropolitan buildings, to make any inquiry or any survey which shall appear to them either necessary or expedient in order to enable them to determine any matters in reference.

82. And, for the purpose of duly recording relaxations of the requisitions of this Act, made in pursuance of the provisions hereof in that behalf, and of providing for the revision from time to time both of such relaxations and requisitions, and of providing against the partial exercise of the powers of this Act, and for the more effectually providing for the due recording of the acts of the official referees, and for exercising a due control thereon; be it enacted that it shall be lawful for the Commissioners of Works and Buildings, and they are hereby authorized and required to appoint a registrar of metropolitan buildings; and that such registrar shall hold his office during the pleasure of the said commissioners; and that, subject to the provisions of this Act, it shall be lawful for the said Commissioners to make rules for regulating the execution of the duties of the office of the said registrar; and that it shall be the duty of such registrar to keep a seal, and to affix such seal to all documents made by the said official referees, and required to be sealed; and to keep all the documents and records relating to the business of their office, and to register the same: provided always, with regard to such registrar, so far as relates to the affixing the seal of office to any document, that if it shall appear to the said registrar that any such documents are contrary to law, or not complete in any of the requisite forms, or beyond the competence of the said official referees, either with regard to the provisions of this Act or any rules or regulations prescribed for their guidance, by the said Commissioners of Works and Buildings, then it shall be the duty of the said registrar to refuse to affix the seal; and that thereafter, if the said official referees shall so require, it shall be his duty, and he is hereby required to report the matter and the particular grounds and reasons for his refusal to the said commissioners; and that upon the receipt of such report it shall be lawful for the said Commissioners to authorize the said registrar to affix the seal or to confirm his refusal; provided always, with regard to such office of registrar, so far as relates to the execution of his duties in certain events, that if such registrar be ill or otherwise unable to discharge the duties of his said office, or if he be absent, then it shall be lawful for the said Commissioners of Works and Buildings to appoint some other person to act in his behalf, and to assign to such person such part of the remuneration of the said registrar, or otherwise to remunerate him as the Lords of the Treasury shall appoint in that behalf.

87. And be it enacted, with regard to such official referees and registrar,

so far as relates to their remuneration, that it shall be lawful for her Majesty to grant to each of such official referees and the said registrar a salary not exceeding *one thousand* pounds by the year, in four equal quarterly payments; and that if any such official referee or such registrar shall be appointed, or shall die, resign, or be removed from office, in the interval between two quarterly days of payment, then he shall be entitled to a proportionate part of the salary for the period of such interval during which he shall hold such appointment.

SCHEDULE (C.)—PART I.—(*See* § 5.)—Rules for determining the Classes and Rates to which Buildings are to be deemed to belong for the purposes of this Act, and the Thicknesses of the Walls of Buildings of such Rates.

CLASSES OF BUILDINGS.—For the purposes of this Act, all buildings of whatever kind, subject to the provisions thereof, are to be deemed to belong to one or other of the following three classes; that is to say—

First Class.—If a building be built originally as a dwelling-house, to be occupied, or intended to be occupied as such—then it is to be deemed to belong to the first, or dwelling-house class.

Second Class.—If a building be built originally as a warehouse, storehouse, granary, brewery, distillery, manufactory or workshop, or be occupied or intended to be occupied as such, or for a similar purpose—then it is to be deemed to belong to the second or warehouse class.

Third Class.—If a building be built originally as a church, chapel, or other place of public worship, college, hall, hospital, theatre, public concert-room, public ball-room, public lecture-room, public exhibition-room, or occupied or intended to be occupied as such, or for a similar purpose, or otherwise used

SCHEDULE (C),—PARTS II & III.—(*See* § 5.)

Conditions for determining the Rates to which Buildings are to be deemed to belong, and the Thickness of the External and of the Party Walls thereof.

Class.	In reference to Height.	In reference to Area.	In reference to Stories.	Rate of Building.	Requisite Thickness of External Walls of each Rate of the First Class.	Requisite Thickness of Party Walls of each Rate of the First Class.
First or Dwelling House Class.	1. If the building be in height not more than 22 ft.,	- - If the building do not cover more than 4 squares,	- - If the building do not contain in height more than 2 stories,	- - It is to be of the 1st or Lowest Rate of this Class.	- - And the thickness of the external walls must be, at the least, 8½ in. from the top of the footing to the top of the wall.	- - And the thickness of the party-walls must be, at the least, 13½ in. from the top of the footiog to the top of the wall.
	2. If more than 22, and not more than 33 ft.,	- - or if it cover more than 4, and less than 6 squares,	- - or if it contain 3 stories,	- - It is to be of the 2d Rate.	- - And the thickness of the external walls must be, at the least, 13½ in. from the top of the footing to the under-side of the gutter-plate; and at the least 8½ in. from the under-side of the plate to the top of the wall.	- - And the thickness of the party-walls must be, at the lea-t 17½ in. from the top of the footing to the under side of the second floor; and, at the least, 13½ in. from the under-side of the second floor to the top of the wall.
	3. If more than 33, and not more than 47 ft.,	- - or if it cover more than 6, and less than 8 squares,	- - or if it contain 4 stories,	- - It is to be of the 3d Rate.	- - And the thickness of the external walls must be, at the least, 17½ in. from the top of the footing to the under-side of the second floor; and, at the least, 13½ in. from the under-side of the second floor to the under-side of the gutter-plate; and, at the least, 8½ in. from the under-side of the gutter-plate to the top of the wall.	- - And the thickness of the party-walls must be, at the least, 17½ in. from the top of the footiog to the under-side of the third floor; and, at the least, 13½ in. from the under-side of the third floor to the top of the wall.
	4. If more than 47, and not more than 65 ft.,	- - or if it cover more than 8, and less than 10 squares,	- - or if it contain 5 stories,	- - It is to be of the 4th Rate.	- - And the thickness of the external walls must be, at the least, 17½ in. from the top of the footing to the under-side of the third floor; and, at the least, 13½ in. from the under-side of the third floor to the under-side of the gutter-plate; and, at the least, 8½ in. from the under-side of the gutter-plate to the top of the wall.	- - And the thickness of the party-walls must be, at the least, 22 in. from the top of the footing to the under-side of the second floor; and, at the least, 17½ in. from the under-side of the second floor to the under-side of the fifth floor; and, at the least, 13½ in. from the under-side of the fifth floor to the top of the wall.
	5. If more than 65, and not more than 82 ft.,	- - or if it cover more than 10, and less than 12 squares,	- - or if it contain 6 stories,	- - It is to be of the 5th Rate.	- - And the thickness of the external walls must be, at the least, 22 in. from the top of the footing to the under-side of the second floor; and, at the least, 17½ in. from the under-side of the second floor to the under-side of the fourth floor; and, at the least, 13½ in. from the under-side of the fourth floor to the under-side of the gutter-plate; and, at the least, 8½ in. from the under side of the gutter-plate to the top of the wall.	- - And the thickness of the party-walls must be, at the least, 22 in. from the top of the footiog to the under side of the third floor; and, at the least, 17½ in. from the under-side of the third floor to the top of the wall.
	6. If more than 82 ft.,	- - or if it cover more than 12 squares.	- - or if it contain more than 6 stories,	- - It is to be of the 6th Rate, and of the 3d Class.	- - And the thickness of the external walls must be, at the least, 4 in. greater than is hereby required for walls of the 5th rate.	- - And the thickness of the party-walls must be, at the least, 4 in. greater than is hereby required for walls of the fifth rate.
Second or Warehouse Class.	1. If the building be in height not more than 12 ft.,	- - If the building do not cover more than 6 squares,	- - If the building do not contain in height more than one story,	- - It is to be of the First or Lowest Rate of this Class.	- - And the thickness of the external walls must be, at the least, 8½ in. from the top of the footing to the top of the wall.	- - And the thickness of the party-walls must be, at the least, 13½ in. from the top of the footing to the top of the wall.
	2. If more than 12, and not more than 22 ft.,	- - or if it cover more than 6, and less than 10 squares,	- - or if it contain two stories,	- - It is to be of the Second Rate.	- - And the thickness of the external walls must be, at the least, 13½ in. from the top of the footing to the under-side of the gutter-plate; and, at the least, 8½ in. from the under-side of the gutter-plate to the top of the wall.	- - And the thickness of the party-walls must be, at the least, 17½ in. from the top of the footing to the under side of the second floor, and 13½ in. from the under-side of the second floor to the top of the wall.
	3. If more than 22, and not more than 30 ft.,	- - or if it cover more than 10, and less than 18 squares,	- - or if it contain three stories,	- - It is to be of the Third Rate.	- - And the thickness of the external walls must be, at the least, 17½ in. from the top of the footing to the under-side of the second floor; and, at the least, 13½ in. from the under-side of the second floor to the under-side of the gutter-plate; and, at the least, 8½ in. from the under-side of the gutter-plate to the top of the wall.	- - And the thickness of the party-walls must be, at the least, 17½ in. from the top of the footing to the under-side of the third floor, and, at the least, 13½ in. from the under-side of the third floor to the top of the wall.
	4. If more than 30, and not more than 50 ft.,	- - or if it cover more than 18, and less than 26 squares,	- - or if it contain five stories,	- - It is to be of the Fourth Rate.	- - And the thickness of the external walls must be, at the least, 17½ in. from the top of the footing to the under-side of the third floor; and, at the least, 13½ in. from the under-side of the third floor to the under-side of the gutter-plate; and, at the least, 8½ in. from the under-side of the gutter-plate to the top of the wall.	- - And the thickness of the party-walls must be, at the least, 22 in. from the top of the footing to the under-side of the second floor, and, at the least, 17½ in. from the under-side of the second floor to the under-side of the fifth floor, and at the least, 13½ in, from the under-side of the fifth floor to the top of the wall.
	5. If more than 50, and not more than 65 ft.,	- - or if it cover more than 26, and less than 35 squares,	- - or if it contain six stories,	- - It is to be of the Fifth Rate.	- - And the thickness of the external walls must be, at the least, 22 in. from the top of the footing to the under-side of the second floor; and, at the least, 17½ in. from the under-side of the second floor to the under-side of the fourth floor; and, at the least, 13½ in. from the under-side of the fourth floor to the under-side of the gutter-plate; and, at the least, 8½ in. from the under-side of the gutter-plate to the top of the wall.	- - And the thickness of the party-walls must be, at the least, 22 in. from the top of the footings to the under-side of the third floor; and, at the least, 17½ in. from the under-side of the third floor to the top of the wall.
	6. If more than 65 ft.,	- - or if it cover more than 35 squares,	- - or if it contain more than six stories,	- - It is to be of the Sixth Rate, and of the Third Class.	- - And the thickness of the walls must be, at the least, 4 in. thicker than is hereby required for walls of the fifth rate.	- - And the thickness of the party-walls must be, at the least, 4 in. thicker than is hereby required for walls of the fifth rate.

or intended to be used, either occasionally or constantly, for the assemblage of persons in large numbers, whether for public worship, business, instruction, debate, diversion, or resort—then it is to be deemed to belong to the third or public building class.

Rates of Buildings.—And the buildings included in the said classes are to be deemed to belong to the rates of those classes, according to the conditions of height, area, and number of stories set forth in the following tables; which conditions are to be determined according to the following rules:

The Prince of Wales Steamer.—This fine vessel made a trip down the river on Tuesday, the 26th March, previously to going on her station between London and Margate, for the ensuing season. She is an iron vessel built last year by Messrs. Miller, Ravenhill & Co., the well known engineers, who also constructed the engines, which were originally a pair of side lever engines, taken out of another Margate steamer. During the experimental trip the Prince made several trials in Long Reach, to test her capabilities as to speed, which may be calculated at not less than 12½ knots through the water. She ran down below the Nore and could find no competitor with whom to try her comparative speed; on her return she again tried her speed at the mile distance in Long Reach, when she met the *renowned* Princess Alice, with the tricoloured flag flying at her mast-head, notifying the presence of Belgian royalty on board. The *Princess* had been announced to have outstripped all vessels she came near. This was a fine opportunity to test the capabilities of the annular engines of the *Princess* and the beam engines of the *Prince*. The helm of the *Prince* was ordered to be brought about, but before the vessel was fairly turned, her sister, the *Princess*, had got a-head full a mile; nothing daunted, the *Prince* moved on, when it was very soon discovered that he was making way fast upon the *Princess*, and in about 30 minutes he went right a-head of her (not very gallant to her highness). All on board of the *Prince* pronounced it a decided victory of at least one-and-a-half to two miles per hour faster than the *Princess;* we may, therefore, pronounce, without fear of contradiction, that the *Prince* is the champion of the river, until any other vessel is found that will eclipse her. This we must own was to us a fine trial: here we had the skill of one of the first builders of iron vessels, Messrs. Ditchburn and Mair, with the annular engines, of the celebrated firm of Messrs. Maudslays and Field, against the iron steam vessel and engines of the *Prince of Wales*, both constructed by Messrs. Miller, Ravenhill, and Co., another firm equally celebrated for the excellency of their workmanship and the success of all their vessels.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM FEBRUARY 26, TO MARCH 28, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

Isabella Larbalestier, of Noble Street, Falcon Square, furrier, for "Improvements in making certain skins resemble the sable fur."—Sealed, February 26.

Richard Kitson, of Cleckheaton, card manufacturer, and John Garthwaite, of Leeds, flax spinner, for "Improvements in wire cards for carding cotton, wool, silk, flax, and other fibrous substances, and for producing tow and yarns from line and tow-yarn waste, which comes from the spinning frames commonly called hard waste."—February 27.

Charles Newington, of Ticehurst, Sussex, esq., for "Improvements in apparatus for ascertaining and indicating the time at which a person is present at a particular place."—February 27.

Thomas Harbottle, of Manchester, gentleman, for "a machine designed for manufacturing boot soles, taps, and also for riveting leather hose, traces, and for other purposes, to which the same may be usefully applied."—February 27.

William Clegg Gover, of Chester Square, Middlesex, gentleman, for "A method of casting off the sash lines and weights from the window sashes, and of taking out the window sashes from their frames without removing the beads."—March 1; two months.

Joseph Crawhall, of Newcastle-upon-Tyne, rope manufacturer, for "Improvements in machinery for manufacturing ropes and cordage."—March 2.

John Stevelly, of Belfast, professor of natural philosophy, for "Improvements in steam engines."—March 2.

Henry Dunnington, of Nottingham, manufacturer, for "Improvements in the manufacture of fabrics produced in warp and lace machinery."—March 4.

Peter Ward, of West Bromwich, Stafford, practical chemist, for "An improvement in combining matters for washing and cleansing."—March 4.

Samuel Atkinson, of Manchester Street, Gray's Inn Road, Middlesex, turner, for "Improvements in the construction of wheels for carriages."—March 4.

Bernard Peard Walker, of North Street, Wolverhampton, clerk, for "Improvements in machinery for making nails."—March 6.

Thomas Foster, of Streatham, Surrey, manufacturer, for "Improvements in preparing composition of India rubber, and other matters for forming articles therefrom, and for the coating of surfaces of leather, and woven, and other fabrics."—March 6.

William Henry Barlow, of Leicester, civil engineer, for "Improvements in the construction of keys, wedges or fastenings, for engineering purposes."—March 6.

William Fairbairn, of Manchester, engineer, for certain "Improvements in machinery used for propelling vessels by steam."—March 7.

Charles Townend, of Manchester, fustian manufacturer, for "An improved process, or manufacture, whereby cotton fabrics are aided and made repellant to water and mildew, and any unpleasant smell is prevented in such fabrics."—March 7; two months.

Alexander Angus Croll, of Brick Lane, Middlesex, superintendent of the gas works, and William Richards of the same place, mechanical inspector, for "Improvements in the manufacture of gas for the purpose of illumination, and in apparatus used when transmitting and measuring gas."—March 7.

Wilton George Turner, of Gateshead, Durham, doctor in philosophy, for the "Manufacturing of salts of ammonia and compounds of cyanogen, from a substance never before applied to that purpose."—March 11.

Charles Harrison, manager of the Coed Talon and Leeswood Iron Works, Flintshire, for "Certain improvements in the manufacture of cast iron pipes and other iron castings."—March 14.

Charles Roberts, of High Holborn, Middlesex, boot maker, for "Improvements in the manufacture of boot and shoe trees, lasts, and stretchers."—March 14.

William Godfrey Kneller, of Wimbledon, Surrey, chemist, for "Improvements in the preparation of zink, and in combinations of zink with other metallic bodies."—March 14.

Henry Pershouse Parkes, of Dudley, Worcester, manufacturer of chain cables, for "Improvements in the manufacture of flat pit chains."—March 14.

Samuel Cunliff Lister, and James Ambler, of Bradford, York, manufacturers, for "Improvements in machinery for applying fringes to shawls and other articles."—March 14.

Frederick Stephenson, of High Street, Birmingham, comb manufacturer, for "Improvements in bookbinding, and apparatus for cutting books or other folded paper, part of which improvements is applicable to pen holders."—March 14.

John Browne, of New Bond Street, Middlesex, esq., for "Improvements in urinary utensils."—March 14.

William Bown, of Leicester, glove and mit manufacturer, for "Improvements in weaving elastic fabrics."—March 14.

John Tatham, of Rochdale, machine maker, and David Cheetham, of the same place, cotton spinner, for "Certain improvements in machinery or apparatus to be employed in the preparation and spinning of cotton wool and other fibrous substances."—March 14.

Moses Poole, of Lincoln's Inn, Middlesex, gentleman, for "Improvements in steam-engines, steam-boilers, and furnaces or fireplaces." (A communication.)—March 14.

Emanuel Wharton, of Birmingham, engineer, for "Improvements in steam-engines, which are in whole or in part applicable to other motive engines, and to machines for raising or impelling fluids."—March 14.

Thomas Seymour, of Riding House Lane, Great Portland Street, Middlesex, gun-maker and John Seymour, of Wellington Street, Gray's Inn Lane, lock-filer, for "An improved safety-bolt and tumbler for the locks of certain kinds of fire-arms."—March 14.

William Henry Burke, of Tottenham, Middlesex, manufacturer, for "Improved machinery for cutting Indian rubber and other elastic substances into balls and other solid figures."—March 19.

William Saunders, of Bush Lane, London, chemist, for "An improved apparatus for modifying temperature in the condensation of vapours, and in the cooling or heating of liquids and fluids."—March 19.

Hugh Inglis, of Kilmarnock, Scotland, mechanic, for "Improvements upon locomotive steam-engines, whereby a saving of fuel will be effected, which improvements are applicable to steam vessels and other purposes, and to the increasing the adhesion of the wheels of railway engines, carriages, and tenders upon the lines of rail, when the same are in a moist state."—March 19.

William Bates, of Leicester, fuller and dresser, for "Improvements in the dressing and getting up of hosiery goods manufactured from lamb's wool and other yarns, and in machinery for raising the nap on the same, and in the construction of legs and other forms or shapes for stockings and other articles of hosiery."—March 19.

Jules Thiebeauld de la Cronée, of Pinner's Court, London, merchant, for "An improved apparatus for, or method of purifying, clarifying, and refining, vegetable extracts." (A communication.)—March 19.

André Drouet de Charlieu, of Sablonière Hotel, Leicester Square, gentleman, for "Improvements in rails for railways, and in wheels for locomotive carriages." (A communication.)—March 20.

William Isaac Cookson, of Newcastle-upon-Tyne esquire, for "Improvements in apparatus for burning sulphur in the manufacture of sulphuric acid."—March 20.

John Holland Butterworth, of Rochdale, Lancaster, cotton spinner, for "An apparatus applicable to preparation machines used in the spinning of cotton and other fibrous materials."—March 20.

Moses Poole, of Lincoln's Inn, Middlesex, gentleman, for "Improvements in dyeing." (A communication.)—March 21.

John Butt, of Maldon, Essex, draper, for "Improvements in candlesticks."—March 22.

John Harcourt Quincey, of Old Street, City Road, gentleman, and John Johnson, of Cursitor Street, lamp maker, for "Improvements in the manufacture of lamps, and shades for lamps and other lights." (Partly a communication.)—March 25.

William Pollard, of Newcastle-upon-Tyne, gentleman, for "Improvements in the manufacture of ammonia."—March 28.

James Hardy, of Birmingham, Warwick, gentleman, for "Improvements in the process of welding tubes, pipes, or hollow rods of malleable iron by machinery."—March 28.

Joseph Maudslay, of the firm of Messrs. Maudslay, Son, & Field, of Lambeth, Surrey, engineer, for "Improvements in steam engines."—March 28.

Alfred Richard Johnson, of the firms of Messrs. Johnson & Co., Regent Street, and Messrs. Griffiths & Johnson, Old Bond Street, Middlesex, hatters, for "Improvements in hats."—March 28.

Joseph Cooper, of Hoxton, Middlesex, gentleman, for "Improvements in the purification and clarification of sugar, which improvements are also applicable to the purifying and clarifying of other articles of commerce."—March 28.

Robert Davison, of Brick Lane, Middlesex, civil engineer, and William Symington, of East Smithfield, Middlesex, civil engineer, for "A method or methods of drying, seasoning, and hardening wood and other articles, parts of which are applicable to the desiccation of vegetable substances generally."—March 28.

Robert Mollett, of Shacklewell, Middlesex, gentleman, and Jesse Bridgman, of Hackney, Middlesex, gentleman, for "Improvements in separating the fatty and oily from the membraneous portions of animal and vegetable substances."—March 28.

Charles William Spicer, of 28, Portman Square, Middlesex, esquire, for "An invention called the nautilus, or portable life preserver and swimming belt." (A communication.)—March 28.

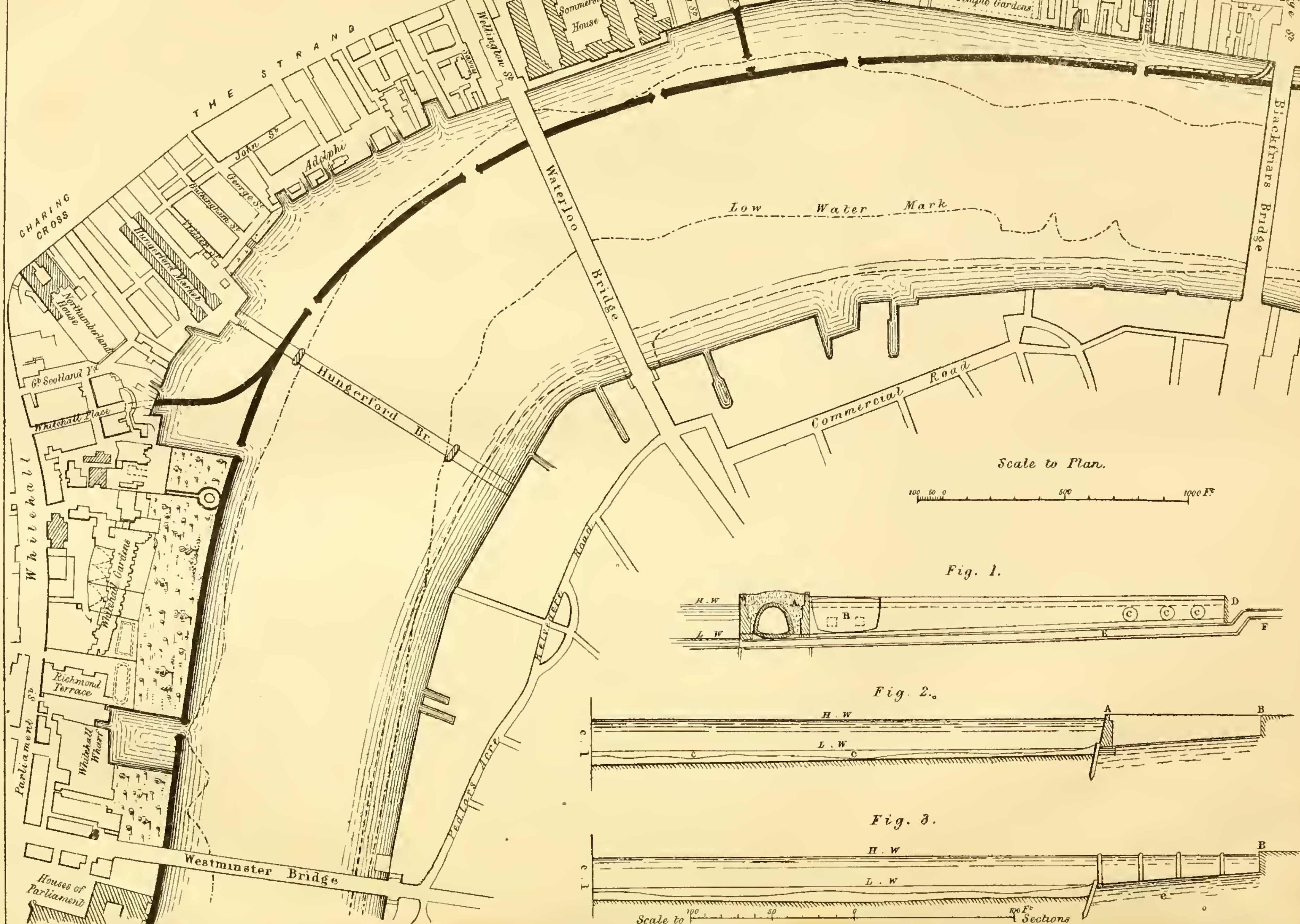
Charles Hector Francois Dumontier, of Rouen, France, engineer, for "Improvements in the construction of lithographic and autographic presses." (A communication.)—March 28.

A New Propeller.—An invention has been made by an ingenious mechanic of Edinburgh, of a new mode of giving motion to vessels, doing away with paddle-wheels and boxes, as well as the Archimedian screw. It is a simple revolving cylinder, placed midships, which acts as a windlass, and makes a rope of the sea; in fact, the velocity acquired is in proportion to the quantity of water discharged by the agency of the cylinder, through a discharging nozzle at each side of the vessel, and what is curious, the discharging nozzle can be turned by a simple operation on deck, so as to stop the vessel, make her move backward or round as on a pivot, within her own length, without even the knowledge of the engineer, or the assistance of the rudder, as no stoppage of the engine is necessary for the purpose. The convenience is a smaller consumption of fuel, and the capability of the broadside carrying an entire armament.—Scotsman.

Copper Balloon.—A balloon composed of copper is so far completed, that it is now exhibited to the public: this immense globe is formed of sheets of copper, united and soldered. The object proposed by this experiment is to resolve the problem of the practicability of the employment of metals in the construction of balloons.—Paris Paper.

PL. VI.

THAMES EMBANKMENT.



J. R. Jobbins, 3, Warwick Ct.

C. Bugster. del.t J.R. Jobbins 3, Warwick C.t

THE TIMBER ROOFS OF THE MIDDLE AGES.

Remarks on the Timber Roofs of the Middle Ages, by THOMAS MORRIS, *read before the Institute of British Architects.*

(With an Engraving, Plote V., containing Roofs of the following buildings.)

Fig. 1. Westminster Hall.—2. Nursted Court, Kent.—3. Old Basing Church.—4. Guard Room, Lambeth.—5. School House, Coventry.—6. Hall Croydon Palace.—7. Conway Castle.—8. Eltham Palace.—9. Wolsey's Hall, Hampton Court.—10. King's College Chapel.—11. Chapel, Croydon Palace.—12. South Wraxall.—13. Westminster School.—14. Crosby Hall.

THE timber roofs of the ancient regal and baronial halls, which form so prominent and characteristic a feature of our national mediæval architecture, merit, in an eminent degree, the attention of all to whom the science of construction is an object of interest; and although other avocations have precluded the present writer from going into the subject in that full and perfect manner which it is calculated to repay, and which its importaoce fairly demands, he trusts he may be able to furnish a few observations, to serve, perhaps, as a stock on which the results of other and more successsul efforts may be at a future season engrafted. So little, indeed, has yet been done towards giving a connected form to the history and principles of English carpentry, that he who would shrink with conscious inability from attempting so comprehensive a project, may yet hope to find not utterly valueless such mere gleanings as the present.

It will not be thought requisite to carry the subject back to that remote period of Anglo-Saxon history when the carpenter (as well as other artificers) was considered, if not a positive vegetable, at least part of what we are accustomed to call the plant of an estate, transferable from owner to owner with the land, as we read that "when the brother of Godwin gave to a monastery a certain manor, he included its appendages; that is, his overseer and all his chattels, his smith, carpenter, fisherman, miller, all these tenants, and all their goods and chattels."

The artificers of the early Saxons appear to have been for the most part either monks or slaves—they were nothing more than sheer necessity made them—they lived and died poor, unhonoured, and unimproved! "The habits of life were too uniform, its luxuries too few; its property too small; its wants too numerous, and the spirit of the great mass too servile and dull," says Mr. Sharon Turner, "to have that collection of ingenious, active, respected and inventive men who make and circulate our internal and external commerce with eager but not illiberal competition; or to have those accomplished artificers and manufacturers, whose taste in execution equals that of the most elegant fancy in its invention."

"In the monastery," says the historian, "were to be found smiths, carpenters, millers, illuminators, agriculturalists, and fishermen." The carpenter was at that time the *treow wyrhta* (the tree or wood workman.) The Anglo-Saxon verb used in speaking of building is commonly *getymbrian*, "to make of wood," and it is known to every architectural antiquary that many early churches were constructed of that material—one at Greensted, in Essex, still remains.

As we approach the time of the Norman conquest, matters became ameliorated, and this was an advantage concomitant with the establishment of Christianity and the influx of Italian clergy. The most durable materials were sought for and applied in ecclesiastical works, and to our architects for several centuries previous to the date of any large wooden roof,

> "The art was known,
> By pointed arch and shafted stalk,
> The arcades of an alleyed walk,
> To emulate in stone."

This art they practised with such admirable skill and effect, that their works have been not unfrequently considered beyond the pale of modern imitation. To these architects who had previously and progressively roofed our edifices with stone, from the simple adaptation of the *more Romanum* in buildings of Anglo-Saxon and Anglo-Norman dates, to the masterly example in the Chapter House at York, who had clothed with so much invention and taste the bold framework of mathematical deduction, are we indebted for the wooden wonder of Westminster. The span of Gothic groined roofs seldom exceeded 35 ft.,[1] while the Great Palatial Hall was double that width. Numerous obstacles to a stone roof must therefore have presented themselves; the builder was thrown upon the resources of his art, but he proved himself his craft's master, and a novel and elegant application of that great element of lightness and beauty, the arch, was the consequence. The former ponderous and friable material was exchanged for one equally susceptible of the nicest equilibriation, and greatly superior in tenacity and tractibility. It was one of the grandest innovations recorded in the annals of English art.

Westminster Hall, Anno 1399.—(Fig. 1.)

Our first consideration (in respect of dimensions if not of date) is due to the roof of Westminster Hall, where the distance between the sides is 68 ft., and the length 240 ft. This length is divided into twelve bays, giving a distance of 20 ft. between the principals or points of pressure and support. At these intervals an arch of great strength and boldness is thrown from wall to wall, setting down on stone corbels, and rising about five-eighths of the span. The curve, from the springing to the vertex, is divided into three nearly equal spaces, but the intermediate points are made to approximate somewhat more closely, in order to facilitate the disposition of the load; and additional stiffness and protection is afforded by the well-devised framework within the arch. It will be seen that the uppermost of these points falls immediately under the middle of the rafter, where the weight is collected by a massive purlin, and carried by an auxiliary arch to the queen posts, and by them conveyed to the hammer beam, a timber which possesses the property of a lever rather than a tie. The point of intersection with the arch (Fig. 1*) is its fulcrum or centre of motion, and the force exerted at the inner end, which represents the weight of the upper half of the rafter, forms a well adjusted counterpoise to the pressure on the pole plate or beam at the foot of the rafter connected with the outer end of the hammer beam. These forces combined follow the direction of the arch, which discharges its load fairly on to the walls; and the outward thrust is so perfectly counteracted by the disposition of the parts, that the flying buttresses of the exterior seem called for, rather as a set off to the casualties of practice than any imperfection in the principle. This appears, indeed, the light in which they were received by the builders, for there seems to have been little attention to regularity even in their original disposition.

This *chef d'œuvre* was completed in the year 1399, when Richard II. kept his Christmas at Westminster, and is said to have entertained 10,000 guests daily, but as that number could barely manage to stand in the hall, it is clear the whole party did not dine together. This was no doubt a circumstance of annoyance to the hospitable monarch who is said to have exclaimed that it was but a "mere dressing room in comparison with what he wished to have!"

Eltham Palace, 1480.—(Fig. 8.)

To the decorated period Mr. Rickman has, I think, erroneously attributed the roof at Eltham. Its characteristics are certainly those of well developed perpendicular. It is a bad imitation of the Westminster roof, the chief arch being an obtuse pointed segmental one, which of course exerts a very considerable pressure against the upper part of the walls, and the hammer beams and brackets are but ill calculated for supporting any part of the load that may be thrown upon them. The designer seems to have taken little pains to obviate a lateral strain, trusting, in this respect, to the resistance afforded by the walls and buttresses. The principal rafters are of large dimensions, and are stiffened by horizontal struts under the purlins. The arched rib relieves the hammer beam of much of the weight at its inner end, and there are no longitudinal arches springing from them as in the foregoing example. The clear span of this roof is 36 feet.

On investigation, I find my previous surmise as to the date of this roof supported, and its erection satisfactorily attributed to Edward IV. The cognizances of that monarch are of frequent occurrence in the masonry, and documentary evidence exists of his having at great cost repaired his house at Eltham. His third daughter (Bridget) was born here in 1480, and in 1483 he celebrated Christmas in a most sumptuous style—2000 persons being regaled daily at the festive board.

Wolsey's Hall, Hampton Court, 1520.—(Fig. 9.)

The roof of the Great Hall at Hampton Court (temp. H. 8) covers a space of 40 ft., (which is the same as at Christchurch, Oxford, and Trinity College, Cambridge,) and is, perhaps, the most elaborate we possess.

As a scientific system of framing, it cannot enter into rivalry with that at Westminster, which will be readily felt, when we consider that the admiration it attracts is directed to a mere casing and not to the actual skeleton. This gives it the character of a ceiling rather than of a roof, but it is to the timbers that our attention must now be

[1] The Chapter House at York is 57 ft. in diameter, but the building is octagonal, and the points of support, therefore, more frequent, and the resistance to a pressure from within greater than in a continuous vault. The nave of York Cathedral is also of the great extent of 48 ft.

devoted, and here we do not recognize that masterly arrangement, that perfect equilibration, which should at once proclaim it to be "By its own weight made steadfast and immoveable," a line that may be applied to Westminster Hall, with equal truth, force and beauty.

In the present instance a considerable thrust is exerted laterally upon the walls, rendering buttresses necessary to its stability. Still there is much ingenuity in the frame work, and the pressure is made to exert itself at an angle of about 70°, being as near to a vertical direction as the scheme of the roof would perhaps admit of. The principal rafters may be said to partake of the property of an arch, and being concealed, their ruder construction does not form a very material disadvantage.

The forces are made to exert themselves upon the hammer beam; but with respect to the manner in which this timber is supported, a marked difference is observable; a difference, indeed, that causes a complete change in the constructive principle and ultimate transmission of the load. At Westminster we have seen the great arched rib proudly spanning the entire width of the hall, and forming the grand support of the whole roof. The hammer beam, as has been shown, is poised with the greatest precision upon a point in the arch, and the weight thrown perpendicularly on the walls at the springing; but at Hampton Court this principle is not carried out, for the hammer beams with their struts support the arch! In estimating the lateral thrust of such a piece of framing, the simplest method seems to be to compose the forces acting on the hammer beam, and draw the resultant, A B, through the bracket and the walls to the ground. We thus have the elements of a lever, the external edge of the wall being the fulcrum or prop. The weight of the wall collected at half its thickness from the fulcrum, as the resistance to be overcome, and the point where the resultant cuts the ground, shows the position of the counteracting force.

In this point of view the ancient massive rubble wall had certain advantages over the light and compact mural works of the moderns. In conveying the forces from the hammer beam to the wall, the bracket is presumed to be of adequate strength; but it ought to include a straight (or more strictly a parabolic) line from the bottom of the queen-post to the corbel, to prevent a cross strain, and the line of the composed forces should pass on the outside of the corbel, otherwise the hammer beam would be liable to be depressed. The form of these brackets being just the reverse of that which the mathematician would prescribe, the introduction of the bolt, an object which is regarded by the carpenter with extreme jealousy, became an act of only due precaution.

Roof of Westminster School.—(Fig. 13.)

This exhibits very closely the anatomy of such as Hampton Court, and was selected by Tredgold as a general type of these works. The deflexion of the hammer beams and derangement of the queen-posts consequent on an excessive loading of the inner ends of the brackets, is quite apparent. The hammer beams of the opposite sides are now connected by bars of iron, a most unsightly and I fear equally ineffectual remedy.

King's College Chapel.—(Fig. 10.)

This roof, which has been very accurately delineated by Mr. Mackenzie, is curious, from the degree of care bestowed on its form and finish, considering its destination as a mere covering to the very beautiful masonry beneath. It illustrates the practice of first roofing in buildings to be vaulted with stone. "There are," says Rickman, "buildings in which, though the upper roof is shown, there is preparation for an inner roof; such is Chester Cathedral, where only the lady chapel and the ailes of the choir are groined, and the whole of the rest of the church is open; but on the top of the shafts is the commencement of the springing of a stone roof.

It is in perfect consistency with the usual order of events to suppose that roofs were constructed with principals of a simple arched rib antecedently to those of more complicated forms and grander dimensions; and at Conway Castle (1284) (Fig. 7) there are appearances which have induced me to suppose that the purlins and other timbers were supported by a series of stone arches and gables, serving the purposes of principals.

Guard Room, Lambeth Palace, 1450.—(Fig. 4.)

This is a very elegant roof of a simple wooden arch, but its precise date is not recorded. It has the lofty two-centred and bold tracery of early perpendicular work, and there is in Brayley's illustrations a memorandum under the date 1452, that on account of the great infirmity of Archbishop Kemp a convocation was adjourned from St. Paul's Cathedral to the Manor of Lambeth, and held in the High Great Chamber, *(altâ camerâ majori,)* which he supposes to be the room in question. It is said to have been the restoration of a still earlier guard room. Though now plastered over there is every reason for concluding that the rafters were originally exposed to view.

Hall and Chapel, Croydon Palace, 1450.—(Figs. 6 & 11.)

These furnish examples with the four-centred arch; and at the Moat House, at Igtham, Kent, is a very bold simple arch which when accompanied by spandril tracery, and the upper part occupied by king-posts and the other timbers, must have produced a very fine effect.

The Roof of the Divinity School, Oxford, may be instanced as a specimen of the arched rib, with pierced tracery in the spandril, supporting a ground ceiling with pendants and elaborate tracery.

In Rickman's work on "Gothic Architecture," is mentioned a roof at Willingham Church, Cambridgeshire, where stone ribs rise like the timber ones, the intervals are pierced, and the slope of roof is of stone; it is high pitched, and the whole appears of decorated character (1307 to 1377).

In smaller examples we often meet with arch-formed timbers serving (otherwise than for ornament) as auxiliaries to the principal rafters, and give no change of direction to the weight. Instances of this are found at South Wraxall (Fig. 12), the Vicar's Hall, Wells, and many other places.

Nursted Court, Kent, 1330.—(Fig. 2.)

At Nursted Court, situated about four miles due south from Gravesend, is a roof of singular interest, doubtlessly anterior to that of Westminster Hall, and attributed, with great probability, to Stephen de Gravesend, Bishop of London, who became possessed of the manor in 1338. In this example the portion of the weight which at Westminster thrown on the inner end of the hammer-beam, is here at once conveyed by a series of arches and posts to the ground. Mr. Carlos says, "The interior of the hall was distinguished by the singular construction of its roof, which was sustained on pillars standing within the area, in this respect differing from the generality of ancient examples which have reached our day, it is however highly probable that Westminster Hall was originally divided after the same manner. The roof appears to have been sustained on a frame work composed of two principal beams and two purlins, and supported by four oaken pillars disposed on two ranges on each side of the area, the beams being converted into arches by the addition to their soffits of arch formed timbers. It is illustrated in the "Gentleman's Magazine," for April, 1837, where there is a notice of a similar roof at Balsall Temple, Warwickshire. The School House, at Coventry (Fig. 5), is another example.

Crosby Hall, 1470.—(Fig. 14.)

Another class of roofs of considerable antiquity, but perfectly distinct in principle from those yet considered, based on the property of the triangle to resist racking or change of form, is met with in several of our colleges, at Crosby Hall, and in many later buildings. It is in roofs of this kind that timbers possessing the nature of a tie, or for which a flexible substance, as a rope or chain, might be substituted, are first advanced in English work, all beams in the former examples being either compressed or subjected to cross strains. This roof was well adapted for the oranamental ceilings of the sixteenth century, when the custom of concealing the timbers prevailed, and formed an easy transilience from the steep inclination of the old roof to the flat unbroken plane of "modern instances."

Gothic roofs, then, (using the term generically, in contradistinction to those with level ties) admit of an obvious and definite analysis into four classes, to one or other of which any roof may be referred. Three of these have the arch for their basis, and the science of equilibriation is called into direct action; the fourth has in itself a countercheck to lateral pressure.

The first class comprises roofs with simple arched ribs as at the Guard Room, Lambeth; the Moat House, Igtham; Ackwell Manor House, &c.

The second class comprehends those examples that have a grand arch spanning the entire width with axiliary timbers, by which part of the weight is suspended from the intrados as at Westminster, Eltham, Boddington, Iuxon Hall, Lambeth, &c.

The third class consists of such as have the arch supported by brackets, as at Hampton Court, Westminster School, &c.

The fourth class, or angular roofing, includes such as are formed of two intersecting triangular frames, in which the tendency to press out the walls is counteracted by the longitudinal stress upon the connecting beams, as at Crosby Hall.

In this latter class we arrive at a point where it becomes difficult to trace the principle of construction, and to determine with exactitude the object of the cross beams. In some instances their use as struts is apparent as at Old Basing Church (Fig. 3), in Hampshire, in others their usefulness as ties can hardly be questioned, as at Crosby Hall. I mention this ambiguity, because the original application of oblique or inclined ties has been attributed to Mr. Revett, an architect of the last century, and known to the republic of letters as the editor of the third volume of Stuart's "Athens." On the one hand it must be confessed that in the older roofs we can hardly be said to meet with timbers in a state of tension. On the other, if we reflect how decidedly the attention of artists was in Mr. Revett's time averted from our natural relics, we shall cease to be surprised if their just pretension met with neglect, and, in some cases, misappropriation.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By Henry Fulton, M.D.

No. 8.

The Farnese or Italian astylar seems likely to gain the ascendant in this country, and, perhaps, all things considered, it is well that it should do so. In the mind of every man of taste the Greek style is inseparably connected with a state of purity which rejects all adulteration, and (whether fortunately or not for the development of our own powers) our climate and customs require so many changes from the original, that in the adaptation of the style, it too often loses all its value, and becomes flat, stale, and unprofitable. Exceptions there are to this in favour of a few temples and isolated buildings, where the style may still be exhibited to advantage; and unpardonable indeed is the architect who does not seize on such opportunities when within his reach; as these must be relied on to maintain and hand down to posterity the true principles of the art.

But although the use of the Greek style, as defined by its orginators, must, for the reasons stated, be in a great measure abandoned, yet unless the love of it and a full and entire perception of its beauties pervade the whole soul of the architect, it would be better for us mortals that his proper calling was to build pigeon boxes or hen coops rather than National Galleries, Museums, Royal Exchange interiors, and club houses. If, in the chances of life, Canova had been cast away on some barbarous island in the Pacific, would he not, if obliged to cut jade into idols, have carried out, even with such materials and for such purposes, those principles of his art which he had acquired by studying the works of Phidias? If our masters—aye, our masters, for we must agree with Sir Joshua, who says, "From the remains of the works of the ancients the modern arts were revived, and it is by their means that they must be restored a second time. However it may mortify our vanity, we must be forced to allow them our masters; and we may venture to prophecy that when they shall cease to be studied, arts will no longer flourish, and we shall again relapse into barbarism," if the architects of the time of Pericles were now permitted to appear amongst us, would they not carry into the designs for our modern buildings the same principles which guided them in designing those structures which *ought* to be the admiration of the world?

Now it is precisely the lack of this feeling and perception, and not the difference of climate and wants which causes the failure of some modern architects. Take the ancient models to pieces, select, appropriate and combine *ad libitum*, but remember the principles, and do not deviate one iota from them. Invent, if you please, and treat your own inventions as you please, but do not take the same liberty with the inventions of others. Do not take a Greek cornice for the purpose of breaking it up into trifling parts, without reflecting that the Greeks themselves obtained grandeur and simplicity by its integrity, and that the same results may not follow a contrary practice. As Sir Joshua Reynolds aptly says, "however contradictory it may be in geometry, it is true in taste, that many little things will not make a great one;" if this be true in painting, much more is it applicable to architectural outline. Do not stick a Greek portico up against a building, because it will then have the appearance of not being part of the original design, but rather an after-thought, which may be easily removed elsewhere, and all the compositions of the Greeks had a monographical character, which gave their most elaborately finished works all the charms of simplicity. If a portico be required on the side of a building, or in any case where it cannot be made to extend the entire front, why not recess it *in antis*, and thus preserve integrity of outline? In truth we have both bill stickers and portico stickers all engaged in the laudable occupation of disfiguring our public and private edifices.

Do not let your pediments have the appearance of having been sliced off from some smaller edifice; that is, let the entire extent of the front be crowned with a pediment, or if that may not be, let there be none at all, for if you place more than one in the same line, as in the river front of Somerset House, for instance, then the composition must have the appearance of being so many separate edifices, and not as one design.

Windows we must have, although, as far as the Greek style is concerned, they are evils, still they are necessary evils, yet it is by no means necessary to make the evil greater and more apparent by means of incongruous ornament, if indeed we may use the word ornament to express any thing when it ceases to be ornamental. Why then do we find two little columns surmounted by a little pediment, which only appears to be made part of the building by an awkward process of grafting? Little columns and little pediments are little things and little in the acceptation of the term, when it implies mean or insignificant; they must have magnitude or they cannot have importance. The proportion generally given for windows is that the height shall be twice the width: in the Traveller's Club the columns of the windows are 10 ft. 3 in., and the interspace between the columns 5 ft.; taking the columns to be ten diameters high, this would give us no less than six diameters from centre to centre; in fact, with a little stretch of imagination, these windows look like the porticos of model temples let into holes in the wall, the centre columns being removed for the purpose of showing the muntons of the sash lights. In considering the subject of intercolumniation, I had recourse to my old friend Palladio, not for the purpose of seeing what he did, for I expected no ally in that quarter, but to see what he said, which may have some weight with those who take his works as their standard. He says, "The intercolumniation may be of one diameter and a half, or of two, of two and a quarter, of three, and sometimes more, but the ancients never exceeded three except in the Tuscan order. Great care must be taken to keep a due proportion, because if small columns are made with large intercolumniations, it will very much diminish the beauty of the former." It is moreover the invariable practice to diminish columns even when engaged, which in the case of windows must leave the opening wider above than at the bottom.

The apex of a pediment should be the crowning stone of the composition, the highest point in the picture; how is this character preserved in windows which have wall and cornice, and, it may be, other windows and pediments above them?

But perhaps it may be asked, "do you require merely a plain opening in the wall?" for my part, I can contemplate a plain cleanly finished, unornamented window, without feeling the same horror which arises from one of the ornate description first alluded to, or the shouldered and balustraded ones which are presented to us in great variety; but there is no necessity for leaving these openings destitute of all ornament, for moulded architraves may in almost every case be supplied with advantage. The Roman arch gives a good form of window, particularly for the ground floor; but it must be quite plain, without even a dropping keystone, which, indeed, looks like the consequence of a mistake on the part of the workmen, who may have accidentally placed the piers or jams too far asunder, and hence the dropping of the keystone. Mathematicians consider the circle as the most beautiful of all figures; the dropping keystone destroys its arc.

The Egyptians, by covering their walls with hieroglyphics, sought to convey and perpetuate information and instruction to the people, and their labours have survived the knowledge of the characters in which they were written. Some architects now-a-days cover their edifices not with graven precepts, but with scored lines, which have neither wit nor worth, excellence nor meaning. The New Zealander thus tatooes his face as the American Indian puts on his paint, that he may bear the distinguishing marks of his tribe; but it will scarcely be urged that tatooing is of the same use in distinguishing one class of buildings from another. Mr. Leeds, in his criticism on the Traveller's Club, says, "Rusticating of different kinds contributes in no small degree to variety and character in this style. Contrary to the idea the term itself at first suggests, so far from producing rudeness, coarseness or negligence, it is not incompatible either with richness or delicacy of finish." For my part, I can distinguish no difference, unless it be that in some examples there is more paring and frittering away than in others. "There is no beauty in straight lines," such as these which break up the surface without giving any breadth of shadow. A few lines are easily drawn on paper, but much labour is given to workmen, and consequently not a little expense entailed on those who are to pay; and for what? to make open joints for the reception of dust and moisture, without having a redeeming feature.

Columns are the most ornamental part of classical architecture, and yet they are quite unfitted for ornament, nor has the attempt to appropriate them for that purpose ever succeeded; the explanation of this seeming paradox is that their beauty principally arises from the exquisite variety of light and shade which they afford when properly insulated; but when engaged doing any thing else or doing nothing, we feel the want of that they do not give, and the more sensibly because they seem only to recall its absence to our memory. Engaged columns give the substance but not the shadow.

We must also notice the introduction of those bloated, stunted, pot-bellied, corpulent things called balusters, (although we regret they do not merit being designated by more elegant terms.) A critic in the March number of a contemporary journal speaking of the Gresham Club, (noticed in Observations No. 7,) says, "That the great merit of club architecture is to make a good kitchen;" and in place of giving any remarks on other points, gives in commendatory terms an account of the "lifts" for the dishes to pass to and fro, and the washing of plates; all this is no doubt very satisfactory to the readers of that journal, and german to the guzzle-ability and gull-ability of the civic members of the club, as well as creditable to the ability of the architect himself, however it may excite the risibility of others. In the façade of this club we have these architectural wall-*flowers* introduced no doubt as emblems of the fat contented state, which the culinary arrangements of the kitchen may probably produce. Sir Robert Smirke has placed these *gouty* columns (as they have been called) on the College of Physicians, for the more humane and noble purpose, as emblems of swathed *podagra*, to remind those who are afflicted with one of the most painful maladies which the pleasures of the kitchen bring, that here they may be relieved. Where it is not necessary to set forth on the elevation by means of these pigmy columns either the bane or antidote, if a screen be requisite, the iron founders furnish many examples in much better taste, more Greek and not less classical. In the Travellers' Club, for instance, both may be compared, and we can recommend this without the imputation of flattery because we bestow our praise to its back and not to its face.

Balustrades might be made highly ornamental and appropriate on gastronomic principles for "Club architecture," if instead of dwarf columns with their capitals reversed, specimens of fat inflated humanity were designed and placed in the same position.

It is the practice of some architects to treat their antæ and pilasters either to foliated or voluted capitals; now the true and legitimate use of a pilaster in a composition is to connect columns with the walls, that the transition be not too violent, and these connecting links should partake of the nature of both; which can be best obtained by neither fluting, diminishing, nor giving them capitals other than suitable mouldings.

Old women and children (it may be remarked without disparagement to the taste of some persons who do not rank as either) invariably prefer the Ionic and Corinthian orders to the Doric. This latter order is plain and severe, and can only recommend itself to the eye by its well adjusted proportions. It would almost appear that its inventors had felt this, and laid down an unerring rule, which, like the laws of the Medes and Persians, properly admitted of no change, namely, that two metopes, and two only, should intervene on the frieze between centre and centre of each column. It is true there is one instance of the contrary, but it forms the exception, not the rule, and it is an example rather to be avoided than magnified and taken as a precedent. I am very far from holding the opinion that the proportion of frieze just mentioned should not *in any* instance be deviated from, for even so much as the entire space of a third metope may be given and the eye shall scarcely detect it if the index be not given in the form of triglyphs. In the basement story of Carlton Terrace, facing St. James's Park, an instance of what I mean may be seen. But in the name of good taste, what innate beauty is there in a triglyph? Is there any form or figure in architecture more devoid of beauty? Yet as used it is the index either of beauty or deformity; it is either the index of a well proportioned arrangement, or the indication of a struggling and weak one, which can neither permit the eye nor the imagination to be deceived. In the Roman or emasculated Doric (which is no more a specimen of the noble order from which it is said to have been derived, and whose name in part it bears, than the unhappy modification of the *genus homo* is a fair example of the class whence he is taken, and whose garb he wears) triglyphs are of the same advantage as false curls are to the shrivelled and withered face of an old harridan, which, as the index respectively of due proportion and youth, only renders deformity, debility, and decripitude the more apparent: and although the age and infirmities of the ancient dame, even when thus indicated, may excite our sympathy, yet the Vitruvian epicene and fabled personification of the other sex has no claims on the extension of our gallantry.

An example of faulty metopical arrangement may be seen in the portico of the University Club, as it appears in Leeds' "Illustrations of the Buildings of London;" there are two columns flanked by coupled antæ, and the triglyph is not placed over the centre of the internal pilaster, and there are three metopes on the frieze above the centre intercolumniation; these incongruities and irregularities would not have been so evident if the frieze had been altogether naked or enriched with sculpture instead of the triglyphs. The Universities have some reason to be dissatisfied with such an attempt at a classical portico.

It neither was the practice of the ancients, nor is it of modern architects to introduce triglyphs into Ionic or Corinthian compositions, yet there seems no reason for not doing so, when the arrangement of the columns admit of it: but we have ancient examples in abundance, and too seldom followed, of sculptured friezes without triglyphs in all the orders.

The first and somewhat distant view of an edifice should give a bold unbroken outline; all ornament should from such a point of view appear softened into a mass, merely soliciting a closer inspection: and when to obtain this the spectator advances, the eye ceases to take in the outline, or to feel that it is all interrupted by the most highly finished or minute sculptured details: but if instead of these, broken entablatures, polytriglyphs, senseless rustic lines, and a spongy-looking surface meet his view, better nothing existed to incite a close examination. Of all the ancient architects, the Egyptians first, and after them the Greeks, alone seem to have been aware of the advantages of these principles. On these the beauty of a composition depends; without them an edifice may be ornate but not ornamental; convenient but not symmetrical; well constructed but ill designed; the work of a skilful builder who understands his trade, but not the production of an accomplished architect who aims at the highest walk in his profession; it may induce the groundlings to stare, but it must force the judicious to grieve; the censure of one of which ought, in the allowance of an architect to o'erweigh a whole crowd of others.

It cannot be denied that disappointment often arises when a structure is finished, an event which was not expected when the drawings of the design were in the first instance submitted for inspection. Employers seldom look at a design except as a picture, and they are ignorant of what the result may be in the solid. Unfortunately architects are obliged to minister to this state of things, particularly in cases of competition, and I believe that few are the instances where the most highly finished and tasty drawings have not been the successful ones; and when once these receive the fiat of approval, the architect is naturally loth to suggest any alteration. A geometrical elevation appears a cold stiff production to every eye that cannot realize its erection, hence the architect is tempted to set it off to the best advantage, and to give it pictorial effect by the introduction of light and shade, to procure which he must often break up his composition. In short, the efforts of the architect may be directed to produce a design on paper as the primary object; the erection of the edifice itself being altogether of secondary importance, and instead of his conception being (if I may so speak) in stone, it is on paper, and must be viewed from very different points of sight. The architect's whole thoughts are centered on the draught, on the ornamenting of which he spends the might of his mind, careless it may be of the effect, which must result in the solid, from his projecting lines which ornament his picture; and as drawings are generally to the subject what an inch is to ten or twenty feet, features scarcely observable are, when thus magnified, rendered unsightly.

It would be most desirable, in all cases, if models were prepared, instead of, or in addition to drawings; it is true some expence would be incurred by the practice, but in many cases it would tend to save expence. Buckingham Palace, for instance, a great part of which was taken down whilst the works were in progress, I believe more than once; and in others, the National Gallery, for example, it might save us a world of regret and disappointment. This is an inventive age, and as soon as the demand for models shall arise, we shall have suitable materials discovered for their construction.

It is said of Fuseli that on seeing a student in the Royal Academy staring at vacancy, he asked him what he was looking at, "Nothing, Sir," was the reply; "See something," retorted Fuseli, "I always see the subjects I am about to paint;" so it should be with an architect, he ought to think of the solid, and in this respect *building castles in the air* may not be an unprofitable occupation, as regards the advancement of his taste. Drawings ought merely to be the memoranda for the assistance of his own memory, and the means by which he wishes to demonstrate to others the subjects of his thoughts.

Some of our readers may be disposed to think that many of the observations in these papers are so trite and self-evident as to be uncalled for; I wish they could show me from modern practice that they were unnecessary; I wish they could bring forward the erections of the last ten years in refutation of what is here urged; then, indeed, the labours of "a mere amateur" would be superfluous, and I should gladly lay down my pen, and give myself up to the contemplation of the beauty of revived architecture. Mr. Gwilt and others have written and spoken with a righteous horror of the interference of "idlers," but let Mr. Gwilt and the rest not confine themselves to writing and speaking against amateurs, let them also write and speak openly against what those amateurs say. A certain clique are too generous, too candid, too much occupied with ideas of their own importance, to attack, even in self defence, an anonymous assailant: let us see what reply they can give to one who does not shelter himself in ambush, to one who although fully sensible of his want of powers to set forth things as he could wish, yet yields to none in a desire to promote a love and knowledge of the art, and who is thoroughly persuaded that the best method of doing so, both for the interest of the profession and the furtherance of the art itself, is to give the public the means of obtaining information. If the writer of these papers should have succeeded in the attempt to promote this, then he has written as he would; but if his endeavours have been marred by lack of ability then he has written as he best could, and he hopes that others more highly qualified may be induced to come to his assistance, point out his errors, and supply that which is deficient.

It has been too much the practice in all ages to meet suggested improvements and proposed deviations from established notions, with other than open and candid argument. Daring is the man who attempts to run counter to the prejudices of his age; *parva componere magnis;* Galileo was put into the Inquisition for asserting that the earth moves round the sun; and Harvey lost his practice as a physician for attempting to demonstrate the circulation; still we can now say with Florence's eldest son,

"The starry Galileo with his woes."

"It moves," as he said, when a ray of light entered between the bars of his prison and fell on a diagram of the Copernican system scratched on the walls of his dungeon. And although worse than monkish bigotry (considering the quarter from whence it came) assailed our own Harvey, still from its citadel, the heart, life's current flows and returns in the very circle which he pointed out. If the immortal conception of the Greek architects, buried amidst the rubbish of false taste, must lie neglected and dishonoured, let Resurgeram be graven on its tomb, for assuredly against us also it shall hereafter rise in judgment.

II. Mr. Gwilt in his Encyclopedia, 'expresses the laudable desire "to form, guide and correct the taste of even the *mere* amateur," and he says that "York Stairs, another of Inigo Jones' examples exhibits a pureness and propriety of character which appear afterwards unappreciated by his successors, with Wren at their head." Will Mr. Gwilt, the learned author of the Elements of Architectural Criticism, have the kindness to state what form, figure or feature of this erection "exhibits pureness and propriety of character?" I am sure the pleasure and instruction he can afford by doing so, will be shared with me by all the readers of this Journal, (I hope a numerous class) who desire to have their taste formed, guided and corrected.

Clonmore, Dublin, April 1844.

PROGRESS OF ART.—WESTMINSTER REVIEW, No. 80.

While the Quarterly, and the Foreign Quarterly Review, both of which used at one time to be rather frequent with architectural topics, together with others bearing upon the fine arts, now never touch them, the "Westminster" here gives no fewer that *four* articles of the kind, occupying one-third of the entire "Number." Architecture therefore seems to have turned up "trumps" in that *quarter;* and whether they be small or high trumps, it holds a most remarkably strong hand of them. The one which may be considered the ace of them, is played off first, viz., that entitled "Progress of Art," which, we may observe, in lieu of the writer's initials, has only a mystifying, * ?, attached to it. That the writer should not have cared to afford any clue to his name, is not particularly surprising; since he does not take a very flattering view of the Progress of Art, either among ourselves or in other countries,—in fact, he considers the Progress to be in some respects a backward and retrograde one,—to be one not of advance but of falling back upon antiquated forms and models, excellent in their time, and admirably adapted to the spirit of it; yet our time is not theirs: Europe is not China: the lapse of comparatively very few centuries has wrought a complete change in the European mind,—and not only in our social and outward habits, but in our mental ones likewise. Nought does it avail to say that such ought not to be the case, if such it really is; consequently it is for those who contend that things ought to be otherwise, to show how they can be made so. Surely Art has not yet gone through every possible phase of it,—has not yet revolved through the whole of its great Platonic year.

We must not, however, allow such vain questions—hardly less useless than perplexing—to detain us; neither can we pretend to notice here what the writer says in regard to the state of painting and sculpture at the present day; accordingly to his comments on architecture, little flattering, or rather, exceedingly unpalatable as some of them are, we confine ourselves. Be they truth or untruth, it is important that architects themselves should be fully aware what sort of opinions get abroad relative to themselves and their art. They may, indeed, shut their eyes and their ears, but they cannot compel the public to do so likewise, therefore it is as well for them to keep a sharp look-out, or they may chance to find the tide rushing in upon, and taking them by surprise when they are quite unprepared.

"Though the whole nation," says the writer, "have and always have had an interest, not only in the private edifices, but in the public buildings erected throughout the kingdom,—while the knowledge and enjoyment of the sister arts have been confined to the affluent and the educated, still architecture is with us at present in a worse position than either of the others, its professors have less title to the name of artists, and its best productions can only claim as their highest praise to be correct copies, or at most, successful adaptations of some other buildings erected in former times, for purposes totally different from anything we at present require. The cause of this, we believe, will be found to lie, even more directly than in the other arts, in the system of copying, to the exclusion of all original thinking, or, indeed, of common sense; and the reason why this should be so fearfully prevalent in architecture will be found to be principally in the anomalous system in which not only the patrons of art, but the artists themselves, have been educated in England."

We have next some severe but just remarks on "gentlemanly education" in this country, and the insufficient system pursued at the great schools and the two universities, with some lustily dealt blows at the latter for their utter neglect of art. Then, after some stringent remarks on the miserable sort of professional education which young men receive in this country, when placed as articled pupils to architects, the writer comes to some of the late, and of the living "notabilities" in the profession. Among the former, Soane, Nash, Wilkins, are fairly enough estimated by him,—we might say, rather favourably than the contrary, for considering the number and the kind of the opportunities afforded them, not one of the three achieved what he might have done; each of them was, besides, too much of a mere mannerist, and seems to have worked with a very limited stock of ideas. Mannerism, monotony, and penury of ideas, still more strongly characterize a *distinguished* living celebrity, who, as far as he has any character at all, may be described as the utter "negation of an artist." As such he is spoken of here,

"Sir Robert Smirke has adopted a safer plan than any of these men; his fame rests entirely on the sound masonry of his buildings, and the only attempt he makes at artistic effect is putting up as many Ionic columns as his employers will allow, One drawing made long ago has served for all his porticos, now about to be brought to the acme of perfection in the British Museum, where forty-four of these useless Ionic columns, placed in various rows, are to form the façade."

This is assuredly sufficiently expressive of contempt, in itself, yet we fear, will be taken, both by Sir Robert and many others besides, as very mild reproach. It is, indeed, by far too much so for so very great an offender—one who has injured art most seriously, and that not so much by his own miserable abortions, which might well be left to contempt, as by robbing it again and again of some of the fairest opportunities that have been afforded to architecture among our public and national edifices, nay absolutely nullifying them. If Pecksniffs there must be in the land, at all events let them not be thrust into high places. The man himself might have been a very respectable "*carcase builder,*" but as an architect is the poorest maudlin imaginable: still in his merely being so there would be nothing very remarkable, but that being so, he should have been allowed to go on to the extent he has done,—to commit failure after failure, is indeed most wonderful and supremely mortifying; and withal shows what kind of encouragement is bestowed in this country on architecture itself, and how far the patronage it receives is judicious, discriminating and sincere.

If towards Sir R. Smirke, the writer in the "Westminster" has been somewhat more lenient than many others, he has not been sparing of criticism towards one who has hitherto been accustomed to have to listen to it only as applause or even homage—we mean Charles Barry. That gentleman would perhaps have been better satisfied, had his works been more briefly mentioned; still he can bear to hear the truth as well as any body; while as to the writer, if he has touched one or two vulnerable points in the architect's greatest work, somewhat ungently, it shows that he is not over-awed by a reputation which seems to carry all before it. After a few strictures on Mr. Barry's club houses, the reviewer goes on to say—

"The Parliament houses are, however, the great architectural undertaking of the present day. Since the rebuilding of St. Paul's nothing so splendid has been attempted in Britain, and indeed, since Versailles, scarce anything on the Continent can compare with them. We have also the satisfaction of knowing that the design is the best of our best architect, and that instead of the grudging economy that is said to have spoiled so many of our undertakings in art, the expenditure here has been not only liberal but lavish; for had we been content with a plain, honest brick building, with stone dressings, such as would have satisfied our fathers or ourselves a few years ago, we might have had all the accommodation the present one will afford, and better arranged, for £150,000 or £200,000, whereas the estimates for this one already amount to £1,200,000, and it will not be finished under a million and a half. Here then is at least a million of money spent on pure æsthetic ornament, a sum that would have restored to their pristine beauty (if we wanted Gotbic) every cathedral or church in the kingdom, or would have established schools of art and design, with collections of art, in all the principal cities in the kingdom; this it has been determined to expend in realizing the design of one architect, and already the nation are beginning to tire of their bauble before they have got it, and to think they have paid too much for what they begin to find out will not be satisfactory when finished.

"The river front is now nearly completed, and as Mr. Barry declares it to be the best part of the design, we may safely assert that the new buildings, though clad in the very prettiest and best selected Gothic detail, will, when finished, be as much like the bold, meaning, purpose-like buildings of our ancestors as the very pretty Swiss peasant girls and very polite brigands and Albanians of our ball-rooms are like the rough originals.

"Every building of our ancestors expressed in every part the purpose for which it was erected, and with a degree of richness or simplicity suited to its destination; here, with the idea of producing a grand uniform whole, every part has been made externally to look exactly alike. The speaker's house is the counterpart of that of the usher of the black rod, and though the latter is obliged to share his residence with a librarian, that is not to be discovered from the exterior; and equal magnificence is displayed in the apartments allotted to the clerks of the House and all the inferior offices. Indeed, whether it is the great conference hall or the public libraries or committee rooms,—whether it is the Queen's robing room or a librarian's bed room, each is externally the same; and whether the room is fifty feet by thirty, or only fifteen feet square, the stories throughout are of the same height, unless indeed, as has been suspected, some of these fine looking windows are to be cut into two by concealed floors, a falsehood no Gothic architect ever was guilty of, and a meanness which two honest windows would never exhibit.

"It is needless to point out at what an enormous sacrifice of expense and convenience this has been effected; but what is worse, it is not only not Gothic, but is an attempt at the same silly pretension which induced Nash, in the Regent's Park terraces, to group together a number of small houses into one design, to make them look like a palace. The truth peeps out at every corner there, and so it does here; and if any one will take the trouble of clothing any of them in Gothic detail, Chester Terrace for instance, he will be surprised how nearly he has re-produced the river front of the Parliament Houses."

Long as is the foregoing extract, we must immediately follow it up by another still longer:—

"It must always appear strange how an architect could have gone so much out of his way to obtain this uniformity, and produce a prevalence of the horizontal lines over the vertical, for not only is this utterly abhorrent from Gothic in every case, but here, where he had a front about eight times the length of its height to deal with, all his ingenuity should have been exerted either to break the horizontal lines, or by bold projecting masses (as at Versailles), to prevent the eye following them, and thus take off the low street-like appearance the building now has; but, as if to make this still more apparent, the towers, instead of being parts of the river front, so as to give it height, are placed behind it, and disconnected, as if by contrast to make it still lower. It is lucky for the architect's fame that the land front, in spite of his worse judgment, will be broken and varied by the projections of Westminster Hall and the law courts, and will thus much surpass the river front; but it is painful to see the great tower placed so as by its mass to depress and overpower the Abbey and Henry the Seventh's chapel. It would have been difficult to invent anything that could be more prejudicial to them than this feature, which, if admissible at all, should have been placed where the speaker's house is, at the angle next the bridge. Had this been done, we should not have had the architect coolly asking for £120,000 to rebuild the superstructure at great temporary inconvenience to the public, and permanent detriment to the navigation of the river, and this merely because he forgot the existence of the bridge in making his design, or had not wit enough to know how to counteract the effect of it on the building. It is besides here, where there is a great thoroughfare and a fine open space (it is understood that the houses in Bridge Street are to come down), where processions and shows can be seen from the square, the bridge, and the river, that the Queen's and Peers' state entrances, with the Peers' House, should have been placed; not as they now are, in a back street of Westminster; and had this been done, and the south end devoted to the Commons, there would have been good grammar and good taste in building that part of a plainer and less pretending style than the north, half devoted to royalty and the peers. This would have been more appropriate to the confined situation, and the saving of expense as great as the additional convenience.

"If, however, the exterior shows all these defects, and many more, which it would be tedious to point out, the interior is far worse, which will be easily understood when it is stated that one-fourth of the whole area is occupied by eleven large and seven small courts; and as these are all entirely surrounded by high buildings, they will be at best but damp, ill-ventilated well holes, whose floors the sun will seldom see. They increase the expense of the building to an extent not easily calculated, not only by spreading it over a quarter more space, but they actually present more lineal feet of stone-faced wall than the whole exterior of the new building put together.

"Had the architect adopted one great court, with a glazed roof, running behind the river front, and divided into four compartments by the two houses and the central hall, these compartments forming four halls might have been surrounded by three tiers of arcades, something similar to the galleries of our old inn court yards, thus affording easy and cheerful access to all the apartments, and doing away with the tunnel-like corridors which at present occupy half the building. If, in addition to this, he had raised the roof of his ground floor about ten feet, and lighted it with good honest windows, instead of the loopholes which at present scarce admit light to render it habitable, a much smaller building would have afforded far more accommodation.

"It is not easy to conceive anything that would, architecturally speaking, have been more magnificent than this range of halls, extending at least 700 feet in length, and broken by the arcades supporting the houses and central hall, so as to take off every appearance of narrowness; and had something like fan tracery been adopted for the roofs, but with the fairy lightness that cast iron would have enabled the architect to introduce, and the interstices glazed with coloured glass, we might fairly have challenged the world to produce anything like it. In these halls, too, might have been placed the memorials of our great men; one court might have been devoted to our literary men, another to our men of science, whilst the others would have been occupied by our heroes and statesmen. Their statues might have stood in the centre, and their illustrious deeds have been painted on the walls.

"By bringing the ground floor into use, it would not only have given the building more height, which it much wants, but have provided space, in conjunction with the halls, for coffee rooms, committee rooms, waiting rooms of all sorts; and by adopting four covered courts instead of the open ones, so much space might have been attained that the building might have been set back fifty feet from the present line of front, and a good broad terrace road obtained, from which the river front might have been seen; at present it is entirely lost, and cannot be seen near enough to be examined from a boat; the present terrace, of thirty feet wide, is too narrow to admit of the building being viewed from it, besides not being accessible to the public."

The terrace is, in fact, not only too narrow, but much too low: it ought to have been raised twelve or fifteen feet more, or to about the same level as the foot of the bridge; that front of the building being still of the same height as at present, consequently loftier than those on the west side. Of course this would have caused material alteration of the plan within, because the principal floor rooms towards the river, must have been on a proportionably higher level than the rest; yet so far from being attended by inconvenience, that circumstance might have been made to contribute not a little towards interior effect, the ascent to those rooms being arranged somewhat after the same manner as will now be that leading up from Westminster Hall into St. Stephen's Hall.

Beyond the two last-mentioned portions of the future "Palace of Westminster," we apprehend, the scheme for fresco-painting and other decoration can hardly be carried out,—at least not so that the public can derive much advantage from it. No provision has been made by the architect for what was not contemplated neither by himself nor any one else, when he first formed his plans. The fresco painting scheme has been entirely an after-thought, and hardly practicable to anything like the extent that has been talked of. Little less than preposterous is it to suppose that decoration of the kind can be adopted for corridors, which, great as will be their extent, will be merely passages of communication—not at all too wide even for that purpose, and with no more light than what is absolutely necessary; yet, it is to be hoped that, come when they may, our English frescos will endure to be seen to advantage without being shown in twilight.

After Barry, Pugin comes in for some share of the critic's notice and animadversion, for while it is admitted that he not only understands the style he follows, but enters into the spirit of it, he is charged with wrong-headed enthusiasm, in endeavouring to dress us all up in the costume of the fourteenth or fifteenth century.

"It might please some enthusiastic persons," says the writer, "that we should give up our science and civilization, and return to the barbarous ignorance and simplicity of those days; but it requires no great sagacity to foresee that, so far from retroceding, we cannot even stand still, but must advance; and although, because we have no other art to admire, we are now wild after correct copies of old churches, it is quite evident that neither the symbolism nor the monkish superstition of the middle ages can have any permanent hold on an enlightened people."

So, too, think we: neither religious feeling, nor feeling for art, is likely to be in the slightest degree benefitted by the ecclesiastical mummery now so largely affected, and accompanied with no small share of hypocrisy on the one side, and of stupid credulity on the other.

SUGGESTIONS CONNECTED WITH THE ANTIQUITIES IN ASIA MINOR.

[The Government determined in 1843 to send out a fresh expedition to Asia Minor, under Mr. Fellowes' direction, to procure further marbles, and to investigate more thoroughly the antiquities of the neighbourhood of Xanthus. The Trustees of the British Museum appointed Mr. Hawkins, Jun., to assist Mr. Fellowes in his architectural researches among the monuments of the country; and the Council of the Royal Institute of British Architects having been applied to for instructions and suggestions to aid the travellers in their investigations, Messrs. Donaldson, Vice-President, Angell and Scoles, were requested to draw up a paper on the subject; the following memoranda were furnished to Mr. Hawkins.]

Most of the monuments in this country are either of the time of the successors of Alexander, or were erected during the Roman dominion. But if there be any of a remoter period they are of very great interest in connexion with the history of art and the usages of the earlier times.

Those of the higher antiquity will doubtless be of ruder execution, and the proportions not so graceful as the later ones of the Alexandrine period. The monuments of this latter epoch will generally be found to be purer in conception and execution than those erected either previously or subsequently; but not so refined as those of *Grecia Propria* of the time of Pericles. Under the Roman rule the wants and luxurious habits of the people increased, and some of the Roman usages were adopted. In these buildings, therefore, there will be found greater intricacy of plan, and frequently a mixture of brick and stone or of brick and marble construction, and the use of the arch more frequent. Examples of the early use of this important feature will be very interesting.

The edifices of the ancients in Asia Minor were frequently subordinate one to another; and their Agoræ, Temples, Theatres, Stadia, Gymnasia, &c., form very interesting groups. It should, therefore, be an especial study of the architect in Asia Minor to observe these combinations, and to mark the reference which one building has to another.

The temples will generally be found to be placed in the centre of a peribolus, which will have the usual propylea. Observe also the circumambient porticos, if any, of the peribolus; whether the inner range of columns, if there be two, be higher than the outer one. Remark, likewise, if there be any arrangement immediately in front of the temple, as for an altar, canopy, pedestals, seats, &c. The interior arrangement of the cella will doubtless be found peculiar in some examples, as for instance in that of Apollo Didymeus at Branchydæ, near Miletus. There is no complete plan of an Asia Minor temple known; those at Magnesia, Teos, &c., being so encumbered with ruins as to preclude investigation, without more means for excavation and removal of blocks than usually possessed by ordinary travellers.

There are many particulars still required respecting the ancient theatres, especially as regards the scene, *proscenium*, *pulpitum*, orchestra. For the lower portions of the theatres are generally piled up with the ruins of these parts. Observe whether the floor of the *pulpitum* be of stone or has been of wood. Remark whether there be any traces of the chambers or recesses for the echeia in the κοιλον or cavea as mentioned by Vitruvius—also the decorations of the scene—of how many orders it consisted, whether it had three or five doors, and any subterraneous passages, and how constructed.

Details of the arrangement of an Agora are desirable, showing the disposition of the shops and general form of the whole, whether square or oblong? Did there exist honorary pedestals or other monuments in the area? Were there two orders of columns one above the other? What temples or other edifices had immediate connexion with the agora? Its propylon—was it traversed by a road?

If any roadways still exist, observe whether they are paved with oblong blocks or polygonal stones—are there stepping stones in the streets as at Pompeii?

Some of the palestræ, gymnasia or baths were of large proportions, as those of Alexandria Troas, and Ephesus already published. But more particular details of such edifices are required; as not only plans but elevations and sections and mode of construction.

Remark also any aqueducts or triumphal arches—take details of the water channel or gallery (specus) and observe, if they have any coating of a strong stucco or cement, or whether they have merely a natural calcareous deposit resulting from the water itself.

So complete have been the illustrations of the details of Greek buildings in the several works on Grecian architecture, that mere details of mouldings and parts are now of less consequence, unless there be any striking peculiarity in them. But the general arrangement of edifices and the disposition of the halls, porticos, vestibules and various chambers in any group demand the especial attention of the traveller, which should be directed to these desiderata and also to the general plans of cities. The walls, towers and other warlike defences and fortifications may afford great novelty, particularly the entrance gates.

Sometimes there are burial places outside the towns at some distance with tombs, sarcophagi and other funeral constructions in a group; at others these sepulchral erections line the roadways leading to a city. Remark how the summit of the tombs was finished, and whether there be signs of a pedestal or statue on the top.

Carefully note all indications of colour on the architecture of this country—and if possible put at once on the drawing corresponding tints—if not write them down—and try to scrape off some of the colour and preserve it in a packet, carefully inscribed with the name of the monument, date and place whence taken.

If any temples should be discovered with the columns still standing endeavour to ascertain whether their axes be perpendicular or inclined either towards the cella or outwards.

In any cases where it may be practicable to excavate and clear away the accumulated earth from the ruins, care should be taken to note down and observe the precise situation of all the fallen blocks, previously to removing any of them, and an endeavour should be made on the spot to design a satisfactory restoration. In some instances the ruins of temples may be found prostrated in almost symmetrical order, and the columns, entablatures, pediments and acroteriæ, may be traced in regular succession. A careful examination of the situation of the fallen masses will also assist materially in ascertaining the causes of the destruction of the edifice, which in many cases will be found to have been occasioned by earthquakes, or by the hands of the conqueror.

All blocks of an irregular form, and which throw any light as to the construction of the masonry, should be measured, and a perspective sketch made of them, after the mode adopted by Mr. Cockerell, as shown in his contribution to the additional volumes of Stuart's Athens. The mortice holes for the insertion of timbers, cramp holes, the mode of tooling, the manner of working the beds, and all points relative to the construction will be found of great use. Observe also as to the mode supposed to be adopted for raising the masonry, for instance, the grooves at the ends of blocks or any other similar contrivance. Examine the description of marble or stone, and ascertain, if possible, the quarries from whence it was brought; these are often in the immediate neighbourhood of the cities and should be visited. Remains of unfinished columns and entablatures may sometimes be found in them. Notice the mode adopted by the ancients in disengaging the blocks from the rock—if by wedges, by fire, by sawing, &c. Where practicable, examine the foundations and lower courses of the buildings; notice the method and age of the construction, as it frequently happens that temples (as in the case of the Parthenon) have been erected upon foundations of a prior date to the buildings themselves. Any Cyclopean remains and works of the heroic ages, which may be discovered, should be carefully examined and described as subjects of paramount interest.

It will sometimes happen that fragments, wanting for the purpose of completing the restoration, may be found built up in an adjoining modern building, or in the walls dividing the fields.

The forms and construction of modern buildings should not be altogether overlooked. The resemblance between the modern constructed wood huts and the representation of beams and timbers in several of the ancient monuments is highly curious, and without doubt many ancient forms and modes have been handed down with but trifling alterations from century to century.

Marble doors are common in Asia Minor in the tombs. The mode of hanging them by pivots or other means should be noticed.

At Antiphellus are numerous curious tombs—a reservoir, theatre, &c., worthy of a visit and attention.

Among other indications of the site of an ancient city the existence of wells is often a guide to travellers in their researches. Tanks for the reception of water from the mountains also exist; and at Antiphellus (now Castelarizzo) is a circular reservoir, which also had the advantage of preventing the town below from being inundated.

Thomas L. Donaldson, V.P.,
Samuel Angell,
J. J. Scoles.

THE PHILOSOPHY OF TERRA FIRMA.

Having devoted the preceding chapters to a brief outline of the chief primary Causes of Effects manifest within the primitive ocean, and the phenomena of primitive earths of exclusive oceanic origin, I will now pass on to the consideration of earths of *Terra Firma*, elaborated by animals and vegetables, as produced by secondary causes, by the moving force of waters, and atmospheric affections, produced and still producing by a regular unbroken sequence of events, being the continuance of the one great chain of life, and still ascending in the scale of development. The primitive soils of the ocean, or more plainly speaking, those which are the exclusive products of the ocean, are silicates, and the earths of calx, and soda, forming sands and pebbles, marls of varieties, limestones, calcarious matters, salts, sulphates, muriates, carbonates, nitrates, and other characteristic fossil and mineral bodies: these several matters being (separately, and under numerous combinations,) the foundations of Terra Firma, and being the secondary and co-operative causes of all terrestrial phenomena embracing the living, fossil, and mineral kingdoms.

Professor Brande, in his lectures, given in this *Journal*, has told you that the presence of alumina is necessary for the generation and maintenance of almost all vegetable species; but he has not, neither can he inform you, under what conditions aluminous earths are formed. The oceanic earths of which I have previously spoken, have no aluminous clay, nor traces of this earth in their composition, unless they have been subjected to those influences by which this earth is generated. The island, and the district apportioned to the main continent, have not only no alumine, which is absolutely necessary for the maintenance of species, but the soil when first elevated above the waters, is wholly inimical to land vegetation, abounding with bitter acrid salts, mechanically and confusedly mixed with the alkaline earths. The conditions of change are atmospheric influences, thus the virgin lands disposed within the hot rainless regions continue bare and desolate for a long unbroken succession of ages, but where the rains fall or the lands are periodically or for any prolonged period of time covered by the freshes, the acrid salts rapidly disappear, contending acids and alkalies uniting, form neutral bodies, and the soil rapidly acquires the generating power. Again, there are secondary causes of fertility, such as sea birds resorting to the newly formed land, or masses of vegetable matter being conveyed there by the tides, or thrown thereon during storms. The species first generated on these desolate soils are uniformly species of mangrove, being aquatic plants, nurtured and fed by saline waters, containing much soda, and sinking within the waters in consequence of their consolidated nature: with these we find rank coarse grasses almost wholly composed of silica, and thorny shrubs of a dry brittle nature: neither the one, or the other, produce the black vegetable soil common to older strata, their chief constituents similating with ocean plants. In the course of time, the soil undergoes a change more favourable to vegetable existence, the dung of aquatic birds and vast quantities of fish brought by them and continually spread upon the soil contributes to increase this favourable disposition, and if rain, only occasionally fall, new species more exclusively belonging to the earth simultaneously or in succession make their appearance; acacias, gum trees, aromatic shrubs, replacing the trees and plants and grasses of a more decided character, as the former occupants die away, or diverge into new species, in conformity to the change of soil and local influence. The law of nature in spontaneous generation is climate and association: the deserts being disposed within rainless regions continue bare and desolate, except in those regions where the rains fall, where rivers and fresh waters spread over the soil, or where these waters find their way by percolating through the porous beds: on the other hand the countless islands of the Pacific derive a rapid fertility from the rains that periodically fall, as well as from each other by a variety of secondary causes, such as the conveyance of vegetation from the one island to the other, by the sea, by birds, and by man:—the generation and increase of vegetable earth depends therefore upon the generation and increase of vegetable species.

Soils of Terra Firma are the resolution of ascesent vegetables generally combined with variable proportions of animal matter; of a black colour; eagerly combining with the atmospheric volumes and with water, by which combinations various known products are generated; they are bibulous, reducible to dust, inflammable, and combustible, converted into clay, and from thence by transition into schist, again decomposing and passing into earths and ochres: sometimes passing into coal. Chemists by the tortuous means of fire produce from pure vegetable earth a definite compound, which they term *humus*, but the student must bear in mind that this compound is artificial, not existing in the natural state, and can only be obtained by causing the separation of those acids, which are part and parcel of the soil, and by oxydating the remainder by means of heat of fusion.

While the living inhabitants of the ocean are continuously occupied in generating consolidated gaseous and volatile products, the architects of Terra Firma, awakened into existence and local action, become in time equally effective elaborators of earths of other qualities than those previously existing; and in climates favourable to vegetation the earths gradually accumulate, forming vast aggregate masses in union with those oceanic products which they abstract from the ocean soil, or that are united with them by the moving force of waters. Of the numerous varieties of animal and vegetable existences peculiar to the earth, to fresh water lakes, streams, rivers, and even to the air, but very few retain their primary form on the cessation of vital action; of those few, some enter into the fossil state, but the great majority are either devoured by animals and pass through the digestive process, or they decompose, their atomic particles and peculiar compounds being received by the earth, the general parent and nursing mother of all—disseminating and combining with each other, and with oceanic substances, as the accident of locality and local influence may determine; the result of change being earths, fossils, and minerals, and also aggregate masses, termed mineral beds: the results produced by purely atmospheric influences, varying from the results manifest in oceanic beds, the material of the animal and vegetable structure being peculiar to the element under the conditions of which it lives, and is enabled to propagate its kind. We have seen the polypes existing by sufferance only, of latitude, dip, and inclination, and such, in fact, is the general law of nature, applicable to all living forms of the earth; and as the polypifus flourish most, and as all oceanic creatures are most abundant beneath tropical waters, so do we find animals and vegetables most abundant in those lands situate within the tropics which are favoured with excess of heat and moisture: many individual species having scarcely any limits to their growth or the multiplication of kind. Time, under all circumstances, is necessary for the full development of species, as it is for the full development of the earth: generations elapse ere the coral reef rears its head as an island or main portion of a continent: generations elapse ere the forest tree attains its maturity of growth, multiplies its species, and thereby generates those vast beds of vegetable matter and clay which meet the view in local portions of the earth. We have, it is true, no hills or mountains of bone, the reliques of terrestrial species; but we have masses of vegetable matter equalling in extent many of the coral formations of the deep. Beneath the Equatorial Band, in those localities which favour the rapid generation, destruction, decomposition, and change of organic bodies, these depositions of vegetable earth cover many thousand square miles of the surface of the earth, and contribute in many places to fill up the unfathomable depths of the ocean, being carried therein by rivers of vast magnitude. The trees of the forest possess, it is true, greater longevity than any known animal species, they stand for ages ere they become impaired by time or general accident, but during this prolonged period they are active agents of change, absorbing carbonic acid and atmospheric air, and thus adding to their consolidated structure, producing foliage, fruit, and flowers periodically—nay, perpetually changing—the leaves, flowers, and fruits falling to the earth, and adding to the vegetable earth previously formed, their volatile products dissipating and finally entering into new combinations, and being the proximate Causes of new Results. Again, vegetables constitute the food of ruminating and granivorus animals, of locusts, and varieties of the insect tribes, of worms and other creeping things of the earth, and of many of the birds of the air: man draws largely upon it for his subsistence, and myriads subsist upon vegetable alone; all adding, by the digestive process, to the animal matter of which they are composed, and also to the earth in the form of soil, cast out at the draught; and, added to the soil, unite with and become a portion of numerous consolidated bodies. Again, the roots of plants continually decay, and are as continually regenerated and extended; thus under whatever form or disposition vegetable matter is deposited on the earth, it adds its portion to the earth, and thereby increases the general sum of inorganic matter.

Animal and vegetable species of Terra Firma maintain their existence on the same tenure as species of the ocean: vegetables exist by the carbon elaborated by animals, as well as by the elements of air and water; they also abstract matters from the soil in which they exist; and they propagate by seeds or separation of parts: animal species are generated, are enabled to exist, and multiply their species by devouring animal or vegetable species: thus it is, in and throughout universal nature an interminable war is carried on, the strong devouring the weak, the weak preying upon and existing by the strong, death and the digestive process of the living continually adding to the soil, and the soil abstracting matter continually from the atmosphere and the waters; the fossil kingdom enlarging as species generate and decay; the mineral kingdom increasing in every vibration of Time, as generations rise and decay, and as matter composing the beds of earth changes in its character and qualities. As the naked polypes elaborate silica, as stony polypes, crustaceous, and molluscous animals elaborate calx and soda, so the vegetable species elaborate the elements of potash, many peculiar acids, and a variety of vegetable products, so animals elaborate oils, animal matter, iron, &c.; the elements of the one, and the elements of the other, uniting in death and contributing to form beds of the earth, in which, although every organic form is obliterated, individual character exists sufficient to enable man to identify its previous condition as a product of the earth. Place a bed of black mould by the side of a bed of chalk, how great is the contrast, how diversified the material, trace each to the fountain head of production, and the like phenomena are observable, countless species, differing from each other in form and character uniting in death, and producing ONE RESULT: blend the one with the other, after subjecting them to climate and consequent chemical action and change, and the results are the varied beds and mineral aggregates of this earth.

"It is generally considered," says Professor Brande, "that lime is elaborated by animal species;" such, indeed, is the expressed opinion of Linnæus and other writers, but it can scarcely yet be said to be the general opinion of geologists. Still, qualified as this admission is, it leads the way to admissions still more important—to a knowledge of facts still more essential to the elucidation of the enigma of nature: it is also admitted that vegetable earth is produced by the decomposition of vegetables, that much of its material is abstracted from the compounds air and water, and much more is formed by the digestive process of animals which feed upon it. The vegetable body, springing from a basis of vegetable and animal matter, is found, on ultimate analysis, to consist of the elements of air and water, and of carbon, the latter constituting the bulk of the vegetable body: the union of these compounds in definite proportions, determining, of necessity, the character of the plant, and the link in the chain of vegetable life extending in a graduated scale from the tremellæ, which have neither form nor size defined, nor appearance of organic structure, to the fungi, mosses, lichens, grasses, plants, and, finally, to fruit and forest trees.

In all climates we observe the first manifestations, the gradual increase, and the vast local accumulations of vegetable earth: the pulverulent lichens, requiring no vegetable soil in the first effort of vegetative life, clothe the barren rock, and in the gradual decay of portions of the roots and minute branches an exceedingly fine earth is formed, gradually accumulating and concealing the rock on which they grow from view: by this continuned increase the plant is eventually destroyed by a too rich soil, it perishes, and in its place foliaceous lichens, plants of larger growth, spring up, destroying all that remains of their humble predecessors, and these in turn give place to mosses. In the plains the acrid grasses and plants yield gradually to species of a more succulent and generous nature, and terrestrial animals always follow in the wake of the vegetable creation. The fossil kingdom is inimical to vegetable life, but as the mineral kingdom forms by and in the decomposition and recombination of these bodies, so the vegetable kingdom, when favoured by warmth and moisture, increases in extent and variety. Humboldt has remarked that in the Canary Islands, Guinea, and the rocky coasts of Peru, the pioneers of vegetable life are succulent plants: in the Pacific, vegetation forms very rapidly, from a variety of causes, and favoured by heat and moisture: in the deserts, as previously observed, the earth remains barren and unproductive age after age, and every region of the earth presents not only mineral and geographical features peculiar to itself, but also peculiar vegetation: "Thus," as Lamoreaux remarks, "the bason of the Atlantic, the west sea of the Indies, comprising most of the Gulf of Mexico, the East coast of South America, the Indian Ocean and its gulfs, the shores of New Holland and the adjacent isles; the Mediterranean and the Red Sea, all have a marked vegetation of their own, differing from each other."

In form, in matter, and in motions, Nature is equally variable: the production of one day disappears in the next; the etherial fluid becomes æriform, vaporous, or aqueous; the aqueous becomes consolidated as rock. Again they change, and again and again, as locally affected, without regard being had to their usefulness or to their utility, All things are Produced, all things are Producing, all things are perpetually changing in their parts and qualities. A stratum is formed to-day, it is destroyed on the morrow; the ocean retires before the earth; the earth is overwhelmed by the flood; the innumerable phenomena constituting earth being necessarily produced by uniting and contending motions, and uniting and contending matters, originating in one and in many causes.

In the changes continually taking place among inorganic bodies, elementary principles, and gaseous compounds, the like difficulties stand in the way of the man of science when he attempts to generalize upon particular phenomenon. Life departing, the passive clothing of life becomes a portion of the soil to which it is accidentally consigned, and the subject of new forces, the nature of the influences exercised upon it, determining the nature of the ultimate result. A forest is prostrated by tempest or by flood, and the wreck covering perchance several leagues, becomes gradually or suddenly entombed in the earth: it is then, the nature of the earth, and the peculiar influences to which it is exposed, determines the character the embedded fossil remains will assume: thus within an earthy soil, they quickly decompose, becoming a portion of that soil; imbedded in saline earths, they are preserved from decomposition, and become mineralized as coal; imbedded in peculiar clays, they perchance mineralize as slate; or, under other circumstances, become siliceous bodies, or proximate causes of the production of basalt; the ultimate result always depending upon the nature of the material in its mixture, and upon the elements to which they are subjected, and by which their changes are directed and governed, the organic body in death becoming the subject of new and peculiar disposition in its atomic parts and qualities, decomposing, or consolidating, as the accidents of circumstance may determine, their primary qualities being for ever lost in their new dispositions. Again, in the more complex organizations and combinations of nature, we see the folly of generalizing upon single phenomenon; for particular fossil species may be found in certain strata which bear a striking analogy to each other, but the Causes of Effects thus manifest may widely differ from each other; thus land animals may be, and often are found in oceanic beds: found, for instance, in the chalk and lias of England are often the relics of elephants and other terrestrial animals, formerly carried therein by running streams: and, again, oceanic animals are abundantly found in terrestrial strata, not only as primarily forming these strata, but also generally diffused through terrestrial earths by the moving causes of flood and fire: the accidents of a day, of an hour, may in a few fleeting moments have produced this complicated state of affairs: but, if the primary causes of many terrestrial vegetable species being locally generated and produced, forming noble forests, verdant savannahs and plains still exist, it follows as a necessary consequence, that the sum of terrestrial earth as vegetable soil still continues to increase; for in all bodies decomposition and recombination is rapidly going on, and all aluminous earths are the results proceeding therefrom. In the rainless regions, particularly the great deserts of the earth, immense local areas are nearly or wholly devoid of life, and as a necessary consequence vegetable earths are not to be found unless deposited in the line of rivers, in deltas, and narrow valleys, such as the Oasis; and this alone is a great testimony that the earths which cover the valleys are not produced as is generally asserted by the disintegration of ancient rocks, for the nature of the silt of rivers is always consonent to the nature of the soil, thus in some streams it is almost wholly composed of salts and vegetable earths, whereas in the absence of vegetable earth the matters held in suspension are such as charaterize the fossil soil, as magnesia, carbonate of lime, soda, iron, mucilagine salt, sulphuric acid, and other compounds belonging to fossil soils only. On the other hand, in local areas of the globe favourable for the development and increase of vegetable species, vegetable earths abound also, the local extent of production of the one depending on the increase of the other, for even when deposited in the beds of lakes and running streams, it is necessary that the ratio of increase be continually such as is consonent with the increase and decomposition of organic bodies from whence the supply is obtained. Thus it is, primary or fossil soils uncovered with vegetable species, and exposed to the action of running waters, suffer degradation to a very great extent, the hills and mountains become intersected with ravines, and beds of rivers are carried below the adjacent soil: the mountain ranges of Arabia and other parts of Asia, of Africa and Australia, suffer degradation to a vast extent during the monsoms or rainy season, the abstracted material being carried into and spread over the valleys and plains, or otherwise over the bed of the ocean from whence it was primarily derived, but in those places where vegetable species abound, the earth is protected from abrasion, and not only so, but the decomposed vegetable bodies carried by the waters into the valleys prevents any further decomposition.

It is an error generally embraced in the present day that the earth receives no increase, but merely changes in its parts and qualities, and that the sum of consolidated matter and of the waters continue the same for ever. This, although in conformity to the opinions of ancient philosophers, is as entirely at variance with the nature of things around us, as it is to facts coming under the cognizance of even common observers. From the waters in the union of oxygen, hydrogen, and nitrogen, aided by light and heat, species are produced, derive their increase, their several capacities and powers, and are enabled to propagate their species: the union of these elements in varying proportions of necessity produces varying results: and, again, with these results, thus generated by the living, the several elements of bodies, and decomposed portions of bodies, again and again unite, producing a further and indefinite series of resclts. Some of the cryptogamia, for instance, derive their nourishment and increase from the atmosphere alone, and thus consolidated matter, termed vegetable earth, is production in incessant decay and reproduction of these plants; quantity being produced from the continued generation of atoms in the unity of these atoms, and quality being produced from the varying mixtures of matter with matter, the earth obtaining increase by the processes of generation, dissolution, and change. Every organic body in the ocean abstracts by its mechanical or chemical operations a certain portion from the waters, the oxygen and hydrogen uniting according to the forces of affinity and motion, ammonia, carbon, and other proximate elementary bodies being produced, previously no existence, and when formed maintaining their integrity of character under numberless combinations, and being incapable of returning to their previous state. In like manner terrestrial species abstract from the waters and the atmosphere—a portion of this abstracted material is again returned to these elementary compounds, but another portion is retained by the body which is thereby enabled to maintain its position as a thing of life, to develope its parts, and to propagate its species. The earth teems with countless myriads of animals and vegetables, and life is sustained in and throughout the whole by incessant absortion, and consequent abstraction of atmospheric air, a fourth body carbon being the result, more concentrated in its nature and of greater specific gravity, and consequently having a greater tendency to consolidate; and the carbon generated by animal life is greedily absorbed and condensed in *form* and *body*, by vegetable species of simple organization and of simple elementary qualities.

The laws of nature, in production and reproduction, are regulated by the force of circumstances; orders are produced by local action and re-action and local influences; genera and species diverge therefrom by local action, accidentally or casually manifested; the genera, order, or species produced, the multiplication of like from like, depending entirely upon the accident of circumstance, over which they have no defined control: thus under favourable circumstances, and in the absence of destroying agents they rapidly increase and multiply, the trees become a forest, the polypes form chains of hills, and locomotive animals assemble in shoals—flocks and herds, or swarms, obscure the face of day. Under less favourable circumstances they become the sport and prey of hostile species, or of the elements; thus the forests are laid low, the flock and herds are destroyed by disease or by carnivorous animals, innumerable enemies thin the shoals of fishes, and storms destroy the gathering insect tribe; brought into being they become immediately the sport of circumstance, destroying and destroyed: the frog feeds upon the insect tribe, the serpent feeds upon the frog, the cormorant and the wild hog feed upon the serpent: each of these has its enemies, and last of all comes man, before whose wishes and desires Death marches terrific, mowing down all in his way. The law of nature is war!—war!—species arranged against species—life against life;—such is of *necessity*, otherwise the ocean water would become stagnant with the living and the dead, and terrestrial earth would for ever remain a desert.

There is, it is true, apparent harmony in the economy of nature, both in the ocean and on the earth, proceeding from the local distribution of animals and vegetables, arranged in groups and families, and also in the local disposition of inorganic matter, which, although produced by many, contains elementary principles and proximate principles, similating and in common with all: but, upon a close examination and analysis, we find that all aggregate masses of matter differ widely from each other, and, although the general aspect of the mineral compound may be such as to enable us to classify and arrange them, still there is a marked difference in the composition, structure, and qualities of aggregates bearing the same name. Motions and matter similating and prolonged to a certain period of Time, produces an apparent but no real regularity of disposition of strata, this apparent arrangement proceeding from similar Causes, by a series of dispositions of like qualities, and of like compound atomic particles, the matter thus brought together, producing ONE RESULT, the stratum thus formed having qualities peculiar to the class to which it owes its origin. In the union of matter inert there is no fixed law, for countless organic bodies of the animal and vegetable kingdoms are confusedly united together after the functional operations of life have ceased, and the nature of these bodies, and of the elementary principles with which they unite in the mineral kingdom, determines the nature of the strata; thus some, in union and general decomposition, form clay—others marls, varying in their qualities, according to thei r mixtures—others sands, or limestone, or other kinds of rock, or compound bodies. In all these Changes the Causes of effects produced may be many, but the result is ONE; the material of the stratum may differ in its local distribution, but the difference escapes the cognizence of the senses as we review the ONE WHOLE.

In the union of particles and proximate principles, of which terrestrial earth is composed, crystaline and cemented masses are produced, and even the ætherial and volatile principles loosely disseminated in the atmosphere, and in the earth, decomposed by the action of light and heat, unite in quantities with the particles and aggregates of matter: thus the bulk of earth receives a continued accession to its parts and quantities; the waters and the air enter into the composition of fossil and mineral aggregates: this being the case, it is not necessary to ensure the continual increase of the earth and decrease of the waters and the atmosphere, that the elementary constituents of organic bodies should be preserved together as one whole after the functions of life have ceased and the body has mingled with the dust; for were the leaves of a forest to volatilize entirely, even then, the volatile principles in their ultimate recombinations become constituents of the rocks, earths, metals, or gaseous products.

This difference in quantities and qualities would have no existence did Nature act by unerring rules: a compound aggregate mass of inorganic matter is naturally formed, but the object for which it is formed, or the intents and purposes of it application, are alike uncertain: there are peculiar kinds of rock, which man can severally and usefully employ, but, at the same time, it will be acknowledged that there is no necessity for any one particular kind of rock, for man could do without it, the earth could do without it, and its absence would very often be an advantage to production and re-production, and more particularly to man, whose brief career is passed in rendering nature subservient to his wants and purposes. Again, strata are produced, but there is no necessity for strata having peculiarity of form, composition, and character, for the use of a thing does not constitute its necessity, even admitting for a moment that it is useful; and this applies even to the precious metals, for, however desirable gold may be in our eyes, still it must be acknowledged there is no necessity for gold—man perhaps would be happier without it.

The stratum forms by the mere accidents of union of matter with matter; it disunites once more, and is irrevocably separated by the accidents of flood or fire, and new results are produced by the mere accidents of union. In all the changes manifest in this planet, Life is subservient to the building of consolidated matter, and this consolidated matter is in turn subservient to life, the accidents of *production* and the accidents of *destruction* equally affecting both. The laws of Nature are the laws of Forces, which regulate the distribution of Forces and consequent Action, and the union of bodies proceeds from the forces of affinity and cohesion which invariably govern the disposition of matter uniting with matter: thus, bodies unite with bodies, similating, or bearing relationship to themselves. Again, aggregates unite by the force of specific gravity and lateral pressure, or upon the cessation of motion, or the disposition of those forces imparted. It is from these necessary consequences of matter united, uniting, and contending with matter, that rocks, strata, and other compound mineral bodies are produced.

Philosophers of the present day have placed a record before us, facts the most astounding, of vast aggregate masses of terrestrial earth, being formed of minute animalcula: thus Ehrenberg speaks of his discoveries of chalk, earths, tripoli, and other compounds, being wholly composed of animal life: "At Swienemude in the Baltic," he observes, "where about two millions and a half of cubic feet of mud were recently removed in one year, one third of that entire mass consisted of microscopic animals. The Moors of Leinburgh present accumulations of fossil infusoria 28 feet in thickness. In the peaty layer of Berlin tunnel-shaped deposits of eggs reach in some places to the depth of 60 feet; there is no doubt," he says, "they are still alive, and capable of increase." The like phenomena are mentioned by American writers as manifest on that continent. M.

Fossil Oak in a Freestone Quarry.—A few days ago, some workmen engaged in excavating freestone from a quarry near Darlaston, discovered an oak tree, nearly 15 feet in length, in a complete fossil state, imbedded in the freestone. This matter is worthy the attention of geologists, it being a very rare occurrence that such specimens are found in freestone.

PROFESSIONAL POLICY.

Sir,—There is by far more truth than there ought to be—perhaps, not quite so much as there might have been—in the reflections thrown out against architects, in page 123 of your last No. Taken as a body, they do show themselves to be both too supine and too self-confident; and they seemingly take no other interest in their art, than what is suggested by a concern for their own personal and immediate interests. It would be folly to look for either among them or any other class of persons, such Quixotic public spirit as would induce them to neglect the latter for the former; still they might manifest something like a disinterested affection for art for its own sake,—supposing they really entertain any; or if they do not, they might, out of mere policy, assume some appearance of liberality of feeling, and might also pay some deference to public opinion. On the contrary, by doing nothing towards the encouraging extra-professional study, they appear rather desirous to check it, and to show themselves determined neither to countenance, nor to pay any attention to what is done or said by any section of the general public.

Science can shift for itself, because its services cannot be dispensed with; but art stands in a widely different position: it depends upon public sympathy and favour, upon a general disposition to encourage it,—which is likely, it may be presumed, to be in proportion as a taste for art is generally diffused and cultivated. If they do not perceive this, architects must be very obtuse; if perceiving it, they do not shape their course accordingly, they must be very disinterested—disinterested at least as far as their art is concerned. But what they do not perceive or now shut their eyes to, they may ere long very sensibly *feel*. Indeed, they might have found out ere this some of the consequences which are resulting from their own negligence and supineness. By standing aloof, and refusing to take any share in the task of enlightening the public on the subject of their art, architects not only betray an unworthy jealousy, but by their own incommunicativeness and silence, they actually surrender up to laymen and extra-professional writers a very important influence—that derived from the power of promulgating their opinions unchecked, and of guiding public taste, whether in a right direction or a wrong one. And though, individually, some of the writers of this class may be feeble enough; as a body they are not to be despised.

If no one else, Mr. Gwilt is, perhaps, now fully sensible of this, because so far from awing—as he, no doubt, flattered himself he should do—Reviewers, Amateurs, *et hoc genus omne*, into silence, his sneers and reproaches seem to have stirred up their blood, to have rendered them more daring and active than ever. He has certainly made himself conspicuous by rendering himself obnoxious, and a mark for their shafts, some of which are likely to remain sticking in him; neither does the poor "stricken deer" meet with any show of sympathy from the rest of the herd, whose maxim on such occasions is, *sauve qui peut*.

Another circumstance which does not say much for the *con amore* feeling with which architects apply to their art, is that, notwithstanding the extraordinarily great numerical increase of the profession, as far as they are concerned there is less encouragement than ever for architectural publications. Were it not for purchasers of a different class, there would scarcely be any sale at all for them. It is the same, too, in regard to works of the same kind imported from the Continent: not one copy in twenty—perhaps not even a single one, finds a purchaser among professional men; it may therefore be questioned whether the latter are even aware of the existence of many foreign publications of the sort, unless they happen to have seen them on the library table of some amateur. It may be that those among the profession who can best afford to purchase expensive architectural books, are those who least of all need them for any information or instruction to be derived from them. Still it might be presumed that whether they have actual occasion for them or not, they would be glad to possess them, just as they do pictures and other productions of art: nay, even if only in evidence of their own affection for *their own* art, and of their willingness to encourage it in every possible shape. But,

> pudet hæc opprobia *tantis*
> Et dici potuisse et non potuisse refelli,

—such is not the case: some of those who can afford to do most in the way of bestowing such encouragement on architectural literature and illustration, are precisely those who show themselves most niggardly; and that, sometimes to a degree quite incredible. Shocking as it may be to say all this, it is still more shocking that there should be any occasion for saying it at all; and to think of suppressing it is perfectly useless, because if it does not reach the public through one channel, it will through another, and the attempt to keep it back will only cause it to burst forth at last with all the greater violence.

As to myself I own that I might honour professional men much more than I now do, did I honour architecture much less.

I remain, &c.,

Censor.

AGRICULTURAL CHEMISTRY.

By Professor Brande, F.R.S., &c.

Lecture VI.—*Delivered at the Royal Institution, March* 3, 1844.

(Specially reported for this Journal.)

The great bulk of a vegetable consisting of carbon, hydrogen, oxygen, and nitrogen, the question arises, are these contained in the water, carbonic acid, and ammonia of the air, and the table given of the composition of these answers in the affirmative; the carbon is in the carbonic acid, the hydrogen in the water and the ammonia, the oxygen in the water and the acid, and the nitrogen in the ammonia. But it may be said that there is carbon in the soil as humus; true, but not in a fit state to act as food for the plant, which would starve when surrounded with these four elements, if they were not in a state of combination proper for its consumption. Carbon is of no use to the plant without it be combined with oxygen as carbonic acid, nor hydrogen without it be combined with oxygen as water, or with nitrogen as ammonia, nor nitrogen except, with hydrogen, it exists as ammonia. These gases are all evolved during the decomposition of animals. In a similar condition is man, for though he requires little else than the elements they contain for his life and growth, yet it is of no use offering him, water, carbonic acid, and ammonia as food; for him these must be elaborated by the plant into gum, starch, sugar, gluten, fibrin, &c. Thus it is seen that the plant feeds upon unorganised matter, but organizing it, converting it into its own tissues, it renders it into a proper condition to become the food of the animal, which, in its turn, converts it into its own substance; and then, to complete the circle, when the animal dies, his decomposing body passes again into those gases which are the proper food of plants.

First, as regards the water. This is always present in the air in large quantities as moisture, but is very variable, depending principally upon temperature and pressure, the supply being always kept up by the evaporation continually taking place. The greater the heat the greater the evaporation, and the more water the air can take up. When the air has not, for its temperature, the proper quantity of moisture, in passing over a field it deprives the crop of some of its water, by increasing too much the evaporation from the surface of the leaf, and is called a parching wind. When, on the contrary, the air is very moist, plants take water from it. Capillary action takes place continually in the juices of a plant, and the evaporation at the surface of the leaf, like that in the soil, causes the thin sap which rises into the leaf to go out of it thick and syruppy. This will serve to explain why the leaf contains so large a per centage of ash.

When water is cooled down to a temperature of 40°, it begins to expand, and continues expanding till, at 32°, it freezes. This expansion takes place with gigantic power, rending asunder the hardest rocks into which water has infiltered, and bursting leaden and iron pipes with facility. Phials, and thick iron tubes, filled with water, may be heard to burst if immersed in an artificial freezing mixture. In this manner the frost acts in disintegrating the soil. In passing from the liquid to the solid state, water gives out heat until it is solid, heat which was not previously sensible to the thermometer, termed latent heat. This heat, which is always evolved when liquids become solid, may be rendered evident by crystallizing a solution of a salt, such as sulphate of soda. If a hot saturated solution of this salt be corked up in a flask whilst steaming, the vapour condensing forms a partial vacuum, and the solution remains liquid; but so soon as the air is admitted, crystallization takes place rapidly, heat is evolved. and owing to the expansion, the liquid rises up the neck of the flask. This may be considered to represent what takes place during the freezing of water. Water is useful also as a solvent of air, as it will take up 1-36th of its bulk. The air which rain or snow contains has been found to have more oxygen than is in the atmosphere, as though they had a greater attraction for the oxygen than for the nitrogen. The proportion is increased from 21 to 32 per cent. It also has from one to six per cent. of carbonic acid. Thus it supplies to the plant air of much more favourable composition than the atmosphere. It also carries down with it a portion of ammonia, which gives to it the feeling of softness. This is of use to the plant, and though 1,000 gallons of rain water is nothing to be evaporated from a field, yet the amount of ammoniacal salts left behind is by no means trifling.

As in the passage from the liquid to the solid, water gives out heat, so in vapourising, or in the passage from the liquid to the gaseous state, water abstracts heat. Wet cloths are frequently wrapt round the head for thi purpose, the water evaporating carries with it heat, which it renders latent, taking it from any substance near it. It is essential for its change of condition, and yet can not be detected by the thermometer; deprive it of it, and it is again liquid. By absorbing its vapour as quickly as formed under an air pump receiver, water may be frozen, owing to the abstraction of heat by its own evaporation. It is from this cause that a wet soil is always a cold one, for when the sun does shine on it, its warming influence is neutralized by the action of evaporation.

These are the effects on plants from mere change of form. But as water is decomposed largely by plants, its composition must be next considered. In 100 parts, water consists by weight of

Oxygen	88·9	=	8
Hydrogen	11·1	=	1
	100·		9

or, by measure, two of hydrogen to one of oxygen; consequently oxygen is 16 times heavier than hydrogen, which is the lightest of gases, being about 1-15th of the weight of air. Resins, with which some trees so abound, have an excess of hydrogen in them. Now this can only come from the water which they decompose, and consequently we find that plants are continually liberating oxygen, no doubt principally from the water of which they have appropriated the hydrogen.

The best method of ascertaining the composition of water is to decompose i ; and if for that purpose electricity is employed, the advantage is gained of being able to collect the products separately. In analysing the air, only one of its components could be obtained, and that only by removing the other. But by bringing the poles of a galvanic battery into water, the electric current causes the hydrogen to separate from the oxygen, and each is evolved at a different pole, all the hydrogen at the negative, and all the oxygen at the positive pole. By placing glass vessels over the poles the gases may be collected, and it will then be found that the hydrogen will occupy twice the bulk of the oxygen, but if it be weighed, it will be found to be only $\frac{1}{8}$ of its weight. A lighted taper immersed in the hydrogen is itself extinguished but ignites the gas, which burns, if in contact with air, with a pale blue flame; immersed in the oxygen, its combustion is much more rapid and brilliant. These gases, when mixed and ignited, explode with great noise, and re-form water. But the best method of effecting this is to screw on to the top of a bell glass filled with the mixed gases, a Cavendish's apparatus, which consists of a strong glass vessel, through each side of the neck of which passes a platinum wire, which wires nearly meet in the interior; having previously exhausted this of its air, let the gases enter into it; then, after closing the stop-cock, without removing the apparatus, send an electric spark through its platinum wires from a Leyden jar, which will cause the gases to unite, and the water formed will trickle down the sides of the Cavendish; by again opening the communication, more of the gases will rush into the partial vacuum that is formed, and it may thus be repeated till all the gases are combined. It will thus be found that nine ounces of water can be decomposed into eight ounces of oxygen and one ounce of hydrogen gases, which may then be reconverted into nine ounces of water. Thus electricity is employed to decompose and to recompose water.

Next with respect to the carbonic acid. The base of this, carbon or charcoal, has been very highly recommended for its good effects when applied as a top-dressing. This was once attributed to the plants feeding on it in some way or other, but that idea is now discarded. It appears as though its action was principally due to its absortion of ammonia. Many substances possess this property of absorbing moisture and gases, but none to so surprising an extent as carbon. If a piece of fresh-burnt charcoal be exposed to the air, it will shortly be found to have increased considerably in weight, owing principally to the water it has abstracted from the air. But this property varies according to the source of the charcoal, as the following table exhibits:—

After one week's exposure of

Charcoal from	Lignum Vitæ,	it had gained	9·6	per cent.
"	Fir	"	13·	"
"	Box	"	14·	"
"	Beech	"	16·3	"
"	Oak	"	16·5	"
"	Mahogany	"	18·	"

But this property of charcoal is shown more remarkably with respect to the gases, many of which are rapidly absorbed to the extent of many times the bulk of the charcoal:—

1 volume of charcoal absorbs of

Ammonia	90 volumes		Carbonic oxide	9·42 volumes
Hydrochloric acid	85	"	Oxygen	9·25 "
Sulphurous	65	"	Nitrogen	7·5 "
Sulphuretted hydrogen	55	"	Hydrogen	1·75 "
Carbonic acid	35	"		

On this account charcoal is frequently employed to sweeten putrid water, by filtering it through it, and it is, after this operation, better fitted as manure than previously, as the substances it withdraws from the water are beneficial to vegetation. In this manner peat waters might be filtered, and the charcoal employed as manure.

But no property of carbon is so important to vegetation as its affinity for oxygen, being by that means converted into gas, and so brought to the plant in a fit state for food. In this manner it has derived its carbon, which in many plants forms nearly one half of their weight. Not that carbon, when pure and uncombined, shows any tendency, at ordinary temperatures, to combine with oxygen, but when in combination in the animal frame, or in the vegetable tissue, by respiration and decomposition, then carbon is readily converted into the gaseous acid. This being wafted over the surface of the leaf is by it, with the assistance of solar light, decomposed, its oxygen being again set free, its carbon, uniting with the elements of water, sometimes forming woody fibre, sometimes gum, with an excess of hydrogen, forming resinous substances, with excess of oxygen, forming acids.

Lecture VII.

When carbon in any state is heated to redness, it entirely passes off as carbonic acid gas; and if this be performed in a jar of oxygen instead of air, the combustion is rapid, and the whole of the oxygen is converted into carbonic acid. If the properties of this gas be then examined, it will be found to extinguish a lighted taper, and if an animal be inserted in it, it will be deprived of life. Air containing one tenth of it causes drowsiness in man, followed by torpor and death; its action is then like that of a narcotic; but when pure, it suffocates instantly, causing spasm of the glottis. The oxygen is combined with the carbon in this gas with so great an affinity, that it almost baffles the chemist's art to separate them. He is obliged to have recourse to his most energetic means in order to do that which the minutest plant is doing so constantly, so easily, and so largely. Phosphorus has not the power of abstracting the oxygen, but if burning potassium be inserted into this gas, decomposition is effected, potash formed, and carbon liberated, which may be rendered evident by diffusing it through water. Carbonic acid is heavier than air, in the proportion of 15 to 10, owing to which it may be poured from vessel to vessel like water, this being rendered evident by the extinction of a taper. It may even be transferred by letting down a little bucket into a jar of the gas. But after a time it will be found to have vanished, for it possesses a property common to all the gases, heavy or light, of mixing with each other till they are perfectly blended. Also heat, by expanding it, causes it to ascend, and it may thus be expelled from a vessel by inserting a red hot ball. Owing to these properties, it is, that it gets diffused in the air so evenly, and its injurious accumulation prevented. Many substances absorb carbonic acid, as is proved by dipping a sponge in caustic alkalies and placing it in a jar of the gas over water. In a short time the water will rise and fill the vessel. Lime, also, rapidly absorbs it, losing thereby its causticity, being converted into chalk. From this chalk it may be again driven by the action of a stronger acid, and this is the readiest means of producing it. The difference of action of this gas and oxygen on a combustible body may be beautifully illustrated by inserting a taper with a long wick, just blown out, into a tall glass jar, the upper part of which contains oxygen, the lower carbonic acid; the glowing wick is ignited on first insertion, on lowering it to the region of the carbonic acid it is extinguished, raising it up to the oxygen it is relit, and with care this may be repeated many times.

Water at the common temperature and pressure absorbs its own bulk of carbonic acid, but will dissolve more exactly in proportion to the pressure given. It is in this manner that water is so strongly impregnated with it to produce soda water, it communicating to liquids a peculiar agreeable pungency. Its solution reddens vegetable blues, proving its acid quality. Plants can decompose it as readily when it is dissolved in water, as when in air, the action taking place at the surface of the leaf. It is the peculiar characteristic of animals to produce carbonic acid, of plants to absorb and decompose it. The enormous increase of carbon in plants in a short time, is truly surprising, and many experiments have been performed, the precautions taken being such that the plant could derive carbon from no other source than the carbonic acid of the air. Grown in calcined clay and water, seed peas have been found to increase in three months as follows:—

Original Weight.		After 3 Months.	Increase.
Carbon	515	2376	1861
Hydrogen	59	281	222
Oxygen	440	1650	1210
Nitrogen	46	101	55
	1060	4408	3348
Ashes	12	33	21
	1072	4441	3369

Seed wheat grown in sand and water, in three months, increased as follows:—

Original Weight.		After 3 Months.	Increase.
Carbon	460	880	420
Hydrogen	58	105	47
Oxygen	441	810	369
Nitrogen	35	37	2
	994	1832	838
Ashes	6	6	
	1000	1838	

But the quantity of carbon thus abstracted from the air being so enormous, and the carbonic acid being present in it in so small a quantity, the question arises, is the air competent to supply such a demand? To ascertain its probability, a few calculations are required, the data for which are well established. The average weight of a crop per acre is about 1½ ton, and as on the average one-third of the weight of a plant is carbon, the total carbon in the crop may be reckoned as about 10 cwt. per acre. The weight of the air is about 15 lb. per square inch, and taking the weight of the carbonic acid present as 3 in 1000, and 63 grs. of carbonic acid to contain 17 grs. of carbon, it will be found that the air on each acre contains about seven tons of carbon, and therefore, if the whole earth were cultivated, it could only support vegetation for 14 years. But as no proof exists that the quantity of carbonic acid in the air is lessening, and as it is being removed so enormously by vegetation, whence can come the supply which maintains the equilibrium. There are at least three sources that can be pointed to as supplying vast quantities of carbonic acid, viz., animal respiration, volcanoes, and combustion of fuel.

1. After respiration, the quantity of carbonic acid present in the air, will be found to have increased a hundredfold, it forming one-fifth of the expired air. It will not then support either life or combustion. Passed through lime water it renders it turbid, from the formation of carbonate of lime. It is calculated that the carbonic acid exhaled from the lungs in 24 hours contains from 5 to 8 oz. of carbon, or from 100 to 160 lb. in the year, the difference depending upon the amount of exercise taken.[1] With increased exercise more carbon is consumed in the system, and more heat produced, exactly analogous to the consumption of carbon in a charcoal fire, carbon when being oxidised always evolving heat, whether it takes place quickly or slowly. Animals, such as horses and cows, would, from their bulk, be expected to exhale at least twice as much as man, but it has been shown by Boussingault, that they exhale very little more than man. The inhabitants of Great Britain being taken at 20 millions, and supposing that other animals expire about the same quantity of carbon, it will be found to amount to about two million tons, or sufficient for about four millions of acres of cultivated land.

2. Volcanoes, both active and extinct, are continually pouring into the air torrents of carbonic acid. From one in the neighbourhood of Coblentz, it is reckoned that 90,000 lb. of carbonic acid are daily evolved.

3. The combustion of 20 millions of tons of coal, which is the annual consumption of Great Britain, adds to the air 14 millions of tons of carbon, and as each acre of vegetation is reckoned to require half a ton, this alone is sufficient for 28 millions of acres, or nearly seven-eighths of the arable land, as it is considered that there are about 34 millions of acres in cultivation.

By such means as these, then, is the carbonic acid restored to the atmosphere as fast as it is abstracted by plants, and thus the balance is maintained.

With regard to the ammonia. This is always present in the air, and is carried down in some quantity by rain. It is considered to be the source whence the plant derives its nitrogen, and not from the air. When its constituents, nitrogen and hydrogen, are mixed together, they do not combine, nor can they be made to combine directly, but it is formed invariably during the decomposition of substances containing these two gases. If horn shavings or other animal matter are heated, ammonia is evolved, and it is even given off during the burning of a cigar and the distillation of coal, thus having both an animal and vegetable origin. It will neither burn nor support combustion, is rapidly absorbed by water, and being an alkali, renders turmeric paper brown, and restores the blue to liquids that have been reddened by acids. It may be made to combine with excess of oxygen and then is converted into nitric acid and water; in this manner nitrate of ammonia is formed during lightning, and Faraday considers it likely that the points of trees, being silent dischargers of the electricity of the earth, in this way contribute to the formation of nitrates in the air. Rain water, evaporated along with an acid to prevent the ammonia from volatilizing, will be found to contain nitric acid, sulphuric acid, and ammonia, thus supplying to the plant its necessary ingredients. The quantity of nitrogen in plants varies, but is always present, even when the soil contains none, and therefore in such cases must come wholly from the air, as must also be the case with wild plants and trees. Boussingault, to whom science is much indebted for the laborious manner in which he has investigated these subjects, testing theories by practice on a large scale, found that in five years' rotation of crops the nitrogen as well as the carbon, was present in greater quantities than the soil could possibly yield. A crop of Jerusalem artichokes, which gave 23,500 lb. to the acre, contained 38 lb. more nitrogen than the soil could have given.

The quantity of nitrogen that various crops contain, and its proportion to the carbon and other constituents, is well seen in the following table:—

	Hay.	Red Clover Hay.	Potatoe.	Wheat.	Wheat Straw.	Oats.	Oat Straw.
Carbon	458	474	440	461	484	507	501
Hydrogen ..	50	50	58	58	53	64	54
Oxygen	387	378	477	434	390	367	390
Nitrogen	15	21	15	23	3	22	4
Ash	90	77	40	24	70	40	51
	1000	1000	1000	1000	1000	1000	1000
Water	158	210	759	145	260	151	287
	1158	1210	1759	1145	1260	1151	1287

Although the quantity of ammonia contained in rain water is very small, one pound containing but a quarter of a grain, yet when the total annual quantity of rain that falls is considered, it will be found to yield a considerable amount of nitrogen to the plant. The average number of inches of rain that falls in Great Britain is about 22 inches and four-tenths, which will give a weight of 117 lb. to the square foot, or 5,096,500 lb. per acre, and at a quarter of a grain of ammonia per pound, is equal to about 120 lb. of nitrogen. Nitrogenous substances are useful to plants, not only as forming part of their substance, but as acting as a stimulant, enabling it to draw the same substance in greater quantity from other sources; in a similar manner salt, muriate of lime, and other substances, are supposed to act, as by their agency the gluten or nitrogenous part of wheat is always increased.

It has thus been shown that plants require two classes of food, organic and inorganic. The inorganic must be rendered soluble, and must be the same as are found in the ashes of plants, which are separated from the other parts by burning. The organic food, composed of carbon, oxygen, nitrogen, and hydrogen, must be presented to it in the form of water, carbonic acid, and ammonia. Having thus then considered the constituents of which all other parts are built up, it remains to examine the subject under three heads:—

1st. The products elaborated by the functions of the plant, known as the proximate elements.

2nd. The mode in which, by its vital force, it eliminates them.

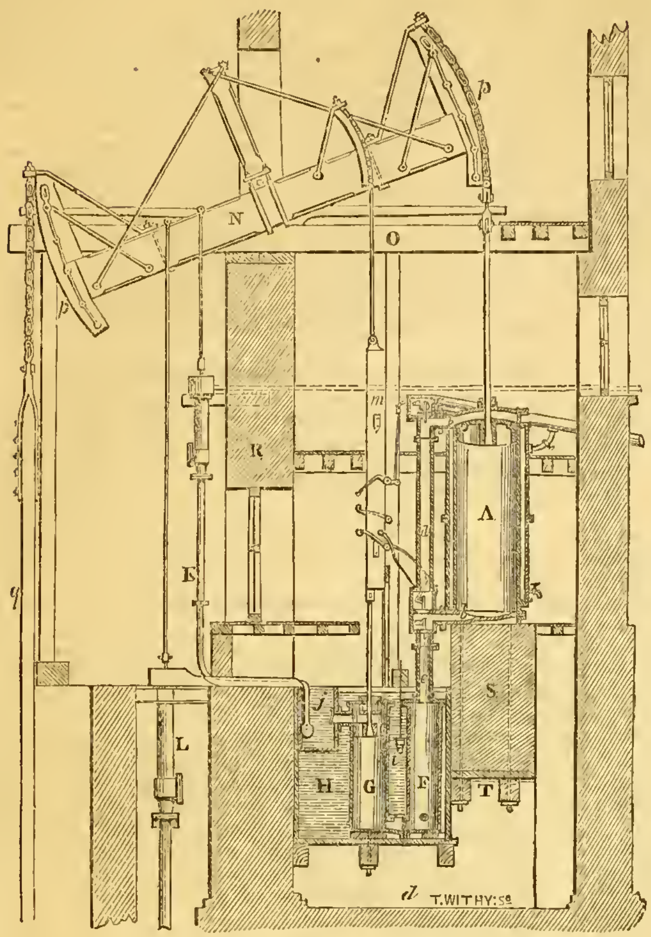
3rd. The mechanical conditions of the soil requisite to enable the plant to carry on these operations in the greatest health and vigour.

Ellis's Improved Turn-Table.—The objection to placing turn-tables of the ordinary construction on the main line of a railway, is, that, by the nature of their construction, they are rapidly destroyed, by the frequent passage of heavy trains over them, besides the injury done to the carriages, and the unpleasant motion and noise. Mr. Ellis has constructed a turn-table, which, when not in use, rests firmly on the curb, and thus allows the train to pass rapidly over it without injury. The iron pintle of the table on which it turns being kept well oiled, works with a loose collar round it in a vertical iron case; which case is supported and kept in its central position by two cross arms of cast iron, at right angles to each other, and attached to the curb. The lower end of the pintle passes through the bottom of the case, below which is a stirrup attached to a cross lever passing at one end through a chase in the circular masonry, or brickwork, supporting the table: attached to the external end of the long lever, is a second lever, working in a vertical direction, and connected with a third, or handle lever, by which the table is put in motion or fixed, as required.

Fountain Extraordinary.—The great fountain now in progress at Chatsworth, is expected to play to a height of upwards of 200 feet. The fountain that plays the highest jet of any fountain in the world at present is in Germany, but the proposed fountain at Chatsworth is expected to surpass it in height about 20 ft.—Derby Mercury.

[1] According to this calculation, the carbon of the daily food, amounting to about 1 lb., is one half returned to the air as carbonic acid.

MESSRS. BOULTON & WATT ON THE STEAM ENGINE.



WATT'S SINGLE ACTING ENGINE FOR PUMPING.

A, Cylinder. *b*, Nozzles and passages. *c*, The cross or steam pipe from boiler. *d*, Perpendicular steam pipe. *e*, Eduction pipe. F, Condenser. G, Condenser or air pump. H, Condensing cistern. *i*, Injection valve. *j*, Hot water cistern. K, Hot water or feed pump. L, Cold water pump for supplying condenser cistern. *m*, The plug tree and working gear. N, The great lever or beam. O. Spring beams. *p*, The great chains and arch head. *q*, Pump rod or spear. R, Main lever wall. S, Masonry or stone platform. T, Wooden platform and bearers to carry masonry.

We now resume this important subject:—

Directions for Putting the Engine together.

SECT. 21. Put the working beam together, and having fastened the gudgeon to it, rest it on the plummer blocks; but do not fasten these to, until the cylinder be fixed.

22. Level the top of the stone platform, and put the outer bottom of the cylinder down in its place; level it truly; and let it correspond with the holding down screw boxes.

23. Apply the inner bottom upon the outer one; and set its upper joint level, by wedging between it and the outer bottom, if required. Then cut out segments of pasteboard, such as is used for boards of books, and not such as is composed of paper pasted together. Let these segments be of such thicknesses as the different parts of the joints may require, accordingly as they be more or less open in different places. Soak the pasteboard segments in warm water, until they become quite soft; then lay them upon boards to dry, and, when quite dry, put them into a flat pan, with a quantity of drying linseed oil. Warm the oil, until the pasteboard ceases to emit bubbles of air; but take care not to heat the oil much hotter than boiling water, otherwise it will harden, or burn, the pasteboard. Anoint the segments on both sides with thin putty, made with fine whiting and some of the linseed oil. Let the whiting be very dry, otherwise it will be very difficult to mix with the oil. N.B. White lead will not answer in place of it. Avoid, as much as you can, using more than one thickness of pasteboard. The segments should be a little broader than the flanch. All the holes should be cut out by a chisel; but not quite so large as the holes in the iron. The segments should also be thinned at the ends, where they overlap each other, that they may form a circle of pasteboard of uniform thickness.

24. Lift up the inner bottom, and lay your segments regularly round upon the flanch of the outer bottom; then place the inner bottom upon them, taking care, at the same time, to put a proper thickness of pasteboard in the joint under the pipe, which proceeds from that inner bottom. In like manner prepare pasteboard for the joints between the inner bottom and the cylinder; and proceed, as has been directed, for the other joints.

25. Having the cylinder ready suspended, lower it down in its place; and in such manner that the square pipe, at its upper end, may be exactly over the pipe of the inner bottom. Thrust a square taper piece of iron, of proper size, into each hole, to enlarge the holes in the pasteboard, and admit the screws. Put in the screws, and screw up the joint, gradually, all round; and do not screw up one side faster than another, or you will be apt to crack the flanch of the cylinder, or bottom, or make a bad joint. No screws must be put through the cylinder flanch over the pipe; therefore that part of the joint must be made with the utmost care, and the pasteboard must be a trifle thicker there. The general thickness of the pasteboard for these joints should be three-sixteenths of an inch.

26. Put in the holding down screws, which should have screws and nuts at both ends; then set the cylinder truly upright, which is done by putting one piece of wood across the bottom, and another across the top, and marking upon both of them the centre of the cylinder at their respective places. Then hang a plummet from the upper centre, and examine if the line be in the centre below; if it be not, you must wedge under the outer bottom, until you bring the line to hang truly in the axis of the cylinder. The holding down screws should be screwed tight, so as to keep the cylinder in its true position after which the screws of the joint must be again screwed up, then taken out one by one and lapped round with a rope yarn and some putty, both under the head of the screw and under the nut, so that each screw may be air tight of itself.

27. Carefully scrape, or rather scour, the rust from the sides and bottom of the cylinder; clean it well out, and grease the sides with tallow. Hang the chains, and put the piston rod cap in their places. Put the piston rod into the cylinder; suspend the piston by two half links, fastened to one of the crosses, and lower it down upon the piston rod. But previous to this, the rod should be tried into the piston; and if the hollow and convex cones do not fit one another, they must be made to do so by chiseling and filing the cone of the rod. A lead ring, an inch square, exactly fitting the inside circumference of the cylinder, must be laid upon the small rim of the inner bottom, to save it in case of dropping the piston; and an iron gland, an inch thick, must be screwed across the base of the cone of the piston rod, by means of two screws passing through the bottom of the piston, and screwed into the gland. The joints of these screws should be cut off, that they may not strike the bottom, when the piston strikes the ring.

28. The piston being lowered down upon the rod, the lid of the cylinder should be laid on without the stuffing box. The end of the working beam must then be lowered down, and the piston rod cap put on the rod, and forelocked fast. The beam must then be raised, and the lid also, and an examination be made, whether the piston has dropped truly down to its place upon the rod. If so, the lid or cover must be let down, and by lowering and raising the beam and the piston, you will perceive whether the rod always moves up and down truly in the axis of the cylinder. It must be made to do so by shifting the plummer blocks out or in; or by shifting the martingales to one side or the other. The utmost care should be taken that the plummer blocks be placed both of one height, and after the beam has been some days in place, it should be examined if the gudgeons be truly horizontal, as otherwise it will cause a most disagreeable motion in the piston-rod.

29. Caulk the joint round the inner bottom, between it and the pipe of the outer bottom, with rope yarn or oakum, as hard drove in as possible. Screw the nozzle to the pipe of the inner bottom; making the joint as has been directed, and with the utmost care, so that the nozzle may hang a quarter or half an inch lower at the point than at the joint, that any water condensed in it may run to the exhaustion pipe. Put a strong wooden prop from the ground to the lower side of the nozzle, right under the perpendicular steam pipe; and care should be taken that the inside of the bottom of the nozzle be even with, or rather lower than, the inside of the bottom of the pipe which comes from the inner bottom of the cylinder, so that no water may lodge.

30. Put on the steam case, screwing the panels together with a few screws. If found to be too short, it may be lengthened by means of a lead flanch put in the middle joint, with a thickness of pasteboard on each side of it; but if found too narrow, and the deficiency, upon being divided equally amongst all the joints, amounts to more than a quarter of an inch, to each joint at the inner side, then a bar of iron must be prepared of such breadth as will make up the whole deficiency, and as thick as it can be received between the screw holes, in the perpendicular flanches of the steam case, and the rings on the cylinder. This bar must be put into a joint of the steam case, on the backside of the cylinder, and be made tight by caulking, or by pasteboard. Re-

member to put the middle of a panel opposite to the perpendicular steam pipe.

31. When you have found that the steam case is of a proper diameter and length, or have adjusted it as has been directed, it must be made tight. Make the joint between the panels, behind the perpendicular pipe and the upper and under rings of the cylinder, by applying a proper thickness of pasteboard and putty, or soft roping, upon the cylinder rings, before you put up these panels; or if you perceive that the joint will admit of it, yoû may wind a soft rope, slackly twisted, once or twice all round the cylinder rings; then screw the perpendicular joints of the panels together (putting in all the screws) until the insides of the joints are quite close, or as close as they will admit; afterwards take oakum, mixed with some putty, made with thick linseed oil; or a soft rope covered with putty, and, with a caulking chisel, drive it forcibly into the joint, and continue caulking in, a little at a time, until you have filled the joint quite to the outside of the flanches. Remember to put oakum, or soft rope yarn, under the head and nut of each of the screws; and do not force the screws too much, lest you break the flanches. Trust, rather, to the caulking. In like manner you must make tight, by caulking the joints between the steam case and the upper and under rings, using a crooked chisel, for more conveniently getting at the under one.

32. Put on the upper part of the lower nozzle, and make its joint. Set on the perpendicular steam pipe, and try the upper nozzle to its place; if the pipe prove too short, lead flanches of a proper thickness must be introduced, equally above and below, to make up the length; but wherever lead flanches be used where hot steam comes, it is necessary to put a thickness of pasteboard, with putty, on each side of them; and the lead should be free from tin. These lead flanches should be a little larger all round than the iron flanches, that their edges may be rivetted up, afterwards, when any leaks are perceived. If the pipe prove a little too long, the upper, or top nozzle, may be raised a little higher than its natural joint, provided that the overlength does not exceed an inch. The round flanch of the perpendicular steam pipe goes uppermost. Four round holes must be drilled into the top of the upper part of the lower nozzle, corresponding to four holes in the flanch of the perpendicular pipe; and they must be screwed together by screws, with heads within the nozzle. Five screws may, in like manner, be put in the flanch above.

33. The cross pipe must next be put on, and its joint made, and the boiler steam pipe must be screwed to one end of it, and the other, be shut by a plate. If any of the joints are not of a proper angle, fill them up with lead.

34. The steam must be made to communicate from some convenient place of the cross pipe to the steam case, by means of a copper pipe, with their copper flanches, which must be fixed to the cross pipe, and the steam case, by small pierced glands, with a square hole in each end, to admit the square necks of two screws, which being screwed at both ends, one end must be screwed into the cast iron, (first tapped for that purpose,) and the other, with a nut, serves to keep on the gland. Another similar, but smaller pipe, must be fixed to the very lowest part of the steam case; but it must be fixed over the flanches, and be inserted into the perpendicular part of the outer bottom, to fill it also with steam. In some convenient part of the outer bottom, as low down as may be, must be fixed a waste pipe, to let out the condensed water. This waste pipe must reach down about five or six feet, and be bent upwards a little at the lower end, and be shut by a valve loaded with a proper weight. This valve will open whenever the elasticity of the steam, and the weight of the column of water, in the pipes, are sufficient to overcome the weight which shuts it.

35. The condenser must now be put into its place, in its cistern. Its joints may be put together, with pasteboard soaked in oil, as directed, and putty; and be firmly screwed up, and caulked afterwards. Or, any where under water, plates of lead may be used, about a quarter of an inch thick, well fitted to the joints, and puttied on both sides. After the joints, made with lead, are well screwed up, and the condenser warmed by fire or steam, the edges of the lead, which had been left projecting a little, must be raised up, both inside and outside. A soft rope about half an inch diameter, coiled round and round, until it covers the flanch, and well puttied, may be used in default of pasteboard, or lead, but either of the two former are preferable, and in every case caulking or raising must be used.

36. If the clack of the hot water pump has two valves, and is not sent ready fitted, the heating, or fixed part, must be chiseled, and filed truly flat. The pivots, or axes of the valves, must be from three-quarters to an inch diameter, according to the size of the engine; the flat part of the iron of the valve, about a quarter of an inch thick, the copper facing, one-sixth of an inch; and the iron plate, under it, also the sixth of an inch. After the two iron plates and the copper facing are firmly rivetted together, they must be heated red hot, laid on their place, a short piece of end wood set above them, and beat down by some blows of a sledge hammer. The pieces of iron, that the pivots move on, must be fixed by means of pins of iron, half an inch or three-quarters square, screwed into the cast iron of the clack, passing through a square hole in the pivot pieces, and forelocked above by spring cutters. Every one of these parts must be made very secure and firm. A guard to prevent these valves from over opening, must be fixed in the hot water pump. This guard may be about an inch thick, and should not touch the edges of the valves, but catch them on the flat part, behind. The cast iron face of the eduction pipe foot must also be made flat, for the valve there to beat against. The pivots of this valve should be one inch diameter. The thickness for the iron, and copper, the same as for the others. The ends of the valves should be one quarter of an inch clear of the sides; and one half inch clear of the bottom of the place it plays in. The pivots should be sunk into the cast iron of the sides until their lower edges be within one quarter of an inch of the opening of the beating part. They should have one inch hold of the iron at each end, and have no play in that direction. In the lid, or clack door for this valve, there should be a groove, for the axis of the valve, that it may not touch it, when the lid is screwed on. The pivots should not be confined against the beating part, but should have a quarter of an inch of play, in that direction, as the air makes its escape partly by the hinge. The valves of the air and hot water pump buckets are to be fitted in the same manner, remembering to make the pivots proportionable to the size of the valves.

37. The condenser being fixed in the cistern, at its proper height below the nozzles, and at a proper distance from the centre of the gudgeon, or of the cylinder, and in such manner, that the middle between the centres of the pumps shall be directly under the middle of the working beam, and the line between these centres, at right angles to the beam, the copper eduction pipe must be fitted to its place. It must be screwed to the flanch of the short pipe, under the nozzle, by means of a loose flanch of hammered or cast iron, applied on the under side of the copper flanch of the pipe. The outside diameter of the loose flanch must be the same as that of the flanch on the nozzle; and its inside diameter must be one inch more than the outside diameter of the bent copper pipe. Its inner angle should be taken off a little, on the side next the copper flanch, lest it should cut that flanch, or crack the soldering. If the loose flanch be made of hammered iron, it should be three quarters of an inch thick, and the holes should be drilled and not punched. In the same way, you must proceed with the joint, at the foot of the eduction pipe.

38. Having carefully tinned the inside of the upper end of the wide, or perpendicular part, of the eduction pipe, and also the outside of the brass ring which goes within it, the ring must be put into its place; and, being heated, the joint must be run with fluid tin solder; after which, four, or more holes may be drilled through both the copper and the brass, and some copper rivets put in them. The spigot and fauset joints must be secured as follows:—An iron ring, three or four inches broad, and half an inch thick, must be put, red hot, on the outside of the fauset part; that, by its contraction in cooling, it may grasp it firmly. The spigot part must then be put in and made tight, by caulking in soft roping and putty. The proper width of a joint for caulking, is three-sixteenths of an inch at the wide, or open end; and drawing quite close at the inner end, but it will do, although a little wider, or narrower. The joints of the bent part of the eduction pipe, and perpendicular pipe, at the brass ring, must also be secured by caulking. If, when the engine shall be set to work, any of the spigot and fauset joints show a disposition to slide, or move, it may be cured, by putting screw hoops round both the spigot and fauset parts, near to the joint; and pulling the joint together, by means of two screws, connected with the screw hoops. In putting the eduction pipe together, care must be taken, to keep the brased joint upwards; that if any defects appear, they may be cured by tin solder. When the eduction pipe is put together, a hole must be cut, in such manner, as to fit the outside of the fauset, accurately. The fauset pipe should point up the eduction pipe, in order that the injection water may strike the upper side of the eduction pipe, within about two feet of the nozzle; but care should be taken, that it do not spout too low; otherwise, it may, by the bent pipe, be reflected against the exhaustion regulator, which will be very hurtful. The fauset pipe, being adjusted to its proper position, and the knee of the eduction pipe tinned round the hole, the fosset must be fixed in its place, either by a strong body of plumber's solder, or by a copper boss, or case, run full of the same solder, heated to a dull red heat. The upper edge of the inner end of the fauset should only go half an inch within the eduction pipe; and the nozzle of the injection, not quite so far. The injection pipe, being set in its true position, the joints soldered with plumber's solder, and its valve soldered on, a hole must be cut into it for the blowing pipe fauset, at, or about, the level of the valve of the injection; not lower; otherwise the engine will blow at the injection, and heat the cistern. The fauset, for the blowing pipe, must be fixed by soldering, or by a boss, as directed for the injection; and its inner end ought not to go more than one or two inches within the eduction pipe, according to the diameter of that pipe. The blowing pipe may then be put together, and its valve soldered on, taking care that the pipe be of such length, that its valve may be six inches under the surface of the water in the cistern. Care must be taken, that the stems of both the blowing, and injection valves, stand nearly perpendicular, when fixed in their places. The injection and blowing pipes must be fixed in

their fausets, by caulking, as directed; and no tin, from any of the solderings, must be left in the pipes.

39. The pump of the condenser must be fixed down by screws passing through the bottom of the cistern and the beam under it; and it must be remembered that its tendency to rise is very powerful, and that if it has any play, it will be sure to spoil the eduction pipe joints; or, perhaps, break it. The hot water pump must have a strong prop under it, and be tied down, as well as the other. A beam of deal, nine or ten inches square, must be put across the cistern, near the air pump rod, to support a pair of shears, or uprights, as a pump break, for that pump, to examine the tightness of the joints by. This break must have an arch, and a chain with a hook, to chain it to the chain of the air pump rod when in use. The buckets of the condenser pumps must be surrounded by a plaited rope, made of rope yarn, of such breadth as will fill easily the interstices between the bucket and the pump barrel. A pudding link chain, four feet long, must be fastened to the top of the sliding rod of the air pump, and to the other parts of that rod which reaches to the working beam. Its use is, to suffer the engine to work without unloosing the hook of the pump break, when trying experiments on the tightness of the engine.

40. The stuffing box of the air pump must be packed with a small soft rope, wrapped round the rod, and forced down into the box pretty tight, but so that the rod may move easily. A flat round piece of wood, about one and a half inch thick, fitted easy to the inside of the box, and to the outside of the rod, must be put above the stuffing, and screwed down by the gland. There need no screws to be put to hold down that side of the air pump lid which is over the connecting box; those on each side of the box are sufficient if proper attention be paid to making the joints. In like manner, the lid or clack door of the lower valve of the eduction pipe foot needs only two screws, one at each end. In the bottom of the air pump must be placed a ring of hammered iron, with three or four feet for the bucket of the pump to rest upon when at its lowest; *i.e.*, when the lower edge of the packing of the bucket is within one inch of the under end of the working barrel. This ring must be so fixed that it may not turn round, and come in the way of the lower valve of the eduction pipe. An upright, six inches square, must be fixed from the bottom of the cistern, near the injection, to screw that pipe to; and its upper end must be fastened to the beam that supports the lever, and the end of the working barrel of the injection. This upright should be fixed firmly; and the injection pipe should be fastened by a stirrup, with screwed ends, grasping the neck of the valve, going through the upright, and having nuts behind it. Any motion in the injection pipe will be apt to loosen or crack the joints of it; therefore it must be firmly fastened.

41. Guards must be fixed over the injection and blowing valves to prevent their opening; for the nob of the spindle, which stops them by the bridge of the valves, is not to be trusted. It may therefore be cut off; which will give the convenience of taking out the fly part of the valve at pleasure. An S hook of iron must be fitted into the eye of the valve, that it may have no motion there; and the rod that pulls it open must have a hole in its lower end, that the upper end of the S may play easily. If allowed to have motion in the eye of the valve it will soon wear it out. Guards must also be fixed over the valves on the air pump lid, to prevent their over opening. These guards may be fixed by means of two of the screws which fasten on the lid.

(To be continued.)

REGISTER OF NEW PATENTS.

(Under this head we propose to give abstracts of the specifications of all the most important patents as they are enrolled. If any additional information be required as to any patent, the same may be obtained by applying to Mr. LAXTON at the Office of this JOURNAL.)

BOILER FURNACES.

Elisha Haydon Collier, of Goldsworthy Terrace, Rotherhithe, Surrey, Civil Engineer, for "*Improvements in the construction of furnaces and flues.*"—Granted September 28, 1843; enrolled March 28, 1844.

This invention relates firstly to a peculiar mode of arranging the flues of furnaces that the smoke and other vapours shall previously to passing up the chimney be made to pass over a clear fire, which fire is in a furnace entirely distinct from the ordinary or original testing fires; secondly, in forming a double flue in the chimney, for the purpose of conducting a current of warm air down the same to the fire.

The drawings which accompany the specification show the improvement as being applied to a marine boiler constructed with five furnaces; the smoke and heated vapours from the two side fires pass through tubes (which the inventor prefers to be made square instead of round) in a direction from front to back of the boiler, and then in an opposite direction (from back to front) through flues, which conduct the smoke to the centre or clear fire; the smoke and vapours after passing over the clear or consuming fire pass along a flue, which at a short distance branches off right and left; at right angles to the furnaces, towards the sides of the boiler, the flues then return and join the chimney, which is at the back and in the centre of the boiler. The chimney is made double, or in other words, is surrounded with a water space, for the purpose of supplying the boiler with a hot feed instead of a cold one; it is also constructed with a double passage, one being for the emission of such smoke as may be unconsumed, and the other for the introduction of air, which air becomes heated in its passage previous to being introduced into the clear fire. The patentee describes two modes of introducing such air into the clear fire; first, by letting the air pass through a perforated plate situate at the front of the fire, and secondly, by way of the ash pit, and through a number of longitudinal openings, at that part of the clear fire or furnace usually occupied by the dead plate: these plates are supported at each end by axis, the arrangement being similar to the Venetian blind, so that by means of a lever the openings can be enlarged or diminished, and the supply of air regulated at pleasure. When applying the improvements, as above, to boilers on land, it will be necessary to place the boilers as near together as practicable; and for coppers, &c., the inventor proposes to construct the flues in such manner, that the smoke from the first fire after passing round the copper, passes over the fire of the next copper, and the smoke of that one over the next fire, &c., and finally over a clear fire of charcoal or coke, other unconsumed smoke and other vapours from the various furnaces then pass off to the chimney.

RAILWAY WHEELS.

Jonathan Saunders, of Soho Hill, Birmingham, Gentleman, for "*Improvements in the manufacture of tyres of railway and other wheels, and in the manufacture of railway and other axles.*"—Granted October 5, 1843; enrolled April 4, 1844.

This invention relates to a mode of so combining iron and steel in the manufacture of tyres for railway and other wheels, that the steel may be at those parts of the surface of the iron most liable to wear, after the steel and iron has been rolled into bars for the purposes above described. In order to carry out this invention the steel and iron is piled together, and then heated to a welding heat, after which they are passed under the hammer and formed into a bloom, and then passed between suitable rollers for forming it into bars adapted for tyres for railway and other wheels; by this means the steel is intimately combined, and is said will possess many advantages over the present mode of applying steel to the face of tyres for railway wheels; the patentee in some cases makes the pile so as to present a surface of iron, with steel underneath, the former being removed when turning up the wheel in the lathe in the construction thereof. The claim is for the mode of manufacturing tyres for railway and other wheels, by rolling them from piles of iron and steel, in such manner that the steel is at the wearing surface.

CANNABIC COMPOSITION.

Benedict Albano, of Piccadilly, Middlesex, Civil Engineer, for "*Improvements in preparing materials and applying them to the manufacture of ornaments, and other useful purposes.*"—Granted October 5, 1843; enrolled April 4, 1844.

The fibrous material to be employed, whether the same be cotton, flax, or hemp, is in the first place to be opened out and then carded, so as to lay the fibres into one even and uniform sheet; a number of these sheets from the carding engine are then laid upon an endless cloth, commonly called a feed cloth, and moves towards a pair of wooden rollers covered with felt, between which the sheets of fibre pass, but previously to entering the rollers, the sheet is copiously sprinkled with boiling water, and then compressed by passing them between the rollers, after which the sheet may be rolled up and laid aside, ready for the next operation, which is as follows:—The dry sheets of fibrous material are to be saturated with a compound consisting of 70 parts by weight of gas tar, and 30 parts of resin, melted together, to which is to be added 15 parts of oxide of manganese. There is also another mixture or compound which consists of 75 parts of linseed oil, 25 parts of resin, and 10 parts of oxide of manganese, which are to be mixed together as before. These two mixtures are then put into a suitable vessel or trough and intimately combined by agitation and gentle heat; the sheets of fibrous material are then placed in the trough (at one end of which there is a pair of rollers), and well saturated with the mixture, they are then passed through the rollers, and as much of the mixture expressed as possible, after which the sheets are conveyed upon an open frame to a hot air stove and dried; they are in the next place subjected to a mixture of linseed oil and yellow ochre, and again passed between the rollers. The sheets are now in a suitable state (after being softened by heat) for being embossed for ornamental moulding, which is effected by means of dies and an hydrostatic or other press. The impressions thus obtained are then to be dried in a stove, and afterwards coated with a composition of resin, dissolved in about one quarter its weight of linseed oil, to which is added a little turpentine and yellow ochre. If the impression is not sufficiently sharp and complete, another coating may be given, and again pressed in the dies. The impressions after being allowed to dry for two or more days, may be coated with a strong animal size and spanish white, when they will be ready for use. The inventor also claims a peculiar method for making the counter die.

CHIMNEY FLUES.

William Denley, of Hans Place, Sloane Street, Middlesex, Bricklayer, for "*Improvements in the construction of fire plnces, flues and chimnies.*"—Granted September 21, 1843; enrolled March 21, 1844.

This invention consists first in an improved method or methods of supplying air to the fire place, to support combustion and draft, and also in the construction of a hollow breast plate for the fire place, which hollow breast plate is placed above or at the upper part of the fire place, and is supplied with cold air, which air becomes warmed therein and is then allowed to issue into the flue, and thereby assist or increase the draft up the chimney, and prevent it from smoking; and secondly, in constructing flues or chimneys, or flues of a series of earthenware tubes or pipes, either round, ovular, or of any other convenient form, and set in brickwork in a peculiar manner; these tubes or pipes the patentee prefers to make of Stourbridge clay or other suitable material, glazed inside to prevent as much as possible the adhesion of soot; and thirdly, in the peculiar construction of downward flues leading from each chimney and fire place tu the basement story of a house, whereby the chimney can be swept, and the dust and ashes from the fire place removed, without the necessity of entering the room.

Fig. 1.

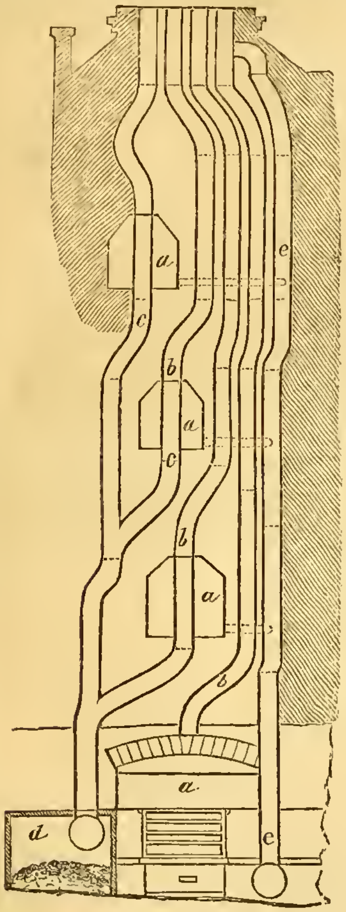


Fig. 2.

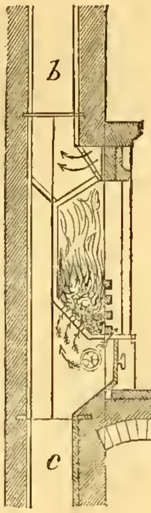


Fig. 1, is a sectional elevation of four fire places constructed according to this invention; *a a a a*, are the four fire places, and *b b b b*, the ascending flues for smoke; *c c c*, the descending flues for soot and ashes, all of which are connected together, and empty themselves of soot, &c. into the box *d*; *e e*, is an air pipe which passes underneath the floor of the basement story, and communicates with the atmosphere; this air pipe is provided with branch pipes, shown in dotted lines, for supplying the fires with air. Fig. 2, shows a transverse section of one of the fire places; *f*, is a perforated plate, which the inventor terms a hollow breast plate, and communicates with the air pipe *e*, the object being to increase the draft, by a current of air passing through the perforated plate, situate just at the entrance of the chimney; *g*, is a branch pipe fixed to the end of the branch pipe leading from the air pipe for regulating the supply of air, which it will be seen is admitted underneath, and at the back of the fire grate, as well as in front in the ordinary manner.

When it is required to sweep the chimney it will be necessary to turn the register plate so as to cover the fire place, when a communication will be formed between the ascending and descending flues, and the operation of sweeping the chimney commenced at the top and swept downwards, driving the soot into the box *d*. The inventor claims first the construction of chimnies or soot flues and downward flues, as above described, of an ovular, cylindrical, or other conveniently shaped earthenware tubes set in brickwork. Secondly, the employment of a hollow breast plate above the fire place, and supplying it with air, as above described; and also the peculiar method of supplying air to the fire for combustion, and to the soot flue or chimney for increasing or assisting the draft.

DRYING OF BRICKS AND TILES.

John Ainslie, of Redheugh, near Dalkeith, North Britain, Farmer, for "*A new or improved mode of drying tiles, bricks, retorts, and such like work made from clay and other plastic substances.*"—Granted September 30, 1843; enrolled March 30, 1844.

The object of this invention is to dry tiles, bricks, &c., made from clay, during the winter and unseasonable parts of the year, by means of artificial heat and a current of air, which removes the vapour from the tiles and bricks as it accumulates, thereby preventing the evaporation being checked. The bricks, &c. to be dried are placed upon carriages provided with shelves; these carriages, which may be placed upon a railroad, are then run into a closed shed or chamber, heated by means of flues passing underneath the floor, or by steam, or the circulation of hot water, or the admission of heated air through small apertures, to about 80° Fahr. The close chamber being heated by any convenient means as above. Cold air may be admitted at certain apertures so as to regulate the temperature of the room, and in order to remove the vapour as it rises from the tiles, &c., an artificial current may be formed by means of a fanner, worked by steam or horse power, or other mechanical means, as will be well understood. The patentee prefers the current of air to be worked about six feet per second; but this, together with the temperature, may be increased, taking care that it be not too high, so as to crack the clay when drying.

IMPROVEMENTS IN FURNACES.

John George Bodmer, of Manchester, Engineer, for "*Improvements in grates, furnaces and boilers, and also in manufacturing or working iron or other metals, and in machinery connected therewith.*"—Granted October 5, 1843; enrolled April 4, 1844.

The first improvements consist in making moveable fire bars, which traverse from front to back of the furnace, carrying the coals along with them, and which are supplied by means of a hopper situated in front of the furnace. At each side and parallel with the ash pit there is a pair of screws, one of which is placed a few inches above the other; these screws are made of cast iron and answer the purpose of bearings for the furnace bars, the ends of the bars resting within the threads of the screws, which threads are cut at the commencement of the screws regular and true, but on approaching the farther or opposite end they are made irregular, commonly called "drunken threaded," so that on giving a rotary motion to the screws, the furnace bars will be simultaneously and steadily carried along, from front towards the back or farther end of the furnace, until they come to that part of the thread in the screws which is made drunken, when they will have an undulatory motion, and which will have the effect of preventing the clinkers accumulating, and free the embers from ashes. At the ends of the screws there is a cam which presses the bars as they arrive at the end of the screws from the upper pair of screws to the lower pair, which latter carry the fire bars in an opposite direction, or from back of the furnace to the front, at which place they are elevated again and placed upon the end of the upper screws. The second improvement is for a metallic packing, consisting of a number of conical rings of brass and tin, or other suitable metal, which packings are calculated to resist a high pressure. The third part of these improvements relates to a screw cutting machine for forming the screws suitable for the purpose above described. The fourth part relates to a furnace similar to that above described for converting iron into steel and smelting metals. The fifth part relates to the application of the description of furnace above described to blast furnaces, and also to puddling hearths. And sixthly, relates to a mode of rolling saw blades, which consists in forming the piece of steel from which the blades are to be made into a hoop, and then passing it between rollers and rolling it to the required thickness without taking it from the rollers.

ARTIFICIAL FUEL.

Ferdinand Charles Warlich, of Eccleston Street, Middlesex, gentleman, for "*Improvements in the manufacture of fuel.*"—Granted October 5, 1843; enrolled April 4, 1844.

The object of this invention is firstly, the submitting fuel composed o small coal, tar, pitch, or other bituminous matter to a high temperature in a retort. Secondly, the peculiar construction of retorts for effecting the same; and lastly, the application of an exhausting apparatus to such retorts, together with the introduction of air into retorts where fuel of the above description is undergoing the process of drying. The patentee commences by stating that it is not necessary to enter into any description of the manufacture, or mode of combining pitch, coal, tar, and other matter into fuel, as the invention does not apply to the compounding of such fuel; at the same time the inventor states that he prefers the compound of coal and bituminous matter to be as follows; 15 per cent. of pitch and coal tar and 90 of small coal, in which may be employed a little "heavy oil" to the extent of from 2 to 5 per cent.; and in order to prevent smoke when such fuel is being consumed, about the same quantity of common salt may be added, or alum dissolved in water. The mixture after being moulded into convenient sizes, is placed in a retort for six or eight hours, and subjected to a heat of from 400° Fahr. and upwards, by which means gases and certain other matters are driven off, which, if permitted to remain, would produce prejudicial effects to which such fuel is said to be subjected.

The retorts, which are of the D form, are built of brick, and are provided with an aperture for the escape of gases, which pass off in the same manner as in the manufacture of gas into an hydraulic main, to which is connected a pipe leading to an exhausting apparatus, which consists of two cylindrical vessels suspended at each end of a beam, and inverted in a tank containing water, so that by raising and depressing the vessels in the water tank, the gases and vapours are exhausted from the retort or retorts, which gases pass off into the atmosphere. At the lower part of the retorts there are a number of apertures which admit a current of warm air, which previous to entering the retort passes through the furnace, so that as the gases are exhausted by the apparatus above described a fresh supply of hot air is continually admitted, which effectually drives off the damp and vapours from the pieces of fuel, which appears to be the object of this invention. The inventor claims the submitting manufactured fuel, containing bituminous matter to a high degree of temperature; also the introduction of highly heated air, together with the exhausting the products from retorts when applying heat to manufactured fuel, which is placed and inclosed in the same.

ORNAMENTAL POTTERY AND MOSAIC WORK.

Richard Boote, of Burslem, Staffordshire, Manufacturer's Clerk, for "*Improvements in pottery and mosaic work.*"—Granted October 5, 1843; enrolled April 4, 1844.

The specification described several methods of impressing devices on pottery, which are as follows. First, in order to produce a coloured design upon a ground of different colours; the device is first made in a mould of the form required, "commonly called figuring:" the devices or impressions thus obtained are then to be put into the mould in which the ware is to be made: the material of the ware when poured into the mould will be found to adhere very closely round the edges of the device, and the same will be imbedded therein. The second method consists in cutting the device in pieces of paper or parchment, which are then to be put in the mould; the two halves of the mould are then fastened together, and the matter which is to form the ground of the ware is poured in; after having stood the necessary time, the parchment or paper forming the device is to be removed, and the colour intended for the device poured in, which will fill up the spaces previously occupied by the paper device. Thirdly, in order to produce raised figures of a different colour from the ground, the figures are first of all engraved or otherwise formed in low relief in a plaster mould: this being done, the colour intended for the raised figures is poured into those parts of the mould which form the figures; the halves of the mould are then put together, and the slop intended for the ground poured in and allowed to stand a sufficient time to form the body of the ware. If the slop is of an expensive nature it will only be necessary to let the slop remain a sufficient time to form a thin coating, after which it may be withdrawn and the substratum filled in with a commoner slop.

Lastly, in producing devices of a mosaic character, the designs are fixed on the halves of the moulds with a composition of the required colour; the halves of the mould are then fastened together, and the slop intended for the body of the ware poured in: after having stood a short time, and the slop adhered the required thickness, the remaining liquor can be withdrawn.

AXLES FOR WHEELS.

John George Briggs, of Leicester, Coach Proprietor, for "*Improvements in axles.*"—Granted October 5, 1843; enrolled April 4, 1844.

This invention consists of forming the axles of two parts or shafts, one solid and the other hollow, whereby greater strength, and less liability to breakage is obtained. In order to carry out this invention the patentee provides a tubular or hollow axle sufficiently long to pass through the bosses of each of the wheels when at the required distance from each other, the calibre or bore of this tube being sufficient to admit the solid axle passing through it, which axle consists of a solid shaft having bearings turned at each end to fit the steps or journals in the frame side of the carriage. The wheels are firmly fixed upon the ends of the hollow axle by means of keys; the solid axle is then passed through the tubular or hollow one, and fixed therein in like manner, by means of keys. When the bearings are within the wheels it will be found necessary in forming the journals to weld two collars upon the hollow axle, so as to obtain greater strength. The claim is for the construction of axles, by combining together solid and hollow shafts one within the other, as described.

SLATE COVERING.

William North, of Stangate, Lambeth, Surrey, Slater, for "*Improvemen in covering roofs and flats of buildings with slate.*"—Granted October 5, 1843; enrolled April 4, 1844.

This invention consists in the application of battens of slate in combination with slates for covering roofs and flats of buildings, which is effected without fixing the slates to the rafters or joists, whereby the joints it is said are not liable to get defective from warping or vibration.

Fig. 1.

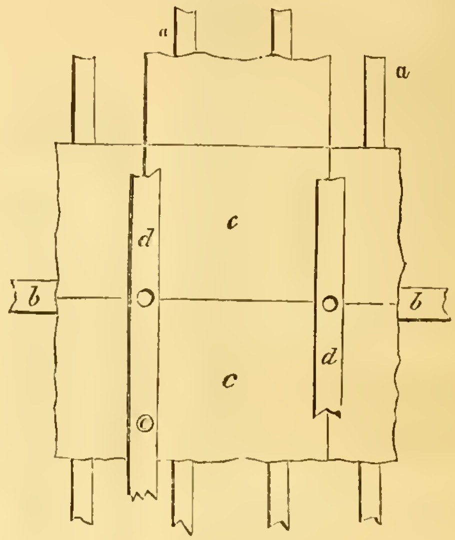


Fig. 2.

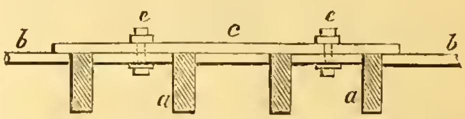


Fig. 1, shows a plan of a roof or flat, and Fig. 2, section; *a a*, are the joists or rafters constructed in the ordinary manner; *b b*, are battens of slate which fit into recesses, formed by cutting a partition of wood from the edge of each rafter; *c*, the slabs of slate, which are supported by the battens and rafters; the ends of the slabs rest upon the battens and are imbedded in putty; *d d*, are fillets of slate; and *e e*, screws, which screws bind the fillets to the slates, and the slates to the battens, the whole being supported by the rafters *a a:* the fillets may if required be placed on the underside instead of the top of the roof or flat.

The pateotee claims the application of slate battens with slate for covering the roof of a building, as described.

SEPARATION OF METALS.

Richard Janion Nevill, of Langennech, Carmarthen, Esq., for "*An improved mode of separating certain metals when in certain states of combination with each other.*"—Granted October 18, 1843; enrolled April 18, 1844.

The inventor takes copper, in which silver is in combination, and melts it in the usual manner; he then pours it in an iron vessel containing lead melted to a red heat or nearly so, and thereby mixes the argentiferous copper with the lead in proportion to the quantity of silver in combination. After the mixture it will be found that the copper with a portion of silver and lead will, as the mixture cools, rise to the surface, which may afterwards be taken off with a pair of tongs, or other mechanical contrivance; for instance, a perforated plate somewhat less in diameter than the size of the iron vessel in which the compounds are, is placed in the vessel, and near the bottom thereof, so that as the metals are melted it will be found that the copper with a portion of silver will rise through the perforations in the plate, and may be lifted out of the vessel together with the plate, which plate is provided with one or more handles for that purpose. The copper with such portion of silver as it may yet contain is then broken into small pieces, and separated by the process of "elequation," which is as follows:—The pieces of copper thus obtained, together with a quantity of charcoal, are then put into a retort or retorts, constructed with an opening at one end, through which the metals ("videlicet" the silver and lead contained in such pieces of copper) flow when in a state of fusion. The retorts, which are fixed in the furnace in a sloping position and closed, so as to exclude all air, are then heated to such a degree as to melt the silver and lead, but not the copper, which former are allowed to pass off through the opening at the lower end of the retort into a suitable vessel, leaving the copper almost free from the silver and lead, which two metals are to be afterwards separated by the ordinary process of cupellation.

IMPROVEMENTS IN BOILERS.

Thomas Morton Jones, of Birmingham, Warwickshire, for "*Improvements in heating liquids and aeriform bodies.*"—Granted October 18, 1843; enrolled April 18, 1844.

Fig. 1.

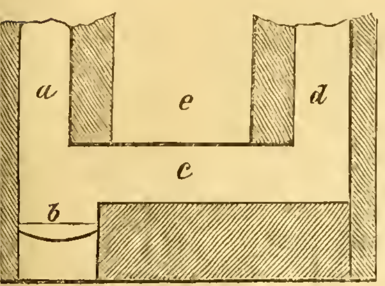


Fig. 2.

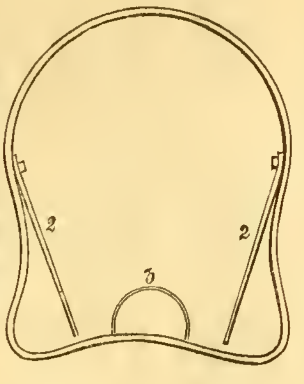
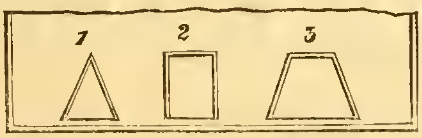


Fig. .



The first part of this specification relates to a mode of constructing a furnace, the arrangement of which will be seen by the accompanying diagram marked Fig. 1, which is a longitudinal section. *a*, is a shaft for feeding the fire with coal or coke; *b*, the fire grate; *c*, the hearth leading to the flue or chimney; *d*, the vessel or matter to be heated, being placed at *e*. The shaft *a*, is covered with a plate, so constructed as to regulate a current of air, which is allowed to descend the shaft *a*, and pass through the upper stratum of coal simultaneously with a current of air which is admitted at the bottom of the shaft and allowed to pass upwards through the fire, which currents meet and pass off with the products of combustion over the hearth to the chimney. The patentee states that it will be desirable to build upon, and over the hearth, a number of arches at convenient distances from each other, under which the flame passes. The second improvement consists in the application of inverted vessels (which the inventor denominates "preservers") fixed at or near the bottom of the boiler or pan, whether the same be open at the top or closed. Fig. 2. shows a transverse section of a wagon boiler with this improvement applied thereto; Q Q, are plates of iron rivetted or otherwise fixed to the sides of the boiler, and extending in the direction shown to within about one-eighth or one-fourth of an inch from the bottom of the boiler. Thus the steam generated within the preserver, that is, between the plate and the side of the boiler, cannot escape above the surface of the water line, but is retained between the boiler and the plate until by its "tension" or elasticity it is forced downwards and underneath the edge of the plate, which will have the effect of sweeping and carrying before it all impurities held in suspension in the liquid, and thereby prevent such impurities from being deposited upon the bottom of the boiler. (Query, how are they to be got rid of?) Number 3, shows an hemispherical preserver; 1, 2, 3, in Fig. 3, show three preservers of the form of a cone cylinder and truncated cone, all of which are supported by any convenient means from the bottom of the boiler, so as to allow the steam, as by its elasticity it is forced downwards and underneath the edge of the preservers, which preservers may be of any required form. The third improvement has reference to the construction of tubular boilers, in which the inventor states, that when tubes containing liquids are exposed to heat, (that is if such are not surrounded by water,) he prefers to make them of copper or brass, or any of the alloys of iron, and insert them firmly through strong iron plates, whereby they may be removed and replaced with much greater facility. When tubes are surrounded by a vapour or liquid, the inventor proceeds to cover them with a suitable meta by means of the electrotype process.

IMPROVEMENTS IN WATCHES.

Edward Mylne, of Albion Terrace, Canonbury Square, Islington, Middlesex, Watchmaker, for "*Improvements in the construction of watches.*"—Sealed October 21, 1843; enrolled April 21, 1844.

This invention consists simply in dishing out or sinking the pillar plates of watches, and inverting the fuzees, thereby obtaining what may be called full framed watches much flatter than heretofore. The pillar plate of the watch is made with recesses, which are turned out to receive the end of the barrel containing the spring, the fuzee, and also the other parts of the watch corresponding. The fuzee is constructed similar to the common fuzee, with this difference, that it is inverted and cut the reverse way, or in other words, left handed, and is provided with a thin circular steel cap. The upper plate of the watch is made about one-third thicker than usual, the pillar plate being about the usual thickness. The patentee claims the mode of constructing watches whereby the fuzees are inverted.

PETER BORRIE'S PATENT REVOLVING STEAM ENGINE.

Sir—I observe in the April number of your *Journal*, that you have been pleased to take notice of my Patent Revolving Engine, and in doing so, you have stated that it differs from one for which a patent was granted to Mr. Woodcock, in 1842, only, in the employment of a double acting air pump in connexion with it. Now I think you have either been misinformed, or have not examined the two engines sufficiently, for on doing so, you will find that Mr. Woodcock's differs very materially in many respects from mine, as you will see by the drawing and description I have sent you; I would have sent it sooner, but have only got the lithographic drawings finished to day.

I have also made an analysis of the economy and power of my engine, which I enclose; this is quite sufficient to show its superiority over any other hitherto constructed.

I am aware that many patents have been taken out for revolving engines, and have successively failed, owing chiefly to defects in their construction; these failures have prejudiced the public mind against all engines on that principle, but from the long experience I have had (both practically and theoretically) with steam engines of every description, I flatter myself that I have entirely remedied the defects common to revolving engines; and from the lightness, compactness, small amount of wear and tear, and greater economy of fuel in my engine, I have no doubt that it will surpass all others hitherto in use.

Requesting the insertion of this letter in your valuable periodical,

I am, Sir,
Yours respectfully,
Peter Borrie.

8, *Princes Square, St. George's East,*
London, 15th April, 1844.

P.S. I may state here that Mr. Mayer Henry has no farther interest in my patent.

Description.

Fig. 1, is a transverse section through the centre of the air pump, and showing an end elevation of the other parts of the engine; and Fig. 2, is a transverse section through the centre of the cylinder.

A, is the foundation plate, to which all the parts of the engine are directly or indirectly attached. B, is the external cylinder fixed to the foundation plate. C, is a smaller cylinder, revolving within the external one, on a shaft D, whose centre is placed so far above that of the external cylinder, that their circumferences may touch one another at the upper point h^1; thus the space between them gradually increases from h^1 to the lower point h^2; (the shaft D, passes through steam tight stuffing boxes in the cylinder ends, and revolves in bearings on the frames Z Z, which are firmly bolted to the foundation plate, and stayed to the cylinder.) E E, are two sliding pistons, consisting each of two arms, connected together by four rods passing over the shaft, their breadth is equal to that of the outer cylinder, and their joint length over their extremeties is necessarily somewhat less than its diameter, owing to the eccentricity of the revolving cylinder; these pistons slide freely at right angles to one another, through passages made in the circumference of the revolving cylinder, their sliding motion being caused by the pressure of one of their extremities on the ascending side of the outer cylinder, (whichever side that may be,) and the eccentricity of the revolving cylinder through which they slide; as their length is always slightly varying during the course of a revolution, the difference is made up by metallic packing placed between the two thicknesses of plates, of which the arms of the pistons are composed, the packing is pressed by springs towards the sides and circumference of the outer cylinder, and will be understood by referring to Figures 1 and 2 on the drawing. There are metallic packings, (in the passages in the inner cylinder, through which the pistons slide,) which are pressed on the flat surfaces of the pistons by springs, and prevent the steam passing to the interior. There are also two steel rollers at the inside of the packings, which are pressed up to the flat sides of the pistons by screws; these are for the purpose of diminishing the friction of their sliding motion. These rollers would not be necessary excepting in large engines. The rim of the inner cylinder is made to project into metallic packing boxes in the cylinder ends, thus the steam is entirely prevented from passing into the interior of the inner cylinder; a packing box is also placed at the point of contact h^1 to prevent the steam passing to either side. It will therefore be understood, that the steam only acts on the projecting part of the sliding pistons, between the inner and outer cylinders.

The steam in coming from the boiler through the steam pipe F, has first to pass the slide G, which is worked by the handle H; it is used for regulating the speed of the engine, and also for stopping it, when required: after passing the above slide it enters the steam tight jacket J, the bottom of which is the slide face having the four cylinder ports K, L, M and N, and the eduction port Q, on it; a slide O, worked by a handle P, passes over these ports for the purpose of reversing the motion of the engine: there are two posts O^1 and O^2, on the slide, one of which, O^2, (in the position the slide is shown on the drawing) is open to the steam port L; the port N, is closed, and the two ports M and K, are open to the eduction port Q, so that when the slide is in this position, the engine will necessarily move in the direction indicated by the arrows, and by moving the slide along until the port O^1 is above the steam port K, then will the port M, be closed, and N and L, open to eduction, so that the steam will act at the opposite side of the cylinder and consequently the motion be reversed.

It will here be observed that the lower cylinder ports M and N, are *never* used for admitting steam, but only for leading off the eduction; the object in placing them so low in the cylinder is to allow the vacuum to act upon the pistons sooner; it will be kept in mind then that, in whatever direction the shaft revolves, the steam is always admitted at one of the upper ports K or L, and the eduction led off at its opposite lower and upper ports. All these ports where they lead into the cylinder, are divided into bridges placed diagonally across them so that the pistons may pass freely over them.

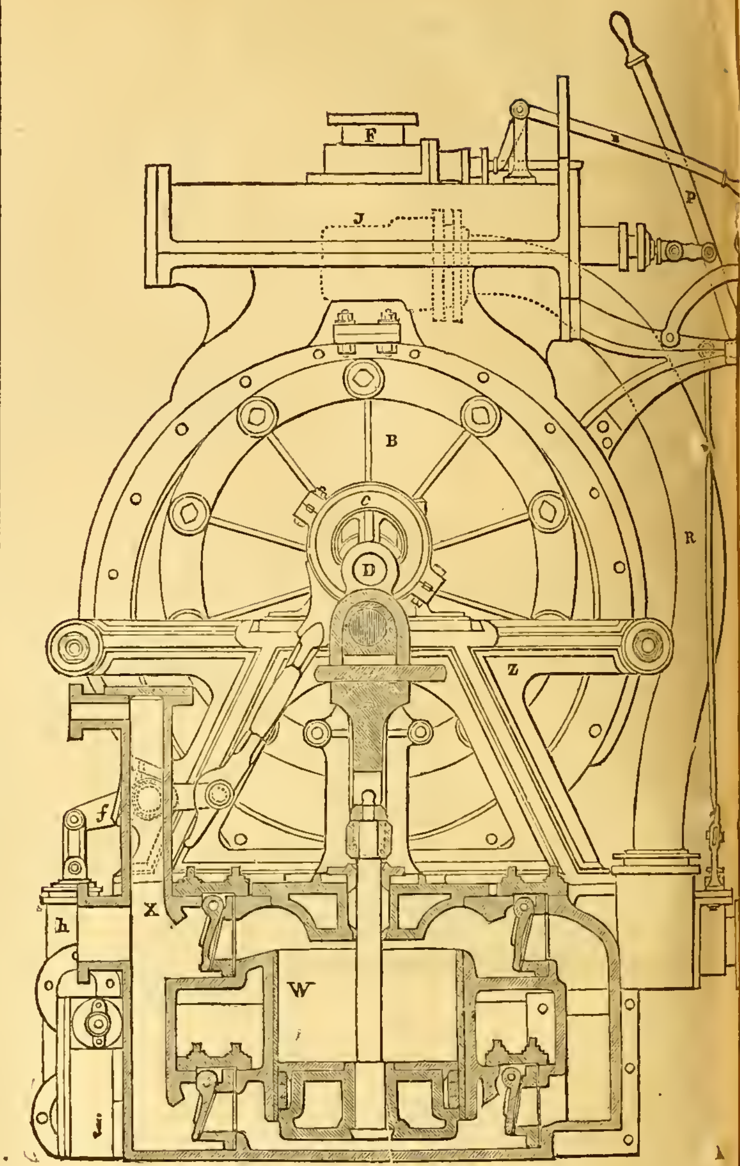
From the relative position of the two cylinders, the distance between their circumferences gradually increasing from contact at the upper point h^1, to the greatest distance at the lower point h^2, (which in this case is one-sixth of the diameter of the external cylinder, but may be varied according to circumstances,) it will be seen that in whatever direction the engine revolves, the area of that part of the pistons which is acted on by steam and vacuum gradually increases, so that the principle of expansion is carried out to its fullest extent, without the aid of expansion valves and gear.

The steam passing through the eduction passage Q, is conducted by the eduction pipe R, to the condenser S; T, is the inspection slide, placed at the lower end of the eduction pipe, and conducting the water up the pipe, so as to act fully on the steam in passing downwards: it is worked by a lever and rod connected to the handle U, which is placed in proximity with the other starting handles H and P. V, is the blow through valve. W, is the air pump, which is a double acting one, the interior arrangement of its valves &c., is shown at Fig. 1; it has a metallic packed piston which is worked from the main shaft by a crank and connecting rod, and the piston rod is, kept parallel by two slide guides bolted on the air pump cover. X, is the hot well, and Y, the discharge passage.

The pumps are worked from the main shaft by an eccentric *c*, connected by rod and lever to a rocking shaft *d*, on which are keyed two levers, *e* and *f*, which are connected by rods to the pumps, *g* and *h*; the pump *g*, is intended for the bilge water (supposing this to be a marine engine), and the pump *h*, for feeding the boilers, the latter has its valve chest *j*, bolted on the hot well.

Among the advantages which render this improved steam engine so peculiarly well adapted for locomotive and marine purposes, may be mentioned the following, viz.;—Small cost of construction, great economy of fuel, the space occupied by it is very little in proportion to its power, and also its comparative lightness, the weight of the engine being only about 2 cwt., per horse power, and that of the boilers only about $2\frac{3}{4}$ cwt. per horse power, so that the whole weight will only be about one half of the lightest engine hitherto constructed.

Fig. 1.*



I herewith annex the following analysis of the power and economy of my "Patent Revolving Steam Engine."

In the above figure, 3, the revolution of one piston is divided into 32 equal parts, and the annexed table shows the quantity of steam consumed; the mean area of the piston, the distance the centre of pressure of the piston travels; the direct, opposite, and effective pressures on the piston; the number of times to which the steam is expanded; and the number of lbs. lifted one foot high in passing through each of these divisions. The external cylinder is 3 ft. 6 in. diameter, and 1 ft. 6 in. long inside, and the greatest distance between it and the internal cylinder, is 7 in. The steam is supposed to be at a pressure of 30 lb. on the square inch, above the atmosphere, and the vacuum to be equal to 12 lb. on the square inch, the shaft making 50 revolutions per minute.

Note.—The direct pressure or force of the steam to turn the engine round in the required direction, is marked on the Table, + pressure, and the opposite or force resisting the motion in that direction, — pressure, of course, their difference, is the effective pressure.

* [We are indebted to our contemporary, the "Mechanics' Magazine," for the use of the wood engravings.]

Fig. 2.

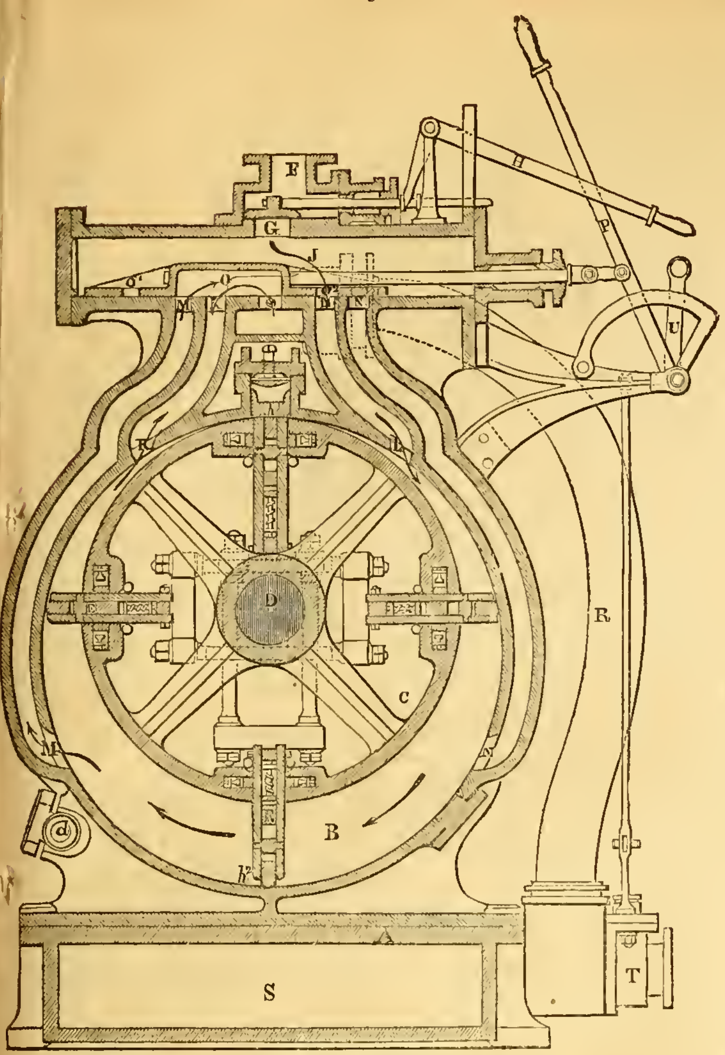


Fig. 3.

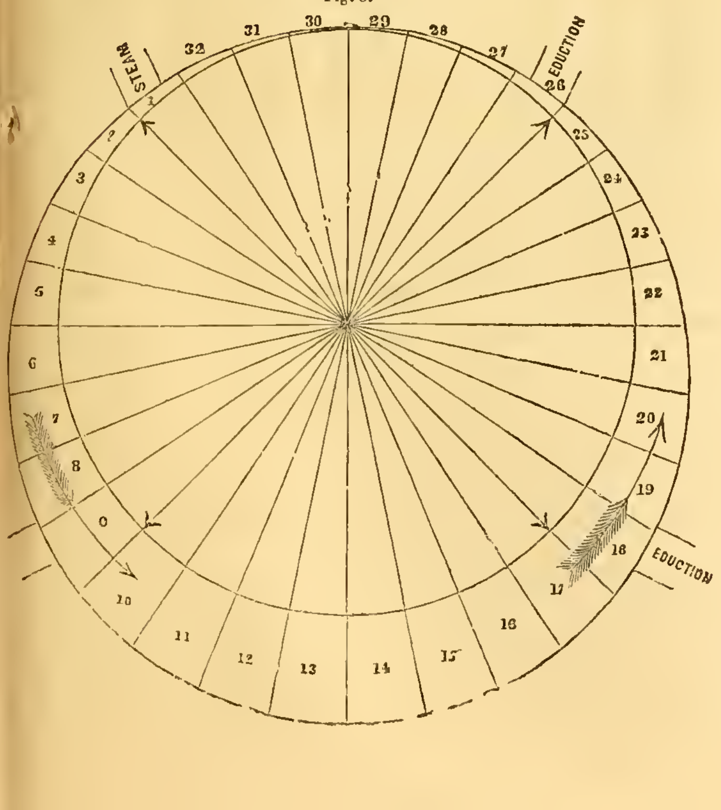


TABLE.

Divisions.	Steam consumed in cubic inches.	Mean area of piston in square inches.	Distance the centre of pressure travels in feet.	Pressure on Piston. + Pressure per square inch in lbs.	— Pressure per square inch in lbs.	Effective pressure per square inch in lbs.	Whole effective pressure on the piston in lbs.	Number of times the steam is expanded.	Number of lbs. raised 1 foot high.
1	126·0	15·8	0·291	44·5	44·5	0·00	0·00	—	0·000
2	72.6	21·0	0·291	44·5	36·47	8·03	168·6	—	49·0
3	108·0	30 0	0·3	44·5	31·12	13·38	402·0	—	120·6
4	145·8	40·5	0·3	44·5	27·3	17·2	696·6	—	209·0
5	194·2	52·5	0·308	44·5	24·3	20·2	1060·5	—	326·63
6	246·2	64·8	0·317	44·5	22·25	22·25	1441·8	—	457·05
7	304·2	78·0	0·325	44·5	21·09	23·41	1826·0	—	593·45
8	367·2	91·8	0·333	44·5	20·41	24·09	2212·3	—	736·7
9	380·0	100·0	0·341	44·5	20·00	24·5	2450·0	—	835·45
10	Steam cut off.	111.6	0·341	36·47	7·5	28·97	3232·0	1·22	1102·1
11	—	120·0	0·35	31·12	2·5	28·62	3434·4	1·43	1202·0
12	—	124·5	0·35	27·3	2·5	24·8	3087·6	1·63	1080·6
13	—	126 0	0·358	24·3	2·5	21·8	2746·8	1·843	983·35
14	—	126·0	0·358	22·25	2·5	19·75	2488·5	2·0	890·88
15	—	124·5	0·35	21·09	2·5	18·59	2314·4	2·11	810·0
16	—	120·0	0·35	20·41	2·5	17·91	2149·2	2·18	752·22
17	—	111·6	0·341	20·00	2·5	17·5	1953·0	2·225	665·97
18	—	100·0	0·341	12·00	2·5	9·5	950·0	—	323·95
19	—	91·8	0·333	2·5	2·5	0·0	—	—	—
20	—	78·0	0·325	2·5	2·5	0·0	—	—	—
21	—	64·8	0·317	2·5	2·5	0·0	—	—	—
22	—	52·5	0·308	2·5	2·5	0·0	—	—	—
23	—	40·5	0·3	2·5	2·5	0·0	—	—	—
24	—	30·0	0·3	2·5	2·5	0·0	—	—	—
25	—	21·0	0·291	2·5	2·5	0·0	—	—	—
26	—	15·8	0·291	2·5	2·5	0·0	—	—	—
27	—	9·0	0·285	—	—	0·0	—	—	—
28	—	3·6	0·28	—	—	0·0	—	—	—
29	—	—	0·26	—	—	0·0	—	—	—
30	—	—	0·26	—	—	0·0	—	—	—
31	—	3·6	0·28	—	44·5	44·5	160·2	—	44·8
32	—	9·0	0·285	—	44·5	44·5	400·5	—	114·1

From the Table the following results are obtained.

The quantity of steam required for one revolution of each piston 1944·2 cubic inches. Distance the centre of pressure of the piston travels in one revolution, 10·065 feet. Average effective pressure on the piston, 1080 lb. Greatest expansion 222,5 times.

Number of pounds raised one foot high by the revolution of one piston, 10,980.

Momentum of one piston ..	10,980 lb.	raised one foot high.
Number of pistons	4	
Momentum of one revolution ..	43,920 lb.	raised one foot high.
Number of revolutions per minute	50	
Momentum per minute ..	2,196,000 lb.	raised one foot high.
Deduct for friction say 10 per cent.	219,600	
Effective momentum per minute	1,976,400 lb.	raised one foot high.

$$\frac{1,976,400}{33,000} = 59·9 \text{ horses power.}$$

	Cubic In.
The quantity of steam consumed by a revolution of one piston ..	1944·2
Number of pistons	4
Steam required for one revolution	7776·8
Number of revolutions per minute	50
Steam consumed per minute	388840·0

Steam at 30 lb. pressure on the square inch above the atmosphere, is 609 times the volume of the water of which it was generated, therefore—

$$\frac{388840}{609} = 638·5 \text{ cubic inches, or 37 cubic feet quantity of water evaporated}$$

for steam per minute.

In a common double acting condensing engine of the same power, the effective momentum will be the same on 1976400 lb. raised one foot high per minute, and if we take Tredgold's data that the effective power is ·63 of the power of the steam, it will stand thus:

$$\frac{1976400 \times 100}{63} = 3137113 \text{ lb. raised one foot high.}$$

If the pressure of the steam on the piston be equal to 35 inches of mercury, or 2·4 lb. on the square inch, and the vacuum the same as in the revolving engine, or 12 lb., then the pressure on the piston will be 14·4 lb. on the square inch, and $\frac{3137143}{14 \cdot 4} = 217860$ = the product of the area of the cylinder in inches, multiplied by the velocity in feet, and 217860 × 12 = 2614320

The loss of steam in filling the passages and spaces at top and bottom of cylinder, say 1-12 217860

Cubic inches of steam required per minute, equal 2832180

Steam at a pressure of 2·4 lb. on the square inch, is 1497 times the volume of the water of which it was generated, therefore, $\frac{2832180}{1497} = 1892$ cubic inches, or 1·095 cubic feet, equal the quantity of water required for steam, per minute, $\frac{1892}{638 \cdot 5} = 2 \cdot 96$ times the evaporation required for the common engine, as for the revolving engine, and consequently only about one-third of the fuel would be required for the revolving engine, as would be required for a common reciprocating condensing engine of the same power.

THE THAMES EMBANKMENT.

Rivers of other countries pass through romantic scenery and regions of natural grandeur, the rivers of the new world have a colossal extent, in the presence of which our insular streams shrink into contemptible rills; but, as in other things, so here, moral influences contribute to give a rank. The Thames, rich in historical associations, presents a scene of commercial magnificence, to which even the teeming population of China cannot present an equal. On the banks of the silent highway, the largest and most commercial city in the world, is placed the metropolis of the mighty English empire, and it may truly be said the central seat of civilisation. Regarded by natives and by foreigners with equal admiration, it has often been a subject of regret that no grand and systematic plan has been adopted for regulating the navigability of the river, and preserving a consistent style of architecture on its banks. The ugly, ill devised buildings, which are a blot on its shores, attest the want of a central authority and efficient control.

Remembering that it is by commerce London has attained its present grandeur, and by commerce it is to be maintained, it is self-evident that more regard is to be paid to the useful than the ornamental, at any rate the useful must not be sacrificed. The inhabitants of the Seine and the Liffey can pride themselves on quays, which interfere with no commerce, but we cannot sacrifice for ornament the machinery of wealth which our river affords. A tide river, upon which the largest argosies are borne, and on which many of our war ships have for centuries been launched, cannot be treated like a shallow upland stream, and however interesting the quays of Paris or Dublin may be, certainly, notwithstanding the timber hovels and the misshapen bulks of building, the numerous craft on the Thames are objects not less pleasing. We must not complain, if we do not rival those cities in river promenades, since we surpass them in commercial grandeur.

While we make this declaration it must not be supposed that we deprecate improvement, on the contrary, we esteem it highly necessary that something should be done for the banks of the Thames, but that whatever is done should be done with caution. The testimony of a man like Wren is of the highest value, and indeed the manifest advantages accruing from a proper direction of the stream would alone enlist our sympathies. We may observe, by the bye, it is curious that after Wren's plans for the adornment of the metropolis should have been rejected two centuries ago, in the present age his views are receiving full accomplishment, and as we are widening our streets, and improving our buildings, so we are in the same spirit about to rescue the noble Thames from the neglect with which it has heretofore been treated. The subject of embankment is one which has long engaged attetnion, and been the subject of much discussion of late years, and the government having published a report in relation to it, we have been induced to devote a large portion of our space to a question so important, both in its engineering and architectural bearings, for, if on the one hand, it is a question of magnificence and ornament, on the other it concerns the improvement of an important stream, the regulation of its channel, and the arrangement of its wharfs and quays, and side docks. We may here, by the bye, observe that the engineer and geologist will in the sections of the river introduced in the report, showing the form of the river bed at various times, acquire most important and interesting evidence, as to the power of running streams, and the changes which can be effected by the agency of water in a few years.

The Commissioners have very wisely decided upon proceeding very cautiously, and instead of grasping at once with both sides of the river from Battersea Bridge to London Bridge, they only in the present instance propose to form an embankment or terrace on the Middlesex side of the river between Westminster and Blackfriars Bridges. It will be perceived by the report that there have been several schemes proposed, but there are only three of them which the Commissioners think are at all practicable, they are the plans of Messrs. Walker and Burges, plan A; Mr. Page, plan B; and Mr. Barry, (one of the Commissioners) plan C; and they have selected a modification of Mr. Page's plan, as shown in the accompanying plate. Notwithstanding this selection, we, after mature consideration of the several plans and the evidence given in the report, are inclined to advocate the scheme of Messrs. Walker and Burges with some modifications. We propose to form solid embankments and recesses in the following manner. To commence at Westminster Bridge with a solid embankment, and continue the same as far as Whitehall Place, as shown in the accompanying plan, but without leaving a dock at Whitehall wharf, which we propose to abandon, as this would only involve the purchase of three wharfs; to set against which we shall have saved the cost of forming the dock, and likewise have a valuable piece of land which will produce a large rental for building chambers for parliamentary practitioners and others, on each side of a handsome communication to be formed from the terrace to Parliament Street. This communication, would not require the removal of a single house excepting what belongs to the wharfs. From this embankment a recess to be formed for the wharfs of Scotland Yard, and Hungerford Market, with three openings of 150 feet each to be spanned by suspension bridges; then, again, an embankment extending the terrace of York Gate, between Villiers Street and George Street, thence a recess for the wharfs of the Adelphi and the Savoy, 870 ft. long, partly to be enclosed with a terrace wall, having three openings of 150 ft. each, as before. Thence a terrace to front Somerset House from the Savoy Wharf to Arundel Street, then a recess for the wharfs near Essex Street, followed up by an embankment for an extension of the Temple Gardens, again a recess for the wharfs at Whitefriars, gas works, &c. 930 ft. long, partly enclosed with a terrace wall, having three openings of 150 ft. each as before explained. These large openings will offer facilities for barges getting at the wharfs at all times of the tide as now, and thereby the recesses will not in our opinion be so liable to silt up as Mr. Page's docks will with the contracted entrances he proposes. The narrowing of the stream by the embankment, and the detached terrace walls will create a scour in the bed of the river, and which will cause the shore gradually to deepen and slope towards the centre of the river, and that coupled with the continuous washing of the banks by the swell created by the steamers, will keep the recesses free from silt; on the contrary, Mr. Page's docks will derive no advantage from the steamers passing up and down the river, as the swell will not enter them, and the continuous wall will prevent the mud or silt getting out. The scouring of the sluices will only force channels through the deposit.

We should prefer the terrace being kept down to within 4 or 5 ft. of high water mark so that it may pass under the bridges, a slight rise to be given to the suspension bridges spanning the openings of the recesses to admit barges with sails. By our proposed embankments communications may be made with the present streets; first, to Parliament Street, at Whitehall Wharf: second, at Whitehall Place; third, at Villiers Street; fourth, at the Savoy; fifth, at Norfolk Street; sixth, at Temple Lane; and, seventh, at Chatham Place.

We consider it indispensable that the terrace should be continued under Westminster Bridge to the front of the Houses of Parliament, by which means a fine opportunity would be afforded to the public to view that splendid pile of buildings, particularly the sculpture and enrichments.

According to our proposal, the lengths of the several embankments and recesses or docks, will be as follows:—Whitehall embankment,

	Feet.
Terrace from Westminster Bridge to Scotland Yard	2440
Scotland Yard and Hungerford Market recess, with three openings	560
York Gate terrace embankment	340
Adelphi and Savoy recess, with three openings	870
Somerset House terrace embankment from Savoy Wharf to Arundel Street	1250
Essex Street recess, with two openings	400
Temple Gardens embankment	710
Whitefriars recess, from Temple Gardens to Blackfriars Bridge, with three openings	930
Total length,	7500

We shall now close our remarks by giving some lengthened extracts from the valuable Report of the Commissioners, and heartily wish to see the undertaking brought through the present session of parliament, and that it may not be marred by the narrow prejudices of the city authorities, who, as they did with railways, will attempt to throw obstacles in the way to prevent the Commissioners carrying out the plan, under the plea that it will interfere with the *undoubted* rights and privileges of the citizens of London!

The Commissioners' Report.

Upon a careful review of the many subjects of improvement for which plans had already been before the public, or were subsequently submitted to us, we considered an embankment of the river Thames to have the first claim to our attention.

For a considerable period the condition of a large portion of the river in its passage through the metropolis has been the subject of observation and complaint; and although measures have at different times been submitted to Parliament, having its improvement for their object, yet nothing of a comprehensive nature has been effected.

The causes of the great change which has taken place in the bed of the river Thames, in that portion of its course which lies between London and Westminster Bridges, may be shortly stated. Among the first, if not the very first, of these in recent times, may be considered the removal of Old London Bridge—a measure, no doubt, ultimately beneficial to the interests of the river as a whole, but prejudicial for a time to the navigation immediately above it.

The operation of this change upon the condition of the river, and especially in the portions between the bridges, though great, and, as already observed, no doubt the immediate cause of the present embarrassment experienced in the navigation, has been uniform in its effects, and consistent in its character. It has produced, as was anticipated, a higher rise and lower fall of the tide than heretofore, and is producing, as was also to be expected, a general, though not uniform, lowering of the level of the river bed.

While the first of these consequences, however, has been immediate and manifest, the second, it is obvious, if left to the operation of natural causes, must necessarily be the work of time; and hence, in the interval, the navigation of the river must be difficult at certain states of the tide.

The shoals and irregularities, however, which constitute the greater portion of this difficulty, are, in the evidence before us, attributed to other causes. We are referred to a want of uniformity in the bends and curves of the river, to the disproportion between the breadth and volume of its waters, and probably to the varying nature of the material forming its bed, as natural agents in working out these results, and, as artificial causes, to projections and recesses in the shores, irregular dredging, and other evils alleged to have arisen from imperfect conservancy.

The conservancy of the river Thames is a privilege and a trust vested in the Corporation of London by very ancient charters, confirmed and renewed at various periods. The exact extent of the rights and of the duties thereby assigned to that body have been the subjects of much diversity of opinion, and of dispute and controversy both in and out of Parliament, strongly showing the necessity for some legal decision, or legislative adjustment, upon a matter of so much practical importance. Upon these points, however, it does not appear to us that it is within the province of this Commission to express an opinion; we therefore conceive that we shall sufficiently discharge our duty under this head, by soliciting the attention of your Majesty to the information furnished on this subject (extracts of which are annexed to this Report) by the Commissioners on Municipal Corporations, by the Committee of Parliament on the port of London, and by the City of London Navigation Committee.

Under the authority of the Corporation of London, and, on some occasions, under special authorities obtained from Parliament, the river has been extensively, though not systematically, embanked, and its water-way irregularly contracted, as will be seen by a plan, annexed to this Report, of that portion of the river which flows immediately through the centre of the metropolis.

Other embankments we find are in progress at the present time, under licenses granted by the Corporation, of which embankments plans are also appended.

The effect of these partial and occasional embankment has been from time to time to alter the currents of the river, and to impair its navigable channel.

The embankments constructed under the authority of Parliament are few. The first of these was projected by Sir Christopher Wren immediately after the Fire of London. The object of this embankment was "to make a commodious quay on the whole bank of the river from Blackfriars to the Tower:" and under the authority of the Act of Charles II. for rebuilding the city, and a subsequent Act of the same reign, it was partially carried into effect.

Under the first of these Acts, no house, outhouse, or other building whatsoever, was to be erected from Tower Wharf to Temple Stairs, within 40 feet of the river, cranes and sheds for present use only excepted.

Although few traces of such a way are at present to be found, yet a portion of it from the Tower to Castle Baynard was actually executed. Encroachments, however, were subsequently made upon it from time to time, and in the year 1821, "notwithstanding a very decided opposition to the measure in both Houses of Parliament, on the part of the Corporation of London, and the inhabitants of Upper Thames Street and its vicinity," the Act in question was repealed.

No further plan for regulating or improving the banks of the river was entertained till the year 1767, when a measure was submitted to the Corporation of London for raising £300,000 for the completion of Blackfriars Bridge by embanking the north side of the river between Paul's Wharf and Milford Lane, upon a line extending about half a mile in length. Arrangements were subsequently entered into with the Societies of the Middle and Inner Temple, and other parties, by which this embankment ultimately included the frontage of the Temple Gardens.

The terms in which this proposal was submitted to the Corporation would apply with very little variation to many parts of the river at the present day; and considering that a century at least had then elapsed since any measure has been attempted for the "regulation and improvement" of its shores, and that another century has very nearly arrived at its completion, the statement is not undeserving of attention. "The wharfs," it is observed, "within those limits, by their different and very unequal encroachments, not only form an irregular and disagreeable outline, but afford the owners of some an undue preference and advantage over others; at the same time that the reflected set of the tides, both ebb and flood, throws the force of the stream upon the Surrey shore, opposite to Blackfriars, and, of consequence, slackens the current on the London side; this, together with the large sewers that empty themselves in the neighbourhood, occasions a constant accumulation of sand, mud, and rubbish, which not only destroys great part of the navigation at low water, but renders the wharfs inaccessible by the loaded craft even at high water, unless at spring tides; the mud and filth thus accumulated, notwithstanding the frequent expense the wharfingers are at to clear it away, is, when not covered with water, extremely offensive, and in summer time often dangerous to the health of the neighbouring inhabitants." The Corporation of London, it is presumed, acquiesced in the correctness of these statements, inasmuch as they adopted the plan; and powers were subsequently given by Parliament for carrying it into effect.

The next embankment of importance took place at Durham Yard and the places adjacent, now known as the site of the Adelphi Terrace, and the buildings connected therewith. In the years 1768, 1769, and 1770, Messrs. Adam and other parties applied to the Corporation of London for their consent to this embankment, but without effect. The Court of Common Council not concurring, the parties applied to Parliament for an Act enabling them to effect a large embankment in that vicinity, not in the lines originally proposed, which Act was subsequently obtained, notwithstanding the most decided opposition on the part of the Corporation in every stage of the bill, and notwithstanding that the clauses subjecting the ground to be gained from the river to the acknowledgment originally offerred to the Corporation were not inserted in the Act.

Within a comparatively recent period further embankments, upon a scale of considerable magnitude, have been effected in the same portion of the river. We refer especially to the embankment which forms a part of the present site of Hungerford Market, and which was sanctioned by the Legislature in connexion with that measure; and to the projection devised for the enlargement and rebuilding of the Palace at Westminster for the accommodation of the new Houses of Parliament.

"During the last 50 years," it appears, "numerous grants have been made, under the sanction of the Corporation, for embankments in various parts of the Thames, throughout the jurisdiction of the city of London, by which the general line of the river, to a certain extent," is alleged to have "been regulated and improved. It was not, however, until within the last 15 years, and under an order of the Common Council, that the balance of moneys received on this account, and for other accommodations on the river, after deducting the expenses applicable thereto, were brought in aid of the conservancy.

The insufficiency of the funds strictly applicable to the purposes of the conservancy appears to have long formed a subject of complaint on the part of the Corporation, and we presume that to this, among other causes, is to be attributed the fact, that as far back as there is any evidence of the defective condition of the river, previously to the year 1840, there is no trace of any measure for a general and systematic improvement of the navigation, or regulation of its banks, having originated with that body.

Of the attempts made in Parliament to apply a partial remedy to this state of things, mention will be made hereafter. They failed, as it appears to the Commission, from causes which need not any longer operate:—in the first instance (in 1825), under an apprehension that the removal of Old London Bridge was too recent to admit of any accurate opinion being formed as to its effects; in the second (in 1840), from the indefinite character of the measures proposed, and from the opposition of the wharfingers, and others in trade, to the plan upon which those measures were to have been founded.

The Report then proceeds make some observations on the schemes proposed by Sir Frederic Trench in July, 1841, and by Mr. John Martin, both schemes the Commissioners appear to consider impracticable.

The plans to which the attention of the Commissioners has been directed as appearing to exhibit in their details the best mode of effecting an embankment of the Thames, were three in number, viz.:

A plan prepared by Mr. Walker (A).

A plan prepared by Mr. Page the acting engineer of the Thames Tunnel (B); and

A plan founded upon the suggestions of a member of the Commission (C). These will be occasionally referred to as plans (A) (B) (C) respectively.

The Commission proceeded, in the first place, to examine Mr. Walker and Mr. Page in reference to the objects, advantages, practicability, and expense of their respective plans. The official opinion of Captain Beaufort, and the professional opinions of Mr. Hartley, Mr. Cubitt, Mr. Gordon, Mr. Rendel, Mr. Macneil, Mr. Rennie, and Mr. Giles, were subsequently obtained; first, as to those leading and general points which appeared to apply to all the plans, and secondly as to the relative merits of the three.

Of these opinions, a portion, it is to be observed, was collected by the Commission in the usual form of oral evidence. It occurred to us, however, subsequently that all the essential questions in an enquiry of this nature might be more effectively condensed, and circulated in writing (an arrangement which was subsequently found conducive also to the parties consulted), and the remainder, therefore, were collected in that form.

Copies of these questions were also addressed to Sir Isambard Brunel, and Mr. J. K. Brunel, and Mr. Donkin; but considerations of health in the first case, and professional engagements and want of time in the other two, deprived the Commission of the assistance of these gentlemen.

In addition to the eminent civil engineers above adverted to we had occasion to examine, upon separate and distinct portions of the enquiry, Mr. J. W. Higgins, a surveyor extensively employed in London, and ordinarily referred to by the corporation for valuations, in cases of embankment upon the river; Mr. R. L. Jones, the chairman of the London-bridge Improvements Committee, a gentleman possessing great information on many of the subjects involved in many of these enquiries; and Captain Maughan, the dock-master of the London Docks, whose connexion with a large commercial body interested in the navigation of the pool, added to his practical acquaintance with the wants and habits of the river generally, made his evidence especially desirable. Messrs. Hay, Peache, and Lucey, barge-owners and lightermen, and Messrs. Tayler, Harvey, and Pocock, coal-merchants, or general wharfingers, in the line between Westminster and Blackfriars bridges, were examined principally on points not touched upon by the Select Committee of 1840, and upon the probable influence of any measure of embankment upon their respective interests.

On the feelings and opinions of the trade, as a body, it appeared to us to be more consonant to the convenience of the parties to be consulted, more conducive to a right understanding of the measures contemplated, and more likely to result in a well-considered judgment upon these measures, if our chairman were to address himself to one of its members in behalf of the whole; to enclose for their consideration copies and detailed description of the plans; and to express the desire of the commission to have a deliberate opinion from all parties concerned as to the principle upon which, and the mode in which (consistently with the permanent interests of the river) an embankment might be effected in nearest accordance with their own views and wishes. A letter was accordingly addressed, and plans transmitted to Mr. Tayler, of the firm of Dalgleish and Tayler, extensive coal-merchants and wharfingers in Scotland-yard; and in the appendix a copy of that letter is inserted, as well as of Mr. Tayler's reply.

In addition to these various sources of information on the subject before us, we were favoured with the written opinions of Mr. William Cubitt and Captain Maughan, subsequently to, and in extension of their respective oral examinations; a "Memorandum upon Estuaries and their Tides," contributed by Sir Henry Thomas de la Bèche; and, finally, with three letters, and various tables and statements prepared by Mr. Page, accompanied by sections of the several bridges, and of the river, presenting a large body of valuable matter not bearing exclusively on the local topics and interests more immediately involved in these inquiries, but on the general question of embankment in tidal rivers. With these we have inserted in the appendix, papers, the result of inquiries made under our direction as to the frontages and occupations of the wharfs on the Middlesex side, with the number of barges and other craft in front of each at certain periods of the inquiry; and also as to the heights above Trinity datum of the nearest line of communication parallel with the river between Blackfriars-bridge and Whitehall, showing the great irregularity in the level of that leading thoroughfare.

The Plan of Mr. Walker.—(A.)

The plan of Mr. Walker, referred to in a former part of this report, originally comprised an embankment on both sides of the river, between London and Vauxhall Bridges. In his evidence before the Commission as to the relative expediency of embanking the Surrey and Middlesex sides of the Thames respectively, Mr. Walker stated his attention to have been principally given to the northern side of the river, adding it to he his own opinion (in which, indeed, almost all the authorities subsequently consulted appeared to concur), that "it would be better to establish a principle, and to show its working in a portion of the river in the first instance," and to make the first embankment on the northern shore. The course of inquiry, therefore, pursued in his examination by the Commission, had reference principally to these considerations.

The lines of Mr. Walker's plan are those shown upon plan A in the appendix. It contemplated the formation of quays along the greater portion of the line, at the level of three feet six inches, or four feet above Trinity standard; these quays to become, upon terms to be settled, the property of the respective parties owning the present wharfs, of which the embankment was, in fact, to be considered an extension.

A continuous solid embankment, however, having been deemed impracticable throughout the whole line, Mr. Walker's plan suggested four exceptions, viz.:—one at Northumberland Wharf; a second above Waterloo Bridge, terminating at the bridge stairs; a third above the Temple Gardens; and the fourth commencing at Whitefriars Dock, and terminating at the Bridge Stairs, Blackfriars. At these places he proposed to leave recesses (shown on the plan) varying from 400 to 800 feet in width respectively, and bearing together, a proportion of about one-third to the rest of the embankment.

"As the deepening of the navigable channel might tend to draw down the ground of the respective wharfs into the river, it was proposed where required, to support the same by close piling in the line of the embankment, the top of this piling not to be above the level of the ground where it is driven." The main body of his embankment Mr. Walker proposed to construct of materials to be obtained from the bed of the river; the embankment wall, excepting at Somerset House, where the wall was to be faced with stone, being of brick with stone dressings only.

Of Mr. Walker's plan, a roadway formed no essential feature. In the event of a terrace or a railway being thought desirable, he proposed that it should be at least 50 feet in width; that, commencing in the neighbourhood of Whitehall, it should be carried over both the embankment and recesses, upon flat arches of 100 feet span, at such an elevation generally above the river as would enable the public in the use of it to communicate with Hungerford, Waterloo, and Blackfriars bridges, at the level of their respective roadways. With the last-mentioned of these bridges it would end.

Assuming, therefore, the height of Mr. Walker's embankment, throughout, to be, at high water, four feet above Trinity datum, the elevation of the roadway of this terrace above it would vary at different places; at its commencement at Whitehall it would be from five to six feet, at Hungerford and Blackfriars bridges 27 feet, and at Waterloo Bridge 37 feet above the same standard. To a spectator from the river, it would in each case present, with the addition of its balustrades, an elevation about three feet higher.

As the fall of the tide would throughout the whole line of the embankment, produce, to the eye, a corresponding addition to its base, the river front of the terrace and embankment together would, at times of ordinary low water, have gained an apparent addition to its height of about 16 feet; making its extreme elevation above low water, with the balustrades, about 56 feet.

The estimated expense of Mr. Walker's embankment, as stated to the select committee of 1840, assuming it to be carried to the Horseferry Road, was £300,000. In his evidence before the Commission no proportion of this amount was assigned to the shorter distance since contemplated; but it is probable that, upon the embankment above Westminster Bridge, a small portion only of that amount would have been expended.

The erection of a terrace (if it were desired) as a separate superstructure, with its piers, arches, and roadway together, would, in Mr. Walker's opinion, involve a further expense of about £400,000.; making the estimated cost, therefore, of the terrace and embankment combined, between £600,000. and £700,000.

The plan of Mr. Walker, as we have already stated, excited considerable opposition in Parliament in the session of 1840, from the wharfingers and others interested in the trade of this locality. It was then directed exclusively to the principle of a solid embankment, subject to the exceptions already referred to, as to recesses in certain portions of the line.

The objections urged against it at that period had reference to its alleged interference with the river frontage, of which, though a large portion, in the opinion of the Commission, might undoubtedly, have been improved by the adoption of such a measure; yet a still larger had been appropriated to purposes dependent upon its proximity to the water side, and adapted principally to the habits of the coal trade.

These objections, it should be stated, though the objections of a majority of the parties affected, were not universal. It was alleged by Mr. Walker that many wharfingers were desirous of availing themselves of the privilege to embank, upon the terms then proposed by the city, viz.—the payment of 1d. per annum for every square foot of ground acquired from the river.

It was objected, however, that assuming this to be permitted, a measure so partial in its operation could not fail to be injurious to a large body of the trade, by creating recesses of indefinite width, uncertain as to the time of their existence, and in the mean time favouring the accumulation of mud.

The evidence of Mr. Walker upon all these points, together with the evidence of those who, on these and other grounds, were opposed to the principle of his embankment, has been before the public now for a period exceeding three years, in the report of the select committee already referred to. No doubt, it appears to us, can exist, upon a perusal of that evidence, that it exhibits a manifest preponderance of feeling on the part of the trade adverse to the plan before that committee.

The object of the Commission, therefore, in calling Mr. Walker before them, was not to re-open the discussion of 1840, but, looking to the result of that discussion, his subsequent survey of the river in 1841, and the probability, from these and other causes, of his having communicated with parties interested in the northern shore of the river within the intervening period, to ascertain whether he had seen reason to alter his opinions or to modify his plan, and especially whether he was prepared to bring the question again under the consideration in a shape that might justify them in recommending its adoption.

From our examination of Mr. Walker on these points, his views appeared to have undergone no change; and with reference to the concurrence which his suggestions were now likely to receive on the part of wharfingers and others interested in the line, we found him unprepared to inform us either as to the extent to which such concurrence might be depended upon, or to which the Commission might reasonably consider itself entitled in reviving the consideration of his plan. One of three alternatives appeared to us to be inevitable; either that such concurrence should be obtained in the first instance, and throughout the whole line, or that considerable sums of money must be expended in compensations; or, assuming the impossibility of the first of these alternatives, and the inexpediency of the second, that the embankment must proceed in small and sometimes widely detached portions of the whole line.

The latter of these alternatives would justify a revival of all the objections to the proposed embankment of 1840, and render the execution of a terrace or river road utterly impracticable.

We are not unmindful that Mr. Walker has endeavoured to provide against these contingencies by recesses sufficient in extent and so arranged in regard to locality as to meet the wants of a large body of the trade; but we cannot but remark, at the same time, that these recesses stood in Mr. Walker's plan of 1840; that he would give them no definite assurance as to the time by which they would be completed, or the period for which they might be available; and that, upon being questioned by ourselves as to the grounds upon which he had determined the proportions of his recesses to those of his solid embankments, he admitted that "he had calculated upon the feeling of individual proprietors in the line, of which, however, he knew little."

In stating to the Commission the origin and purposes of his survey of 1841, Mr. Walker observed, "The great object of the City in that survey, as it appears to me, has been to determine a river line, to which parties making applications might, but beyond which they must not, extend their premises; and, to show how the navigable part of the river may be deepened and improved, without injuring the berths for barges where parties do not wish an extension of solid wharf, which is in no instance proposed to be compulsory."

Upon being questioned by the Commission whether that opinion should be understood as applying to the plan under consideration, he replied,

"I have stated that at present there is no intention of anything compulsory, so far as I am aware of. I am not sure that it would not be expedient for a considerable time to leave it to be optional. I think if the measures were now intended to be compulsory, there would be demands from the owners on the banks of the river for compensation; whereas if the thing were left to work its own way for a time, parties would be allowed to carry out and extend their premises; some in the shape of recesses or docks, and some in the shape of embankment the property being then considered theirs in fee. In that way portions being taken in different parts all along the river, if it should be desirable afterwards to be made compulsory upon the minority, the majority of owners and occupiers agreeing in the plan, or if they got to be all unanimous, there would be an excellent standard along the whole course of the river on which to value the land, or to pay for damages if any were done." The Commission upon this observed, "Then the embankment would take place at separate intervals?" To this observation Mr. Walker answered "Yes."

The amount of moneys to be paid as compensation under such circumstances, or of other moneys to be raised in consideration of the land embanked, are subjects, therefore, into which it would be obviously impossible for this Commission to enter with any certainty or profit. According to Mr. Higgins, who was examined before the Committee of 1840, and whose views, like those of Mr. Walker, would appear to have undergone little alteration subsequently, a revenue of about 3,600*l*. per annum might be realised if the embankment were complete; but "he had taken what would be gained by the embankment; in no case what would be otherwise lost." He had made no separate estimate of the amount to be expended in compensations, and his estimate of the revenue was admitted to be irrespective of any outlay of the kind.

The advantages of Mr. Walker's plan for a solid embankment, if it were complete, would undoubtedly consist in its simplicity of outline, its freedom from details, and its entire exemption from restrictions and regulations of any kind for its after-management. In making this observation, we desire to apply it either to a solid embankment throughout, or to the embankment with recesses to which Mr. Walker's proposal is at present limited; for, although the objections, on the score of the accumulation of mud in these recesses, and of the insufficiency of the ordinary traffic of the river for its dispersion, pervade the whole of the evidence taken by the Commission, yet the general tendency of that evidence is to show, that, if they were judiciously constructed in the first instance, a moderate application of artificial means, such in fact as is at present resorted to in the best constructed wharfs on the river, might answer every necessary purpose.

The objections to the plan, however, on other grounds are not so easily disposed of. According to the evidence before the Commission, the abstraction of the tidal water from a navigable river is in principle objectionable, inasmuch as it diminishes the efficacy of the scour. Various opinions were offered as to the degree to which this objection would apply to Mr. Walker's embankment. Mr. Hartley was of opinion that it would be considerable; and, with Mr. Giles, that its effects, if not felt in the Pool itself, would be more or less injurious in the district of the river below the Pool: Mr. Rennie, that it would operate both in the Pool and in the river below the Pool. The general tendency of these opinions, indeed, in reference to the plan immediately before us, was that, assuming the navigable current to be improved by judicious dredging, and an uniform course and increased velocity to be given to its channel, the loss would, in great measure be compensated. But these opinions were given in reference only to a small portion of the river, irrespectively of any system for its general management, and, of course, without contemplating that extension of its present plans, which this Commission may feel it right to recommend hereafter.

It was objected as to the recesses, that in proportion as they were favourable to the trade, they would become injurious to the navigation. Mr. Hartley was of opinion that they would abstract from the full force of the tidal current, and in a limited or proportionate degree affect both the tide and the scour: Mr. Cubitt, that an embankment so formed would not be continuous enough above low water mark to form a good and efficient tide to the river: Mr. Gordon, that by causing eddies they would disturb the current of the main stream, and prevent the establishment of any uniform regimen for the river: Mr. Rennie, that they would have a strong tendency to interrupt the free flow of the tide. Mr. Rendell, speaking in his evidence of these recesses, observes, "I cannot imagine any arrangement which would be more likely to make the bed of the river worse than it is at present. If there were a series of long embankments, and a series of long recesses, they would, instead of giving an uniform velocity to the stream make it more irregular than it is at present." On the other hand, Captain Beaufort was of opinion that, practically, they would have no effect on the scour of the river, and Mr. Macneil and Mr. Giles that "embankments, with occasional recesses," would conduce to its "improvement," and to the "benefit of the navigation."

The mode of levelling these recesses, proposed by Mr. Walker, and of providing them with permanent foundations, is fully explained in his evidence. The objections on this head took a wider range, though intrinsically of less importance, than those above adverted to, inasmuch as they involved the use and the construction of these receptacles for trade. Of the persons in trade examined by the Commission in reference to the dwarf piling proposed by Mr. Walker, Mr. Hay (a lighterman) was of opinion that it would be injurious to the craft. The answers of Messrs. Pocock and Peache (the first a coal, and the second a timber merchant) were not adverse: Mr. Lucey (a lighterman) gave no decided opinion; Mr. Tayler (a coal merchant) and Mr. Harvey (a wharfinger), both of them occupiers of extensive river frontages, were generally in favour of its adoption. The opinions of these witnesses, it is right to observe, were given in evidence, and without any previous reference to plans, sections, or other sources of information. Mr. Tayler and Mr. Harvey appear to have formed the most correct conception of the course proposed to be pursued.

Of the professional witnesses consulted, the attention of the majority appears to have been directed to the effect of this dwarf piling upon the navigation, in connexion with the recesses: of those who expressed their opinions with immediate reference to the use or convenience of it to the trade, Mr. Cubitt thought that dwarf piling would be inconvenient, as forming a step or threshold under water, and Mr. Rendel, that barges would be liable to ground upon, and be endangered by it. These opinions, it should be observed, were given, not in evidence, but upon a deliberate examination of the sections which accompanied Mr. Walker's plan.

The objections of the trade to the general principle of a solid embankment, whether with or or without recesses, have already been adverted to in the history of the proceedings upon Mr. Walker's plan before the select committee of 1840. Of the witnesses in trade examined by the commission, Mr. Harvey objected to a solid embankment, that it would prevent him from getting his barges to the warehouses; that he should have to carry all his goods twice; that his craft, by being exposed to the swell of the steamers, without proper moorings in the stream, would be subject to increased wear and tear; and that any measure which deprived him of his accustomed means of access would be attended with additional expense in the landing and warehousing of his goods. Mr. Pocock attached no great importance to the wear and tear apprehended by Mr. Harvey; but in every other respect concurred in his objections. It was suggested, and assented to by those gentlemen, that piles driven out in the main stream might diminish the difficulty as to moorings, assuming the extent of these to be equivalent to the accommodations of their present frontage (in many cases usurped); but this equivalent would have involved a projection into the navigable waterway of 160 feet in the one case, and from 180 to 190 feet in the other, and, allowing for the depth of solid embankment proposed in this particular locality (viz., in the neighbourhood of Whitefriars), would have carried the piling, on the northern shore alone, very nearly into the present centre of the river.

The opinions of the lightermen consulted on the last-mentioned of these points had reference principally to the exigencies of their own calling. Assuming a solid embankment to be constructed throughout the line, they were agreed that, with the additional velocity to be given to the stream in heavy frosts, and with a channel loaded with ice, the craft would drift at the mercy of the current, and that no system of piling would avail for their security.

The professional opinions consulted by the Commission were very nearly in accordance with each other on both of these points.

On that of the wharfage, Captain Beaufort, Mr. Hartley, Mr. Rendel, Mr. Macneil, and Mr. Giles were of opinion that continuous lines of solid embankment shown upon the plans could not be made consistently with the interests of the trade or the convenience of the public; Mr. Rennie, on the other hand, that the two objects were conjointly practicable; Mr. Gordon—that, "after a serious interference with, and breaking up of, existing arrangements, the trade would be ultimately great gainers by a solid embankment."

On that of the river—Mr. Hartley thought, that "to force all the craft to moor in the navigable stream would be a source of inconvenience to the trade, and of obstruction to the navigation;" Mr. Gordon—that, "as in the present system of traffic on the Thames, the bights or bays are indispensable as places of rest and refuge, the solid embankments of plan A would tend to injure the trade;" Mr. Rendel—that, "if the Thames were embanked with a solid embankment, according to the plan suggested, the wharfingers would find it absolutely necessary for their own protection not to moor out into the stream;" that "as the object of making a solid embankment would be to give the Thames such an uniform velocity as would keep open its channel, that velocity would prevent the use of the then shores by those barges;" that "the strongest run of the tide could not be taken at less than three miles an hour, and that three miles an hour would be quite enough to prevent the mooring of those craft along the shore;" that the utmost extent to which such a course would be practicable would be "a couple of barges in length," and that guard piles carried out to an extent to meet the requisites of the trade "would not continue a week." The opinions of Captain Beaufort, Mr. Cubitt, Mr. Macneil, Mr. Rennie, and Mr. Giles were addressed rather to the question of recesses, and their convenience to the trade as shelter from the open tideway, than to the positive difficulties and disadvantages connected with solid projections.

The foregoing, we think, may be referred to as a faithful summary of the opinions whether for or against the adoption of Mr. Walker's plan, having reference exclusively to its own merits. Its relative advantages and disadvantages, with reference to other plans, will be referred to hereafter.

The Plan of Mr. Page.—(B.)

The principles of Mr. Page's plan are distinct in character from those of Mr. Walker, and, in some respects, opposed to them. It proposes an embankment with side channels, the embankment of itself forming a continuous public terrace. Assuming every abstraction of tidal water from a navigable river to be injurious to the navigation below the locality of the embankment, by depriving a portion of the river of its scour, Mr. Page proposes, first, to avoid encroaching upon the capacity of the river for the reception of its tidal waters, and to make the prevention of encroachments at any future period, as far as practicable, a leading feature. Secondly, to leave to the wharfingers and others interested in the trade of the locality the possession of their present accommodations on the river shore; and, thirdly, to provide increased facilities of communication between the east and west ends of town by a public road constructed in the river.

The details of a plan professing to be founded upon these principles must, it is obvious, be far more extensive and complicated in their character than those of any plan based upon an alternation of solid embankments and recesses only. A river wall interposed between the navigable channel and the shore must have openings to afford facilities of intercourse between the two, the position of these openings would form one subject for inquiry—their width another—the facilities of access at different states of the tide, another. These openings could, of course, be passable only by bridges; and those bridges, in accordance with one of the leading principles of Mr. Page's plan, should be of sufficient width and height to admit of the accustomed traffic of any locality at any state of the tide. On the other hand, Mr. Page's terrace was to pass under the respective bridges which connect the Middlesex and Surrey shores of the river; and hence it would appear impossible entirely to satisfy one of these conditions without conflicting, in some measure, with the other.

Another point, the importance of which was not to be overlooked, was the convertibility of these side channels into docks or floating basins. The treatment of this question involved the discussion of locks, their position, their capabilities, their size, and their probable cost. The relative advantages of tidal docks and floating basins, in reference to the trade and the navigable interests of the river; the supervision necessary to the regulation of either; their respective tendencies to silt, and the facilities for cleansing and keeping them free from mud, furnished further subject for inquiry, and, the Commissioners are compelled to add, for much conflicting opinion.

Of the plan before the Commission a copy will be found inserted in the Appendix, together with a statement of its objects and alleged advantages, drawn up by Mr. Page at our suggestions. As its features were comparatively new, and as we had not before us, as in the consideration of Mr. Walker's plan, a body of existing evidence to refer to, we were induced by these and the causes previously mentioned to examine Mr. Page at great length, and to enter minutely into detail on matters some of them exclusively technical in their character, and to which therefore it is scarcely necessary to refer in this Report, except as to their relative importance to, and bearing upon the main subject of inquiry.

Looking to the principles which Mr. Page assumes as forming the basis of his plan, its consideration may be divided, as stated by himself, under three heads; viz.—

1. As any embankment constructed upon these principles may affect the Thames as a navigable river.
2. As it may affect the wharfingers and other proprietors on its banks; and
3. As it may improve the means of communication in the metropolis by opening new facilities for traffic, and for promoting generally the health and convenience of the public.

The first of these considerations opened of itself an extensive field of inquiry, and involved a class of interests not so much connected with the locality immediately concerned as with the Pool and lower portions of the river. We trust that the magnitude and importance of these interests have not been forgotten.

The abstraction of the tidal water from a river, wherever an embankment is projected upon its shores, and the prejudicial consequences necessarily arising from that abstraction, are topics upon which, of course, this Commission can be competent to express an opinion only upon the evidence before it. The expediency of maintaining if not increasing the volume of tidal water in the higher portions of the Thames, is stated by Mr. Page to have suggested a leading feature of his plan, and many of the letters and papers already referred to as inserted in the Appendix to this Report, are addressed to this interesting but necessarily difficult branch of the inquiry. Of the soundness of the principle which it is the object of these papers to enforce, and looking to the embankment of the locality under consideration as part only of a larger system of improvement, which is at this moment professed to be in operation in various parts of the river, of its great practical value we can entertain no doubt whatever; and, if the evidence before us is not altogether so concurrent as might have been desired as to its application to that particular locality, irrespective of other portions of the river, yet the very conflict of opinions has had its use in impressing upon us the necessity of caution.

The plan under consideration was, of course, open to little positive objection on this head. Captain Maughan, indeed, considered even Mr. Page's embankment as involving prima facie a violation of his own principle, inasmuch as it would displace by its own bulk a portion of that water, and, pro tanto, abstract it from the scour of the river below. In the letter, however, addressed by Captain Maughan to the Chairman of the Commission, he observes, that, assuming the water in the side channels "to pass in and out with the tide, Mr. Page's plan, compared with the other plans, would curtail in a lessened degree the tidal water; while one of his propositions being to remove the mud banks and other inequalities of the river above low water mark, it is probable that the cubic spaces so gained would equal those lost by the terraces, and that thus the river below would sustain no injury."

Its merits, therefore, are to be tested, in the first instance, with reference to the trade of the river shore. The principal objection to which it is obnoxious may perhaps be best stated in the words of Mr. Harvey, a general wharfinger, in considerable trade, occupying the Grand Junction Wharf, Whitefriars:—"I consider that any obstruction, whether by wall or otherwise, which would prevent me from getting my barge into the stream, at any time while she was afloat, would be a disadvantage. The embankment itself would be an obstruction; wherever a barge lies now, whether we want to go up or down, we have only to put her astern and get into the stream. If there is a flood-gate, and we have to go out at one particular spot, we must accommodate the other craft, so as to come out at that particular place. At present it requires a good deal of contrivance to place a large barge alongside of our wharf; and, if the room were much lessened, it would be almost impracticable." To a question whether his objections were confined to the inconvenience of access, he replied, "The inconvenience of access is one point. Then it shortens my water-way. If the embankment take place outside what we consider our present water-way, I could not of course complain, except as to the impediment of access." Mr. Pocock, the owner of an extensive coal-wharf in the same neighbourhood, concurred in these objections of Mr. Harvey. The outer pile of Mr. Harvey's wharf was stated to be 160 feet—that of Mr. Pocock's wharf to be from 180 to 190 feet from the shore, the space assigned to these wharfs, upon Mr. Page's plan, was about 140 feet; the space usually granted by the city, according to Mr. Richard Lambert Jones, from 70 to 100 feet.

A further reference, however, to the evidence of Mr. Jones on this point may help to clear up much of this difficulty. In reference to Mr. Page's plan, he observes, "I dare say the coal merchants would say, at first starting, that there is not sufficient room for them; for I know enough of the applications by the various coal merchants to the corporation of London to put piles in, and to have what they call floating craft; but we never can confine them to that; though they may ask for one pile, they will carry it further out, We confine them that they shall not come out more than five or six craft into the river; and they will take the liberty of having seven or eight; that is, they make the warehouses for coals on the river, instead of having them on the land, as they are at Liverpool and other outports; it is the cheapest warehouse they can get."

Mr. Tayler, on the other hand, of the firm of Dalgleish and Tayler, coal merchants and general wharfingers in Scotland Yard, to a question as to the bearing of this plan of embankment on their interests as wharfingers, replied, "I should rather have the river (speaking of it as merely connected with our business) as it is. It would give us a great deal more trouble getting out and in of this dock; it would impede our business a little, but I think not to a material degree." These gentlemen are the occupiers of two wharfs adjoining to each other, at which the average number of barges is about 30, the mooring room at one of them alone being sufficient for 53.

Of the professional opinions obtained by the commission upon this part of the question, there were none addressed directly to the reasonable sufficiency of Mr. Page's inner water way. No doubt, however, as to its sufficiency is expressed by these gentlemen in the discussion of any portions of Mr. Page's plan, or of the modifications of which it was represented to be susceptible; and the commission think it will be clear, from the general tenor of their evidence, that no such doubt was entertained.

The evidence of these gentlemen as to the merits of the plan under consideration, as it would affect the wharfingers and other proprietors on the bank of the river, involved questions of detail upon which it was necessarily difficult for the commission to obtain, or indeed for them to give, direct and unqualified answers. Having no personal interest to serve, the tendency of their evidence was rather to suggest alterations, than to take objections, upon all the really practical parts of the inquiry. The reply of Captain Maughan to one of the questions of the Commission affords an illustration of this statement:—"Mr. Page's plan," he observes, "admits of two modes of application—either with open entrances (or entrances open only during particular periods of the tide), or locks, which would make his side channels floating basins; but the object of it, I understand, is to leave the wharfs as they are at present, and otherwise to meet the exigencies of the trade, whichever mode of entrance may be more convenient;" and the bulk of the evidence on this point is accordingly associated with one or other of the modes of application above adverted to.

To the inquiries of the Commission as to the best mode of improving the navigation of the river, with reference to the trade of the locality, and assuming approximate uniformity of width to be desirable for such improvement, Mr. Hartley observes, "I am of opinion, that approximate uniformity of width is desirable for the purpose mentioned, and I conceive this may be obtained without injury to the trade of the locality, by leaving open the spaces between the embankment and the shore for the use of those now occupying the margin of the river." Mr. Gordon—that "as in order to regulate the river, it should be brought to approximate uniformity of width, the best mode of accomplishing this, with reference to the convenience of trade, would be the principle of the plan B, whereby the present river fronts remain intact, and, all things considered, the craft would have better and safer accommodation than at present." Mr. Rendel—"that the local trade would be best consulted by leaving the space between the wharf and the embankment open to the tidal flow and ebb." And Mr. Macneil—that "the best mode of accomplishing the object, having reference to the trade of the same localities, will be to construct a wharf wall sufficiently wide to form a thoroughfare upon it, and at such a distance from the shore as to allow barges and other craft to ply to the different wharfs, as at present, upon the principle of plan B." In Mr. Cubitt's judgment, on the other hand, "the better mode would be to construct the shores of the river with strong walls, and to form floating docks between such walls and the present shores, and wharfs for the accommodation of the trade." The opinions of Captain Beaufort, Mr. Rennie, and Mr. Giles are not directly expressed on the point, and are consequently not available.

To a subsequent question, whether the principle of plan B would be better carried out by the substitution of locks and floating basins for tidal docks or side channels, as originally proposed, the replies of Mr. Cubitt, Mr. Rendel, Mr. Rennie, and Mr. Giles were in the affirmative; of Mr. Hartley, Mr. Gordon, and Mr. Macneil, in the negative. In the series of questions submitted to the Hydrographer to the Admiralty, this question was inadvertently admitted.

We think it right, in reference to this point of our inquiries, to advert to the distinct and practical testimony of Captain Maughan. "Side channels," he observes, "admitting the rise and the fall of the tide would, in my opinion, be preferable to docks." The former appear to possess advantages over the latter plan, viz., access for the barges at all times of the tide (at least as long as there is water inside the terraces), the saving of a very considerable expense in constructing locks, double lock gates, &c., as also the usual cost of maintenance, and of the establishments for working them. Locks would also very much encroach upon the side channels, and, if many of them should be required for the admission of barges, the annual cost would be very heavy indeed."

He adds, "If the side channels were converted into floating basins, the abstraction of tidal water would of course be equal to the cubic contents of these docks; and so far as the navigation is concerned, this modification of Mr. Page's plan would be as injurious as a solid embankment."

The next in the series of considerations connected with Mr. Page's plan are the alleged difficulties of entrance to these side channels from the river. The number, position, and dimensions of these, it is obvious, might be modified at almost any period previously to the commencement of the works, and we confined ourselves, therefore, to points less susceptible of modification. Mr. Hay, a lighterman, observes, "I think Mr. Page's plan is the best I have seen, and if a project of that kind is to be executed, I have never seen any plan equal to it; but if the river is narrowed, the tide will go up with greater velocity. We have great difficulty, now, in bringing up with our craft. Now, we can bring up to the wharfs, and bring up in a recess, and get out of the way; but I doubt whether we can ever bring up at all when the tide is running so hard as it would. Still Mr. Page's plan is a very excellent one; I have seen nothing equal to it, if these difficulties of getting in at the openings can be done away with." On being further questioned whether his objections would equally to open entrances, he replied, "If there is a plan intended to be carried into effect on the river, there cannot be a better; but I fear when we come to the openings the tide will carry us by." Mr. Lucey, also a lighterman, apprehended no difficulty whatever; referring to the entrances of London and St. Katherine Docks, he depended upon the eddy to assist him, and gave his reasons for that dependence. Mr. Tayler thought there would be no difficulty, "unless the speed of the tide were very much increased. In the flow of the tide it would then require some very experienced bargeman to bring up, and ring-bolts or piles must be resorted to for the purpose." Assuming an increase of 15 per cent. upon a velocity of three miles an hour, he anticipated no difficulty whatever. Mr. Harvey had conversed with intelligent lightermen, and inferred, from the same causes, that admission would be more difficult. Mr. Pocock adverted to the increase of existing difficulties since the removal of Old London Bridge, and was also of that opinion, attaching little importance to the drift or eddy anticipated by Mr. Lucey; and Mr. Peache, referring to the fact that a great portion of the craft was worked by only one man, considered that there would be difficulty, in such cases, in getting in without further assistance.

On this point it is observed by Captain Beaufort, "the entrance to the docks in plan B would be often difficult when the tide might be strong; and, if these entrances were converted into locks, great inconvenience would probably arise from several barges arriving at the same time. At the docks which are used by large vessels, specific times of the tide are selected for letting vessels in, and they are then attended by a sufficient number of men to overcome all difficulties; whereas a barge is moved about the river by a single man, who would be quite incapable of conducting her into a narrow gate or lock."

Looking to this question as one having rather a practical than a scientific bearing, the opinions of the engineers consulted were, perhaps, not unexpectedly, discordant. Mr. Hartley and Mr. Cubitt disapproving of the particular entrances shown in plan B, were nevertheless of opinion that there would be no difficulty in designing entrances such as should afford entire protection against strong currents and high winds; the first, however, saw no necessity for locks, the second admitted locks in deep recesses. Mr. Gordon also was of opinion that there would be no difficulty, thought the gates in the plan "judiciously placed," and recommended the addition of others. Mr. Rennie, observing that all the entrances to the various docks at present on the river are occasionally affected by currents and high winds," assumed that "a careful observation of the prevailing winds would determine their position;" Mr. Giles, that "they would be affected by the same causes, but that these would not impose greater difficulties than exist at the entrances of the various docks on the river, and which might, by the means resorted to in these cases, be overcome." On the other hand, Mr. Macneil was of opinion, that "these entrances would impose difficulties and obstructions such as do not now exist at the entrances to the various docks or wharfs on the river;" and Mr. Rendel, that "they would be difficult, if not dangerous, except for an hour and a half, at most, before and after high and low water."

The experience of Captain Maughan may here be again of service in elucidating a practical question. To questions whether the entrances should be at right angles with the stream, he replies, "As regards facility of entrance, I think that is of very little importance. The craft will have to stop outside first of all, and, if there is no tide, which I apprehend there will not be, close to the embankment wall, they will go in as they like; I do not think the stream will run rapidly close to the terrace, so as to prevent the easy ingress of barges." He apprehended no difficulty in getting in, no pressure of the tide upon the vessels at the entrances. In his letter he observes, "The difficulties which have been raised about entrances at right angles I confess I cannot understand; they appear to me very much exaggerated. With a floating platform or dumb-lighter, and piles driven down at proper distances to check the barges, any lighterman could pass in his craft, even should the stream run up rapidly outside, but which I very much doubt its doing, as stated in my evidence."

The discussion of these entrances, without reference to the principle involved in the one or other of the modes of appropriation already suggested, involved a further consideration of some difficulty. The sufficiency of their width was generally admitted, but their height above high water mark, assuming moveable bridges to be dispensed with, afforded subject for much difference of opinion. Mr. Tayler and Mr. Pocock considered, as coal-merchants, that from six to eight feet headway would be sufficient for their purposes; but for straw barges, and other description of craft engaged in similar traffic, and, in short, for general uses, Mr. Hay regarded, 10; Mr. Lucey, 11; Mr. Peache, 12; Mr. Tayler, 14 or 15; and Mr. Harvey, 30 feet, as the smallest allowable reservation. The diversity of opinion upon such a point, between parties whose interests and daily habits should make them conversant with these details, is sufficient, we think, to justify a doubt as to the reasonableness of some of these requisitions.

As the object of any measure for the improvement of the river should be obviously to get rid of the mud at present accumulated upon its shores, the attention both of Mr. Walker and Mr. Page had, of course, been directed to these points: Mr. Walker trusted chiefly to the inclination of his recesses towards the river, and to the tide in cleansing them; Mr. Page, to an inclination to be artificially given in the first instance, and to the subsequent operation of culverts and sluices.

The relative advantages of, and objections to, Mr. Walker's recesses in regard to this question have been already stated in referring to his plan. The tendency to such an accumulation in the side channels of Mr. Page, and the efficacy of the means devised for its prevention or removal, gave occasion to much diversity of opinion, and incidentally involved the discussion of a point already adverted to, viz. the relative merits of open docks and floating basins. Upon the former of these points, it is observed by Mr. Cubitt, "I think the docks proposed by plan B, with single pairs of gates only at their entrances, and subject to be filled up and emptied at every tide, for the purposes either of navigation or scouring, would be very subject to silt up with mud."—Mr. Gordon's opinion was to the same effect, though qualified; Mr. Macneil's, that they would have a greater tendency to silt than the recesses of plan A; Captain Beaufort's, that the tendency would be at least as great; Mr. Hartley's and Mr. Rendel's, that it would be less. Captain Beaufort and Mr. Cubitt were of opinion that, by the conversion of these docks into floating basins, the evil would be diminished; and all concurred in stating that either by the means immediately recommended, or other artificial resources, they might be rendered practically unobjectionable.

The necessity of resorting to these means, however, even upon the simplified basis of side channels, as originally proposed, implied at the same time a necessity for supervision, and this supervision an expense, to which any modification of the plan in the shape of floating basins with lock entrances, would of course involve some addition. Assuming, therefore, the plan B to give to the wharfingers in common the use of large reservoirs of water, and to require the supervision of officers, whose duty it would be to regulate the scour, and the ingress and egress of craft at particular states of the tide, we submitted to the professional gentlemen consulted, whether this supervision, if restricted within proper limits, would entail any serious expense, or offer any obstruction to the trade, or injuriously affect the interests, or trench upon the convenience of the owners or occupiers of the adjoining property. We submitted, at the same time, a second question; viz., whether it would give them any advantages which they do not possess at present?

In reply to the first of these inquiries, Mr. Rennie answered simply, and generally, in the affirmative; Mr. Giles, "that it would become an objectionable restriction upon the freedom of the navigation of the river;" and Mr. Rendel, "that the interests and views of the numerous owners and occupiers of wharfs would make the supervision and police of such docks difficult and expensive; that supposing the entrances to be made sufficiently commodious and numerous, and the docks kept clear of mud, the owners of the wharfs would have no reasonable ground of complaint." Captain Beaufort, Mr. Hartley, Mr. Cubitt, Mr. Giles, and Mr. Macneil, were of opinion that the supervision need entail upon the parties affected no injury, serious trouble, or expense, or none, at least, for which its advantages would not afford ample compensation; and concurred with Mr. Rendel, that the conversion of the side channels into floating basins, notwithstanding its attendant increase of expense, would give them a positive accession of advantages.

The remaining considerations connected with the plans before the Commission involve a discussion of their relative claims to adoption. With the plans of Mr. Walker and Mr. Page, a terrace and public thoroughfare are undoubtedly consistent. In both plans the sewage is treated upon the same principle—viz. by extending the sewers to the outer line of the embankment, and connecting it with the river under low water mark.

After an attentive examination of the plans of which we have thus explained the principal features and details, and also of the evidence adduced in support of each of them, the first question upon which we felt called upon to exercise a judgment was, whether an embankment of the Thames between London and Vauxhall Bridges be indispensable to the improvement of the navigation of that part of the river; or whether, referring to the means by which an embankment might be made available for other objects of public utility, it should be treated as a question of expediency, having reference to other interests combined with those of the navigation.

Upon the urgent necessity which exists for some measure having the improvement of this portion of the river for its object, we think there can be no doubt whatever. It is a fact open to daily observation and complaint, that in this part its bed presents an alteration of deeps and shoals, prejudicial to the navigation; and that its shores, on the Middlesex side especially, exhibit for the greater portion of every 24 hours, accumulations of mud which cannot fail at certain seasons to generate disease, and at all times to become a powerful auxiliary to it when arising from other causes.

An inquiry into the the cause of mischief, at the present period, offers no practical advantage, except as leading to the suggestion of a remedy. Whether natural or artificial, it falls under the supervision of that body in which the conservancy of the river is vested, and whose especial duty it is to investigate and to cure these evils.

Of the causes to which the present state of the river between London and Vauxhall Bridges is to be attributed, the number of its projections and recesses, especially on the Middlesex side of the river, is undoubtedly the most prominent. The discreditable state of the shore in the neighbourhood of Hungerford Market and the Adelphi was first occasioned by large embankments in the river in the neighbourhood of Whitehall and Privy Gardens, and these parts have, in their turn, been subsequently embedded in mud by the still greater projection of the site of the new Houses of Parliament higher up the river. We think it evident, with such irregularities still existing, and with their prejudicial effects before us, that no system of dredging can alone be looked to as ensuring a permanent uniformity in the bed of the river in this neighbourhood;—that, dredging itself, unless very carefully and systematically performed, becomes a source of evil;—that the necessity for such operations should be as much as possible avoided;—and that the obvious, if not the indispensable course under such circumstances would be, after giving the bed of the river the best possible form, so to regulate the natural agencies that they should maintain its condition.

On reference to the "Questions" already referred to in this Report, it will be seen that our earliest inquiries were addressed to this portion of the subject. Adverting to the shoals and irregularities at present existing in the navigable channel of the Thames, we submitted to the Hydrographer of the Admiralty and the civil engineers consulted, the following question: "Do you think it desirable to remove them, and, if you do, are you prepared to suggest any plan less expensive than that of a general embankment for accomplishing this object, consistently with the prevention of future shoals and irregular deposits, and the maintenance of the river at a proper and uniform depth?" We have stated the precise terms of the question, in order to show that our inquiry had reference to the navigation, and the navigation alone. The answers, it is true, in some instances, glanced at objects to which, on other grounds, an embankment might be rendered of undoubted public utility; but the result of these opinions generally, in reference to the navigation alone, may, we think, nevertheless, be fairly collected. In Mr. Gordon's opinion, "a system of embankments is the only certain means of establishing an uniform régime." Mr. Rendel is "not prepared to suggest a complete plan for effecting the desired object short of an embankment." Mr. Macneil recommends "walls and embankments, with dredging, so as to ensure such a sectional area, and such a regular velocity of current, as will neither make a scour nor allow a deposit." Mr. Giles "considers the plan of a general embankment, coupled with dredging the channel to a proper and uniform depth, to be the least expensive and most effectual means of accomplishing the object." Capt. Beaufort,—"if there were a sufficient fall from London to the sea,"—and Mr. Cubitt,—probably assuming such a fall already to exist, consider "the sinking of a new bed and the raising of new shores" would be sufficient for all the necessary purposes;—Captain Beaufort, however, concludes "the only resource to be embankment." Mr. Hartley and Mr Rennie incline to "a judicious and well organised system of dredging."

With the exception of Mr. Hartley and Mr. Rennie, therefore, the whole of these authorities make the improvement of the river dependant upon an altered condition of its outline; Captain Beaufort, Mr. Gordon, Mr. Rendel, Mr. Macneil, and Mr. Giles, by the erection of embankments; Mr. Cubitt, "by forming new shores in a less expensive manner than by continuous walls of masonry." "Taking into consideration the other subjects of navigation, trade, and communications along either side of the river," Mr. Cubitt, "indeed is not aware of any plan short of a general embankment that could, at a moderate expense, effect all these objects;" Mr. Hartley observes, "I do not assume that an embankment must be constructed for the proper navigation of the Thames; but in a general point of view, I consider that embankments would be very desirable;" and Mr. Rennie does "not think embankments necessary, but only in the light of auxiliaries, and not of equal importance to the river with dredging."

A second question suggested itself to us in connexion with the foregoing, which was as follows: viz.—If an embankment be deemed expedient between London and Vauxhall Bridges, is it necessary that the river should be embanked on both sides at the same time, and as a part of the same plan of operations; or, looking to the necessarily experimental character of any proceeding for regulating the current of the river, and maintaining a proper uniformity in its bed, should it begin on the Middlesex side, as that which, according to the evidence before the Commission, would afford the best means of working out this result?

The opinions of Mr. Walker upon these points have been already stated. With reference to the navigation of the river, the expence to be incurred, and the engineering difficulties to be encountered, "his feeling upon the whole was in favour of the Middlesex side," and his conclusion, that "it would be better to establish the principle, and to show its working on a portion of the river before embracing too much." To the questions addressed to the several civil engineers consulted, the answers were, in their general tenor, consistent and uniform. Mr. Rennie assigned the priority of importance, if embankments were to be executed, to the northern shore. Mr. Hartley, Mr. Cubitt, Mr. Gordon, Mr. Rendel, and Mr. Macneil, were also of opinion that preference should be given to the Middlesex side of the river. Mr. Gordon, however, qualified his opinion of this alternative by describing it as one "excluding every consideration save the mere regulation of the river." He thought it "highly expedient," and Mr. Giles "deemed it equally necessary," that embankments should be constructed on both sides of the Thames, and that they should be carried out as part of the same plan, and at the same time, Mr. Cubitt, Mr. Gordon, and Mr. Rendel were further of opinion that, of the northern or Middlesex side of the river, the portion between Westminster and Blackfriars Bridges demanded the earliest attention.

A third question which it became necessary for us then to consider was, whether looking to the frontage of that portion at present occupied for the purposes of river trade, the requirements of that trade were incompatible with an improvement of the navigation? Upon this point we found no diversity of opinion whatever. The whole of the professional authorities consulted concurred with us in believing the two objects to be perfectly compatible. The interests of the navigation were first to be considered; secondly, those of the trade; and the mode of embankment was to be determined as far as practicable on the principle of combining a due provision for the former, with the utmost possible accommodation to the latter.

A fourth, and, with reference to the objects of this commission, an important question to be considered was, whether the interests of the trade and the exigencies of the navigation between Westminster and Blackfriars Bridges were incompatible with an extension of the present means of land traffic in the same locality; or whether, looking to the demand for new and improved thoroughfares in the line of the river, especially on the Middlesex shore, an embankment could be so constructed as to combine these objects by the appropriation of the superstructure as a public terrace or highway? On this point, also, there was great concurrence of opinion amongst the professional authorities consulted by the commission, as well as in assigning the greatest necessity for such a communication to the northern side of the river.

It then remained for us to consider whether, assuming the objects to be attained by an embankment, in whatever part constructed, to be—

1. To improve the navigable course of the river;
2. To insure to the river side trade its present accommodation to the greatest possible extent; and,
3. To extend the facilities of intercourse between the two extremities of the town;

the several plans before the commission were both in principle and in their respective details, equally adapted to satisfy these requirements: or whether the weight of evidence before the commission gave a preference to any one of them, as being better adapted than the others for effecting all these objects by reason of its principle or its details, or on the ground of the greater economy with which it might be carried into execution.

With reference to the lines of embankment laid down on the respective plans, and their probable effect in improving the navigation of the river, Mr. Hartley, Mr. Rennie, Mr. Giles, and Mr. Macneil, considered those of Plan A to be the best: Mr. Gordon, on the contrary, observes, "Of the three plans before me, A has the least reference to the principles which ought to guide the choice of lines." On the other hand, it is observed by Captain Beaufort, "There is but little choice between the lines presented by these plans, all being sufficiently continuous;" by Mr. Cubitt,—"There is great similarity in the lines of all the three plans, and, as regards the question of navigation, only, the adoption of either, as permanent lines of bank, would be a great improvement;" by Mr. Macneil,—"I have no doubt that any one of the lines would be found, with some partial modification, to answer the purpose intended;" by Mr. Hartley, in answer to the fifth question,—"There can be no doubt that any of these plans would tend much to benefit the channel of the river and improve its navigation." The relative value, therefore, of the embankments proposed, as agents in working out such a result, is undecided by these observations.

There seems little reason to doubt, from the evidence, that a terrace or roadway could be usefully and consistently made upon the embankments projected in all these plans; of course with the same qualification as to the relative facilities and advantages of either.

But there is not the same concurrence of opinion in reference to the accommodations of the trade, combined with the furtherance of these objects; and in this respect there appears to us to be a material difference in the relative merits of the three plans.

The inquiries of the Commission on this part of the subject were not limited, as we have already stated, to the opinions of professional men. They involved points, it is obvious, upon some of which science could throw no light whatever, and upon which, if a choice of opinions were indispensable, the practice and experience of those in trade would undoubtedly, in the first instance, be referred to. On the other hand, however, the evidence of parties interested, either directly or by the habits of their various callings, in the probable issue of improvements of this nature, is seldom altogether free from prejudice; and upon the whole, probably, the professional acquaintance of civil engineers with questions involving the requirements of trade, in connexion with those of navigation, may be considered as supplying the best general evidence on such a subject.

We have been induced to present the foregoing minute and detailed review of the very voluminous evidence, and the great mass of professional opinion, which we have collected with reference to an Embankment of the Thames, by the conviction that we could not by any more summary exposition of it, have done justice to the importance of the subject itself,—to the various and extensive interests connected with it,—to the high character and station of the eminent professional gentlemen from whom we have derived so much valuable information (most readily and unreservedly afforded), and also to the authors of the several plans which we have considered in comparison with each other.

We have observed with great satisfaction the almost unanimous concurrence in opinion, upon all the main topics to which our inquiries were directed, among the scientific and practical gentlemen thus consulted; and it was with a corresponding confidence that we finally came to the following Resolutions:—

1. That it appears to the Commission that the present state of the river Thames above London Bridge is such as to render highly expedient the adoption of some proceedings for remedying the existing defects, and for preventing the further deterioration of the navigation.

2. That for securing these important objects, an embankment of the river would be the most effective measure.

3. That though a general embankment between Vauxhall and London Bridges appears to be highly expedient, yet that it is most urgently required on that portion of the Middlesex, or left bank of the river, which lies between Westminster and Blackfriars Bridges.

4. That such an embankment might be advantageously combined with the formation of a carriage and foot line of communication between Scotland Yard and Blackfriars Bridge, whereby the great objects of public recreation and health would be promoted, and considerable relief be given to the existing insufficient thoroughfares between the eastern and western districts of the metropolis.

5. That by the adoption of the general principles of embankment presented in the plan of Mr. Page, or plan B (with certain modifications which have been suggested, and others which may be suggested hereafter), there is reason to expect that the great public benefit of the improvement of the river, and the obtaining a new line of communication, may be acquired without detriment to the trade now conducted on the Middlesex shore.

6. That the Commission being disposed on these grounds to recommend the adoption of this great metropolitan improvement, will proceed forthwith to ascertain as nearly as it can be done, the probable expense of carrying it into execution; and also to inquire in what manner the funds required for the purpose may best be provided, so as to press with the least possible weight and inconvenience on the inhabitants of the metropolis and its environs.

In pursuance of these resolutions it became necessary for us to place ourselves in immediate communication with Mr. Page, and to direct his attention to such modifications of his plan as had occurred to us in the course of this inquiry. These modifications, however, necessarily involved many deviations from the estimate already before us, and we directed, therefore, that further and detailed estimates might be prepared and submitted for our consideration. The nature of these modifications will be best explained by reference to the appendix. They involve, as will be seen, in principle, no departure from Mr. Page's original plan.

The estimate based upon the plan originally proposed comprised an embankment and roadway between Blackfriars and Westminster Bridges, on the northern shore of the river, 40 feet in width, and varying from three feet six inches to 10 feet above Trinity high water mark, with carriage road, foot path, balustrades, &c. from Middle Scotland Yard to Blackfriars Bridge. The whole outlay upon this portion of Mr. Page's plan would have amounted to £192,728

Add for gas fittings, lamp posts, irons, &c.	2.450
	£195,178
Add for contingencies, 10 per cent.	19,517
	£214,695

The further estimate which Mr. Page was directed to prepare and lay before us, was to comprise an embankment and terrace 20 feet in width from Westminster Bridge to Whitehall Place, and 50 feet in width for the remainder of the distance, varying in height from 3 feet 6 inches to 10 feet above Trinity datum; and to show the relative expense of constructing these—1st. With brick walls faced with granite; and 2nd. With brick walls and granite dressings only. The following was the result:

For an embankment and terrace 50 ft. in width and varying from 3 ft. 6 in. to 10 ft. in height, having brick walls and a facing of granite .. £366,409

For a like embankment and terrace, having brick walls with granite dressings only £301,391

As the mode of connecting the general line of the proposed embankment with the frontage of the premises now occupied by the residents in Privy Gardens, and also with that of the Temple Gardens, may be subject to modifications of various kinds, with a view to meet the convenience of the respective parties, the foregoing estimate may be affected by the ultimate determination respecting these portions of the work, probably so as to diminish the cost of it to the public.

A decision upon these, and upon many of the less important details of this plan may, we think, be profitably reserved for the present until your Majesty's Government shall have determined, after a perusal of our Report and its accompanying evidence, and estimates, upon the expediency of adopting and bringing under the notice of Parliament, the measure to which these relate. To that evidence we think we may confidently refer in proof of our desire to enter into all the bearings of this difficult, and, as far as regards the general character of metropolitan improvements, somewhat novel inquiry; to test the accuracy of the estimates laid before us, and ultimately to obtain for the inhabitants of the metropolis, as large a measure of improvement, of its kind, as could be effected, consistently with the extensive and important class of interests involved in its accomplishment.

We have adverted to the manner in which the funds required for the improvements in the City of London, connected more or less, with the approaches to London Bridge, and also the great alterations more recently sanctioned by Parliament, and now in progress, have been provided; and although it may not appear strictly a part of our duty to accompany our recommendations of such further improvements as may appear to us to be the most desirable by suggestions of pecuniary resources for defraying the cost of them, we trust that we shall not be considered as transgressing the limits of our Commission if we submit to your Majesty our views of the means which appear to us the most readily available, and with the smallest degree of pressure and inconvenience to the inhabitants of the metropolis and its vicinity, for the immediate object of our present Report, and also for some of those further improvements which it will be our duty hereafter to submit for the approval of your Majesty and of Parliament.

We have stated that the coal duties of 8d. per ton in the Port of London are now charged until the year 1862, with the improvements already made or in progress. The whole rate of duty upon this article, as now collected, is 13d. per ton; viz. 8d. charged as before-mentioned,—4d. received by the Corporation, in lieu of certain rights and interests,—and 1d. also collected by them for compensation to be paid to individuals, and other expenses incidental to the coal market, on the occasion of the new regulation of the coal trade under the Act of 1831.

It is estimated that the charges upon the last-mentioned duty of 1d. per ton will be extinguished in about three years from the present time.

Such being the existing state of these duties, it is our opinion that it may be advisable to augment the total rate of the tax collected from 13d. to 18d. per ton; making the duration of the whole contemporaneous with that of the duty of 8d. per ton, as above-mentioned—excepting of course the duty of 4d. per ton belonging to the City of London, which is permanent. By these means there would be at the disposal of Parliament, for Metropolitan improvements, and more immediately for that which is the subject of our present consideration, the produce of a duty of 5d. per ton until the duty of 1d. per ton, appropriated to the coal market, is set free, and of 6d. per ton for the remainder of the term. It is estimated that the annual amount would be, in the former case, £54,875, and in the latter, £65,851.

We are anxious that your Majesty should be assured that we should not lightly recommend even this comparatively inconsiderable augmentation of local taxation, nor without a careful consideration of the interests of that great community on which this additional temporary burthen would be imposed. We should not, indeed, venture to offer this suggestion except under the strongest conviction that benefits much more than equivalent to the sacrifices thus proposed would result from the adoption of the plans now submitted for your Majesty's approval. The labours of successive committees of the House of Commons who have pursued elaborate inquiries, and have expressed decided opinions on the subject, have spared us the necessity of setting forth in detail the grounds upon which we consider that an addition to the coal duties is (within certain limits) the most equitable and the least burthensome mode of providing for improvements of this description; and we therefore cannot hesitate to recommend it as the best resource for the accomplishment of a measure having for its object to secure to the metropolis the advantages of an improved and better regulated navigation of a great portion of the noble river which flows through it; and calculated at the same time to contribute largely to the convenience, the recreation, and the health of its inhabitants.

Appendix—Description of Mr. Walker's Plan (A.)

This plan (A) proposes, as a final measure,—

First, to bring the river Thames to a more uniform width than it is at present, by means of embankments, in the lines shown on the accompanying plan. Secondly, to improve the present river lines where the ground is not built upon, by easing the present quick curves. Thirdly, to remove the shoals by dredging, and to form the bottom of the navigable channel to a regular line, (Plate VI. Figure 1,) the excavated material being applicable to filling in behind the embankments, and thus to form quays at the level of 3 feet 6 inches or 4 feet above high water, Trinity standard. These quays to be, upon terms to be settled, the private property of the parties owning the present wharfs, of which they may be considered as an extension. Fourthly, to continue the covered sewers out to the front of the proposed embankment, where they may discharge below the level of low water. Fifthly, to avoid the heavy claims that might be made for interference with the coal and timber merchants, if a solid embankment were at present formed in front of their premises, it is proposed not to interfere with such at present, if the parties object to an embankment, but to leave them, forming open docks or recesses. (Plate VI. Fig. 2.) It is supposed that four of these docks may at present be required between Westminster and Blackfriars Bridges, viz., one at Northumberland Wharf, one above Waterloo Bridge, terminating with the Bridge Stairs; one above the Temple Gardens, and one commencing at Whitefriars Dock and terminating with the stairs at Blackfriars Bridge. There may be modifications in the situation of these, at the request of parties. As the deepening of the navigable channel may tend to draw down the ground of those wharfs into the river, it is proposed, where required, to support the same by close piling in the line of the embankment, the top of this piling not to be above the level of the ground where it is driven; the loose mud to be taken out from these recesses or docks, and small chalk and gravel, laid in a regular slope, to be substituted; this, and the wash by the winds and steamers, will, it is supposed, keep the bottoms clear of mud without much trouble.

The dotted lines upon the plan show the proposed future margin of the river on both sides; but as it is proposed first to embank the north or Middlesex side, between Westminster and London Bridges, the number and position of the docks or recesses on the Surrey side have not been considered. Nor is it intended entirely to preclude barges from lying *outside* the embankment; but the stations there will be less convenient than the recesses for such trades as coal and timber.

Should a terrace, or even a railway, be thought desirable, the marks upon the plan (coloured yellow) show the position of piers to support flat arches, 100 feet span. The roadway, which is shown by dotted lines, might enter on the embankment at Whitehall and terminate at Blackfriars Bridge, crossing Hungerford and Waterloo Bridges at the level of their roadways, and thus communicating with these thoroughfares.

(Signed) James Walker.

[We have not been able to give an engraving of Mr. Walker's plan, but it will be sufficiently understood, with the following explanation, by a reference to the annexed engraving. Mr. Walker's plan has a solid embankment from Westminster Bridge to Scotland Yard, then a recess; then embankment in front of Hungerford Market to Salisbury Street, then a recess to Waterloo Bridge; then embankment in front of Somerset House to a little below Arundel Street, then a recess for the wharfs at Essex Street; then embankment fronting the Temple Gardens to Whitefriars Dock; and, lastly, a recess to Blackfriars Bridge. The dotted line on the Surrey side of the river is Mr. Walker's boundary for an embankment.—Editor.]

Appendix.—Description of Mr. Page's Plan (B.)

Mr. Page's plan pre-supposes terraces and side channels, and may be referred to under three heads:—

First, as any embankment constructed upon this principle may affect the Thames as a navigable river.

Secondly, as it may affect the wharfingers and other proprietors on its banks.

And, Thirdly, as it may improve the means of communication in the metropolis by opening new facilities for its traffic, and for promoting generally the health and convenience of the public.

In the first case, the arrangement is based on the principle that any abstraction of the tidal water from a navigable river by embanking or otherwise, must injure that river to a certain extent below the locality of the embankment; and although the injurious effect of embankments may be greater in estuaries which depend for their depth of water on the tide alone, it is a known fact that the reservoir of water in a river at any particular spot now available for the scour, operates to that effect as far as it runs out with the ebb tide. Taking as an instance the locality of Hungerford, the water in the broad expanse of the river in that part operates in scouring the bed of the river as low down as Woolwich, according to the duration and velocity of the ebb; and it is assumed, therefore, that any abstraction of this water must, to a certain extent, deprive that portion of the river of its present scour.

It is further assumed that it is desirable in all navigable rivers to attain great depth and moderate velocity; that the permanent and efficient scour is produced by depth of water and moderate velocity combined, as is instanced in the beds of all rivers as they approach the sea; and that, therefore, the greater capacity of a river at high water at any particular spot, the more important is that water for scour, because it then acts with the greatest effect, namely, when the greatest body of water is passing down, say from high water to half ebb. It is therefore also assumed, that the loss of water at the sides and bays of a river cannot be compensated for by deepening its mid-channel,[1] inasmuch as the water so gained, if any shoal or shelf occurred below it, would not flow away in the ebb, remaining in fact in the reservoir dredged for it; or, if being higher than the surface of the water below, it did flow down, would be available only towards low water, when, though the current is stronger, yet, for want of body of water, it would be inefficient in producing scour.

It would appear to be admitted, from the observations of engineers of experience, that the river Thames has been injured by solid embankments; that in the case under notice the effect of such embankments from Hungerford to Milbank is shown by the accumulation of mud banks below them; that not only the tendency, but the practice in every alteration by the river side, has been to encroach upon the river, even by projections beyond a straight or a continuous line; and in the few cases where engineering authorities have been consulted, it would appear that the principle of non-abstraction of the tidal water, though fully acknowledged, has been perverted to suit particular cases. It is also assumed, therefore, that in any alteration of a public nature, the condition of preventing further encroachment should, if practicable, be a leading feature.

Secondly, With regard to the wharfingers, the object of the proposed plan is to leave their wharfs, warehouses, means of unloading, &c., in their present state; in fact, not to interfere with their property, and to allow all the accommodation for their barges, &c., in the very places they now occupy, as may be consistent with the width required for the main stream of the river; and,

Thirdly, With these provisions for the river, and for the wharfingers, the plan provides for increased facilities of communication between several points of the metropolis, and extensive promenades by the river side.

For obtaining a more uniform boundary for the main stream of the river, it is proposed to construct lines of terraces from Milbank, where the river is 600 ft. in width, to Queenhithe, where it is 650 ft.; the width between the terraces varying from 650 to 750 ft., and leaving side channels between the terraces and the wharfs varying from 303 to 150 ft. in width. The width of the terraces is 40 ft.; 10 ft. of which on the river side is appropriated for foot passengers, and the remainder for carriages.

The areas of these side channels are, on the Middlesex side, 37 acres, and the Surrey side 40½ acres; together 77½ acres, or more than double the area of the London and St. Katharine's Docks, exclusive of the basin.

The lengths and widths of the side chanoels are shown by the following table:—

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[1] This may be illustrated by supposing that in the part to be deepened there are five feet water at the lowest run of the tide, and the bed of the river be then dredged four feet deeper; there would then be nine feet water at the lowest run of the tide; but no portion of this water would run out and scour the river below. It is assumed, therefore, that all the water which does scour the river below any locality, is contained between low water mark and high water mark; and that the greater cubic quantity of water between those two points, the more efficient will be the scour.

Middlesex Side.	Length. Feet.	Av. Width. Feet.	
From Westminster Bridge to Blackfriars Bridge	520	250	
	1,150	245	
	500	325	
	200	230	
	323	360	
	900	280	Opposite Waterloo Bridge & Somerset House.
	830	140	
	600	240	
	1,950	180	
From Blackfriars to Trig Stairs	1,300	160	
Surrey Side.			
From Lambeth to Westminster Bridge	1,000	140	
	600	160	
	800	170	
	300	230	
	350	180	
From Westminster Bridge to Blackfriars Bridge	1,250	210	
	1,910	220	
	1,900	230	
From Blackfriars to Bankside	1,000	170	
	600	120	

The entrance to the side channels would be by openings as conveniently situated for the admission of barges on the flood tide as circumstances will admit. They may be increased in number for greater facility of entrance, but, from observation at other entrances, are concluded to be fully equal to the wants of the wharfingers. The openings are 40ft. in width, capable of admitting two barges abreast, and are provided with gates for the purpose of enabling the wharfingers, of course under proper regulations, and subject to the supervision and control of properly appointed persons, to retain the water after high water if requisite; secondly, for preventing the overflow of the river at high runs of tide; and, thirdly, for providing for the cleansing of the side channels by means of sluices in the cross walls of communication with the streets.

These communications are proposed to be solid and provided with sluices for the sole object of retaining the water in any one division of the side channels, and cleansing the adjoining division by an easy flow of water through them, say once a week, probably at wider intervals, but the period would necessarily be very much subject for after regulation.

As the object is to enable the wharfingers to carry on their business in the same manner as they do now, these side channels are not provided with locks, it being assumed that with these, although additional facilities for sending away barges at all times of tide might be gained, there would be an increase of trouble and expense; and they are to be regarded, therefore, merely as side channels, and the gates are not to be closed except for the purposes above mentioned. The retention of the water for two hours after high water, for the purpose of expediting the unloading of the barges and giving this additional quantity of water for the scour of the river is only provided for, but is not an essential part of the plan.

The height of the terrace generally, although first proposed to be four feet above Trinity high mark, is, for the more easy entrance of craft, and for preserving uniformity of transit on the terrace, proposed to be 10ft. above that line, except in front of Whitehall Gardens and the Temple Gardens. The height of 10ft., however, is not to be considered as any essential portion of this plan, but as having been suggested since the plan was first brought before the Commission, and to meet a difficulty applying only to a particular description of craft, not very numerous, it is believed, on the river.

The width of the side channels is considered amply sufficient for the accommodation of the barges in front of the respective wharfs. From Blackfriars to the Grand Junction Wharf, a distance of 600ft., some of the wharfingers state that they require 200ft. in front of their wharfs, and the distance from the wharfs to the terrace allowed by the plan at this particular spot is not more than 180ft.; this is considered to be as large a waterway as could be strictly insisted upon, and more than would probably be asked for if the plan proposed were properly carried out.

It is not an object of the design that width for the general passage of barges should be provided in the side channels, the main stream of the river being the proper and more desirable channel for their transit; but sufficient space is attainable for ingress and egress without inconvenience to the barges unloading, and two barges abreast might be moored outside the terrace to the mooring-rings and piles provided for their accommodation.

This provision, and the space in other parts of the side channels forming receptacles for barges, would, it is believed, amply accommodate the various craft, on the spot they now occupy.

For the efficient action of the water from the sluices on the shores at the wharfs which may require cleansing, it is proposed to bring the shore of the side channels to a regular inclination as per diagram, disposing it in three planes: the first, with a slight inclination of say three inches in sixty feet towards the wharfs; the second, an inclined plane sloping towards the terrace; the third, horizontal. When the shores are to be cleansed, the barges would be removed to the sloping bed A C, and the upper sluices being opened, the mud on the first bed, the accumulation whatever it might be, would be washed away by the flow of water, the excess of water above the point A flowing down the sloping bed to the lower level, the sluice of which being afterwards open would clear away all the remainder into the main steam.

At present the sewers discharge at the line of the wharfs, leaving a deposit of filthy mud, and discharging noxious effluvia at every outlet. In the plan it is proposed to continue the sewers under the bed of the side channels and under the terrace into the main stream, so that the sewage would be discharged below low water mark. As the wharf property would be relieved from any deposit of sewage, the mud which might collect would consist of the general sediment of the river water, and although provision is made for clearing away any deposit, it is anticipated that very little would take place, as there would be a stream in the side channels at both flood and ebb tide.

By this arrangement the wharfs and warehouses are left undisturbed; the same facilities the wharfingers now possess for carrying on their business they would retain; their craft would be better protected from damage and depredation, and from the losses occurring during drifts of ice; and these advantages it is considered would far outweigh any difficulty in passing the openings to the side channels. As there are several slips and docks on the wharf property, these, it is assumed, might be increased in number and area as occasion might require. The general tendency to encroach on the river would give way to a general tendency to set back, and every alteration on this principle would be beneficial to the port of London by increasing the reservoir of tidal water for its scour.

By the proposed plan, it is intended that communications for the public should be opened from Blackfriars Bridge to Whitehall on the Middlesex side, without purchase of any property, except a small garden and one house; and that the crowded thoroughfare of Fleet Street and the Strand should be cleared of much of the lighter class of traffic which at present obstructs it.

On the Surrey side the same communication from Blackfriars to Nine Elms would be attained without the purchase of any property, and below Blackfriars a foot communication, as shown on the plan.

Embankments for pleasure ground, with capacious culverts running through them, are proposed in front of Whitehall Gardens (Crown property), and in front of the Temple Gardens, leaving to the former a private river front, and opening to the latter a desirable communication to the western part of London; but inasmuch as these embankments would form expensive portions of the plan, and to a certain, though not important extent, abridge the space for water between the terrace and the shore, the tide might, in the first instance, be allowed to continue its present course past both of these localities, and the conversion of them into pleasure grounds might, if necessary, be effected hereafter.

Note.—Although these observations are intended to apply principally to the terrace as an embankment, including a carriage way and promenade, it is not out of place to state, that instead of filling up its contents with solid matter, it is proposed to construct a continued reservoir within it, equal to a circle of 28ft. in diameter (Fig. 3), into which the pure waters of the river Wandle may be conducted, for the supply of those four water companies which now provide their respective districts with water from the Thames (mixed with the sewage), and for the general use of such establishments as may wish to avail themselves of it. But into the particulars of this proposition it is not considered necessary to enter at the present time, as the plans are quite independent of each other.

(Signed) Thomas Page.

[We have not given Mr. Page's plan (B), but we have given the modified plan of the Commissioners, founded upon plan B, which will sufficiently illustrate Mr. Page's description.—Editor.]

Reference to Engraving, Plate VI.

The plan exhibits the river wall or terrace on the Middlesex side of the river between Westminster Bridge and Blackfriars Bridge. The dotted line, L. W., is low water mark, and the dotted line nearly parallel with the bank on the Surrey side is the extent of Mr. Walker's proposed embankment and Mr. Page's proposed docks.

Fig. 1, one of Mr. Page's transverse terraces of communication with the streets, with culverts for sluicing and openings for the passage of barges. A, terrace with proposed reservoir for pure water; B, gates with sluices, the gates to be closed and sluices worked when the side channels require cleansing; C, culvert for sluices; D, section of present wall: E, continuation of sewer; F, present sewer; H. W., Trinity high water mark, and L. W., low water mark.

Fig. 2, a transverse section of the river with Mr. Walker's embankment wall A, to be filled in behind, B present wharf, *h. w.* high water, *l. w.* low water; the irregular line *c*, the present bed of river, *d* bottom of river of the proposed deepening. Fig. 3 shows a transverse section of the river with one of the recesses, *e*; bed for barges as at present; *f*, guard piles; *g*, dwarf piling the top to be driven down to the level of the bed of the river; *c. l.*, central line of river.

REVIEWS.

FARADAY AND THE ELECTRICAL SCIENCES.

Lectures on Electricity, comprising Galvanism, Magnetism, Electro-Magnetism, Magneto and Thermo-Electricity. By HENRY M. NOAD, Author of Lectures on Chemistry, &c. London: George Knight & Sons, Foster Lane.

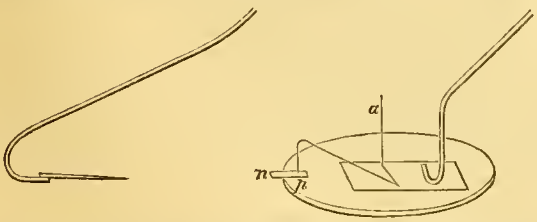
Mr. Noad has published a new edition of his Lectures on Electricity, which give succinctly an account of each department of electrical science, with the forms of illustrative experiments and the history of the most recent discoveries and improvements. In perusing this work we have seen with gratification how much Dr. Faraday has contributed to every branch of these sciences, and we thought we could not give a much better example of the value of Mr. Noad's book, nor a more interesting selection for our readers, than to extract some account of Dr. Faraday's valuable labours.

It will not be forgotten that it was by means of an apparatus, in some degree resembling the Electrophorus in principle that Faraday succeeded in demonstrating that induction is essentially a physical action, occurring between contiguous particles, and never taking place at a distance without polarizing the molecules of the intervening dielectrics. The conclusion seems to be that induction is not through the metal of the apparatus, but through the air in curved lines. In fact, as Mr. Noad puts it, it is an action of the contiguous particles of the insulating body thrown into a state of polarity and tension, and capable of communicating their forces in all directions. With regard to the theory of electro-chemical decomposition, in his second ecture, page 77, Mr. Noad remarks—

"The following beautiful experiments, made by Faraday (See Exp. Research. series v. 462 et seq.), prove that, so far from electro-chemical decomposition depending upon the simultaneous action ot *two metallic poles*, *air* itself may act as a pole, decomposition proceeding therewith as regularly and truly as with metal.

"A piece of turmeric paper, not more than 0·4 of an inch in length, and 0·3 of an inch in width, was moistened with sulphate of soda, and placed upon the edge of a glass plate opposite to and about two inches from a point connected with a discharging train arranged by connecting metallically a sufficiently thick wire with the metallic gas pipes of the house, with those of the public gas works of London, and with the metallic water pipes of London. A piece of tin-foil resting upon the same glass plate was connected with the machine and also with the turmeric paper by the decomposing wire *a* (Fig. 1.)

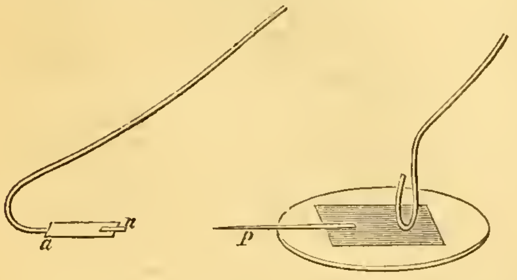
Fig. 1.



The machine was then worked, the positive electricity passing into the turmeric paper at the point *p*, and out at the extremity *n*. After forty or fifty turns of the machine (a plate fifty inches in diameter), the extremity *n* was examined, and the two points or angles found deeply coloured by the presence of free alkali.

"A similar piece of litmus paper dipped in a solution of sulphate of soda (Fig. 2) was now supported upon the end of the discharging train *a*, and its

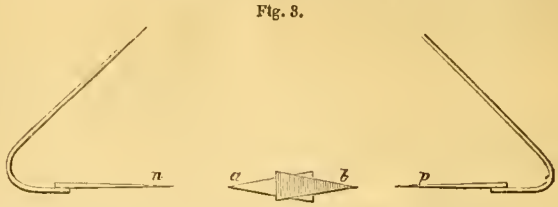
Fig. 2.



extremity brought opposite to a point *p*, connected with the conductor of the machine. After working the machine for a short time, acid was developed at both corners towards the point, that is, at both corners receiving the electricity from the air. Then a long piece of turmeric paper, large at one end and pointed at the other, was moistened in the saline solution and immediately connected with the conductor of the machine, so that its pointed extremity was opposite a point upon the discharging train. When the machine was worked, alkali was evolved at that point; and even when the discharging train was removed, and the electricity left to be diffused and carried off altogether by the air, still alkali was evolved where the electricity left the turmeric paper.

"Arrangements were then made in which no metallic communication with the decomposing matter was allowed, but *both poles* formed of air only. Pieces of turmeric and litmus paper, *a* and *b*, (Fig. 3,) moistened with solution of sulphate of soda, were supported on wax between the points, con-

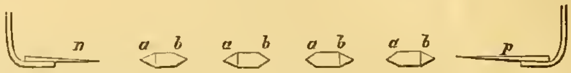
Fig. 3.



nected with the conductor of the machine and the discharging train, as shown in the figure; the interval between the respective points was about half-an-inch. On working the machine, evidence of decomposition soon appeared, the points *b* and *a* being reddened from the evolution of acid and alkali.

"Lastly, four compound conductors of litmus and turmeric paper were arranged as shown in Fig. 4, being supported on glass rods; and on working

Fig. 4.

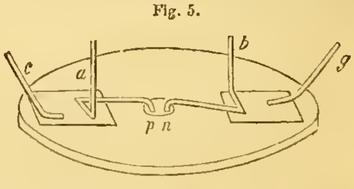


the machine carefully, so as to avoid sparks and brushes, evidence of decomposition was obtained in each.

"Notwithstanding, then, the absence of metallic poles, we have here cases of electro-chemical decomposition precisely similar to those effected under the influence of voltaic battery; and we appear to have direct proof also that the power which causes the separation of the elements is exerted not at the poles, but at the parts of the body which is suffering decomposition.

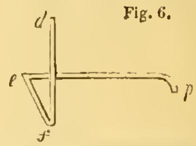
"The arrangement shown in Fig. 5 was employed by Faraday for effecting electro-chemical decomposition by common electricity. On a glass plate, raised above a piece of white paper, two small slips of tin-foil, *a*, *b*, were placed: one was connected by the insulated wire c with an electrical machine, and the other by the wire *g* with a discharging train, or with the negative conductor. Two pieces of fine platinum wire, bent as in Fig. 6, were provided, and so arranged that the part *d*, *f*, was nearly upright, while the whole rested on the three bearing points, *p*, *e*, *f*.

Fig. 5.



The points *p*, *n*, thus became the decomposing poles. They were placed on a piece of filtering paper wetted with the solution to be experimented upon. When litmus paper, moistened in solution of common salt or sulphate of soda, was employed, it was quickly reddened at *p*; a similar piece, moistened in muriatic acid, was very soon bleached at the same point, but no effects of a similar kind took place at *n*. A piece of turmeric paper, moistened in solution of sulphate of soda, was reddened at *n* by two or three turns of the machine; and in twenty or thirty turns, plenty of *alkali* was there evolved. On turning the paper round, so that the spot came under *p*, and then working the machine, the alkali soon disappeared, the place became yellow, and a brown alkaline spot appeared in the new part under *n*. When pieces of litmus paper and turmeric paper, both wetted with solution of sulphate of soda, were combined, and put upon the glass, so that *p* was on the litmus, and *n* on the turmeric, a very few turns of the machine sufficed to show the evolution of acid at the former and alkali at the latter, exactly in the manner effected by a volta-electric current. (See Exp. Researches, third series, 309 et seq.)

Fig. 6.



"In these experiments the direct passage of sparks must be carefully avoided. If sparks be passed over moistened litmus paper, it is reddened; and if over paper moistened with solution of iodide of potassium, iodine is evolved. But these effects must carefully be distinguished from those due to electro-chemical powers, or true *electrolytic* action, and must be carefully avoided when the latter are sought for. The effect just mentioned is occasioned by the formation of nitric acid by the chemical union of the oxygen and the nitrogen of the air: the acid so formed, though very small in quantity, is in a high state of concentration, and therefore reddens the litmus paper, and decomposes the iodide.

"It does not appear that Faraday was more successful than Wollaston in effecting a true electro-polar decomposition of water. He says, 'there is reason to believe that when electro-chemical decomposition takes place, the quantity of matter decomposed is not proportionate to the intensity, but to the quantity of electricity passed; but in Wollaston's experiment this is not the case. If with a constant pair of points the electricity be passed from the machine in sparks, a certain proportion of gas is evolved; but if the sparks be rendered shorter, less gas is evolved; and if no sparks be passed, there is scarcely a sensible portion of gases set free. On substituting solution of sulphate of soda for water, scarcely a sensible quantity of gas could be procured, even with powerful sparks, and almost none with the mere current; yet the quantity of electricity in a given time was the same in all these cases."

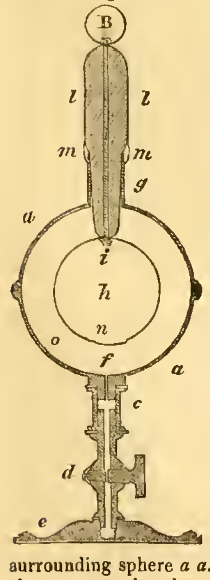
"I believe at present that common electricity can decompose water in a manner analogous to that of the voltaic pile. But when I consider the *true effect* only was obtained, the quantity of gas given off was so small, that I could not ascertain whether it was, as it ought to be, oxygen at one wire and hydrogen at the other. On substituting solution of sulphate of soda for pure water, these minute streams were still observed; but the quantities were so small, that on working the machine for half an hour, I could not obtain at either pole a bubble of gas larger than a small grain of sand; and if the chemical power be in direct proportion to the absolute quantity of electricity which passes, this ought to be the case.' In paragraph 359 he says, 'It is doubtful whether any common electrical machine has yet been able to supply electricity sufficient in a reasonable time to cause true electro-chemical decomposition of water.'

"Mr. Goodman, of Salford, near Manchester, who has published a very ingenious essay on the 'Modifications of the Electric Fluid," has, however, succeeded in decomposing water *by current alone*, and with *unguarded poles*."

We think it will be interesting here to give Faraday's views of induction and conduction. "According to this philosopher, both *induction* and *conduction* ought to be considered the same in principle and action—every body appearing to discharge in a greater or less degree, which makes them better or worse conductors—worse or better insulators. He considers the first effect of an excited body upon neighbouring matters, to be the production of a polarized state of their particles, which constitute induction; and this arises from its action on the particles immediately in contact with it, which again act upon those contiguous to them; and thus the forces are transferred to a distance. If the particles can maintain this polarised state, then *insulation* is the consequence; and the higher the polarised condition, the better the insulation; but if the particles cannot maintain their polarized state, if they possess the power to communicate their forces, then conduction occurs; and the tension is lowered, conduction being a distinct act of discharge between neighbouring particles. Thus, as the higher the polarized condition which the particles of the body can assume, the better insulator is that body; so is a body a better conductor in proportion to the inappetency of its particles to retain a state of polarity. The discharge which takes place between two conducting surfaces is termed *disruptive*; it is the limit of the influence which the intervening air or dielectric exerts in resisting discharge; all the effects prior to it are inductive, and it consequently measures the conservative power of the dielectric. It occurs not when all the particles have attained to a certain degree of tension; but when that particle which is most affected has been exalted to the subverting or turning point, all must then give way, since they are linked together, as it were, by the influence of the constraining force, and the breaking down of one particle must, of necessity, cause the whole barrier to be overturned. In every case, the particles amongst and across which the discharge suddenly breaks, are displaced—the path of the spark depending upon the degree of tension acquired by the particles in the line of discharge. The spark may be considered then, as a discharge, or lowering of the polarized inductive state of many dielectric particles by a particular action of a few of the particles occupying a very small and limited space: all the previously polarized particles returning to their first or normal condition in the inverse order in which they left it, and uniting their powers, meanwhile to produce, or rather to continue the discharge effect in the place where the subversion of force first occurred."

Mr. Noad also says:—

Fig. 7.



"It was with an apparatus constructed on the principles of the Leyden phial, that Faraday succeeded in proving by the most decisive experiment that *induction has a particular relation to the different kinds of matter through which it is exerted*. A section of this ingenious contrivance is shown in Fig. 7. *a, a*, are the two halves of a brass sphere, with an air-tight joint at *b*, like that of the Magdeburgh hemispheres, made perfectly flush and smooth inside, so as to present no irregularity; *c* is a connecting piece, by which the apparatus is joined to a good stop-cock *d*, which is itself attached either to the metallic foot *e*, or to an air pump. The aperture within the hemisphere *f* is very small: *g* is a brass collar fitted to the upper hemisphere, through which the shell-lac support of the inner ball and its stem passes; *h* is the inner ball, also of brass: it screws on to the brass stem *i*, terminating above by a brass ball B; *l, l*, is a mass of shell-lac, moulded carefully on to *i*, and serving both to support and insulate it and its balls *h*, B. The shell lac stem *l* is fitted into the socket *g* by a little ordinary resinous cement more fusible than shell-lac applied at *m, m*, in such a way as to give sufficient strength and render the apparatus air-tight there, yet leave as much as possible of the lower part of the shell-lac stem untouched as an insulation between the ball *h*, and the surrounding sphere *a a*. The ball *h* has a small aperture at *n*, so that when the apparatus is exhausted of one gas and filled with another, the ball *h* may also itself be exhausted and filled, that no variation of the gas in the interval o may occur during the course of an experiment.

"The first substance submitted to examination was shell-lac, as compared with air.

"On making the experiment with all the care and attention that could be bestowed, an extraordinary and unexpected difference appeared, and the conclusion was drawn that the specific inductive capacity of shell-lac as compared with air is as 2 to 1. With glass a result came out, showing its capacity compared with air to be as 1·76 to 1; and with sulphur a result showing its capacity to be as 2·24 to 1. With this latter substance the result was considered by Faraday as unexceptionable, it being, when fused, perfectly clear, pellucid, and free from particles of dirt, and being moreover an excellent insulator.

"During the experiments with shell lac, Faraday first observed the singular phenomenon of the *return charge*. He found, that, if, after the apparatus had been charged for some time, it was suddenly and perfectly discharged, even the stem having all electricity removed from it, it gradually recovered a charge which in nine or ten minutes would rise up to 50° or 60°. He charged the apparatus with the hemispherical cap of shell lac in it, for about forty-five minutes, to above 600° with positive electricity at the balls *h* and B, Fig. 7, above and within. It was then discharged, opened, the shell lac taken out, and its state examined by bringing the carrier ball of Coulomb's electrometer near it, uninsulating the ball, insulating it, and then observing what change it had acquired. At first the lac appeared quite free from any charge, but gradually its two surfaces assumed opposite states of electricity, the concave surface, which had been next the inner and positive ball, assuming a positive state, and the convex surface, which had been in contact with the negative coating, acquiring a negative state; these states gradually increasing in intensity for some time.

"Faraday was at first inclined to refer these effects to a peculiar masked condition of a certain portion of the forces, but he afterwards traced them to the known principles of electrical action. He took two plates of spermaceti and put them together, so as to form a compound plate, the opposite sides of which were coated with metal. The system was charged, then discharged, insulated, and examined, and found to give no indication to the carrier ball: the plates were then separated, when the metallic linings were found in opposite electrical states. Hence, it is clear that an actual penetration of the charge to some distance within the dielectric, at each of its two surfaces, took place by conduction: so that to use the ordinary phrase, the electric forces sustaining the induction, are not upon the metallic surfaces only, but upon and within the dielectric; also extending to a greater or smaller depth from the metal linings."

Mr. Noad in discussing the subject of chemical phenomena, page 196, says, "*Chemical Phenomena.*—Before entering upon this interesting branch of our subject, it will be necessary that we describe the new terms introduced by Faraday, and state his reasons for adopting them. According to the views of this celebrated philosopher, electro-chemical decomposition is occasioned by an *internal corpuscular action*, exerted according to the direction of the electric current, and is due to a force either *superadded to, or giving a direction to the ordinary chemical affinity* of the bodies present. He conceives the effects to arise from *forces* which are *internal*, relative to the matter under decomposition, and not *external* as they might be considered if directly dependent upon the poles. He supposes that the effects are due to a modification, by the electric current, of the chemical affinity of the particles through or by which that current is passing, giving them the power of acting more forcibly in one direction than in another, and consequently making them travel by a series of successive decompositions and recompositions in opposite directions, and finally causing their expulsion or exclusion at the boundaries of the body under decomposition, in the direction of the current, *and that* in larger or smaller quantities according as the current is more or less powerful.

"What are called the *poles* of the voltaic battery are merely the surfaces or doors by which the electricity enters into, or passes out of, the substance suffering decomposition; Faraday hence proposes for them the term *electrodes* from ηλεκτρον and οδος a way, meaning thereby, the substance, or surface, whether of air, water, metal, or any other substance which serves to convey an electric current into, and from the decomposing matter, and which bounds its extent in that direction.

"The surfaces at which the electric current enters, and leaves a decomposing body, he calls the *anode*, and the *cathode*; from ανα upwards, and οδος a way,—*the way which the sun rises*; and κατα downwards, and οδος a way,—*the way which the sun sets.*

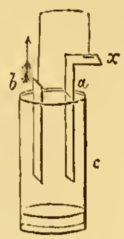
"Compounds directly decomposable by the electric current are called *electrolytes*, from ηλεκτρον and λυω to set free,—to *electrolyze* a body is to decompose it electro-chemically; the elements of an electrolyte are termed *iöns*, from ιων, participle of the verb ειμι to go; *anions* are the iöns which make their appearance at the anode, and were formerly termed the electro-negative elements of the compound, and *cations* are the iöns which make their appearanc at the cathode, and were termed the electro-positive elements. Thus chloride of lead is an *electrolyte*, and when *electrolyzed* evolves two *iöns*, chlorine and lead, the former being an *anion*, and the latter a *cation*: water is an electrolyte, evolving likewise two iöns, of which oxygen is the anion, and hydrogen the cation: muriatic acid is likewise electrolytical, boracic acid on the other hand is not."

Another of Faraday's grand discoveries is that of definite electro-chemical action. In the experiments on this subject he proved that water, when subjected to the influence of the electric current is decomposed in a quantity exactly proportionate to the quantity of electricity which passes through it, whatever may be the variations in the conditions and circumstances under which it may be placed, and this is generally true of all electrolytic bodies. We regret that while on this subject we cannot give the interesting summary of results at page 209 of Mr. Noad's work.

On the subject of the voltaic pile it is well known that Faraday has given his support to the chemical theory, and the evidence adduced by him has greatly contributed to its reception in this country.

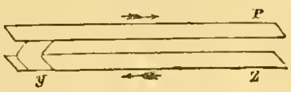
"The source of the electricity of the voltaic pile was made by Dr. Faraday the subject of the 8th, 16th, and 17th series of his Experimental Researches. Having succeeded in producing electricity *quite independent of contact*, a plate of zinc (Fig. 8) was cleaned and bent in the middle to a right angle; a piece of platinum, about three inches long and half an inch wide, *b*, was fastened to a platinum wire, and the latter bent as in the figure. These two pieces of metal were arranged as shown in the sketch; at *x* a piece of folded bibulous paper, moistened in a solution of iodide of potassium, was placed on the zinc, and was pressed upon by the end of the platinum wire; when, under these circumstances, the plates were dipped in the diluted nitric and sulphuric acids, or even in solution of caustic potash, contained in the vessel c, there was an immediate effect at *x*, the iodide being decomposed, and iodide appearing at the anode, that is, against the end of the platinum wire. As long as the lower ends of the plates remained in the acid, the electric current proceeded, and the decomposition proceeded at *x*. On removing the end of the wire from place to place on the paper, the effect was evidently very powerful; and on placing a piece of turmeric paper between the white paper and the zinc, both papers being moistened with a solution of iodide of potassium, alkali was evolved at the *cathode* against the zinc, in proportion to the evolution of iodine at the *anode;* the galvanometer also showed the passage of an electrical current; and we have thus a simple circle of the same construction and action as those described in the last lecture, except in the absence of metallic contact.

Fig. 8.



"The mutual dependence and state of the chemical affinities of two distant portions of acting fluids, is well shown in the following experiments. Let *P* (Fig. 9) be a plate of platinum, *Z* a plate of amalgamated zinc, and *y* a drop of dilute sulphuric acid; no sensible chemical action takes place till the points *P Z* are connected by some body capable of conducting electricity: then a current passes; and as it circulates through the fluid at *y*, decomposition ensues.

Fig. 9.



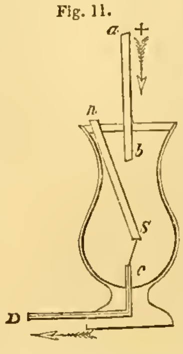
"In Fig. 10, a drop of solution of iodide of potassium is substituted, at *x*, for the acid: the same set of effects occur; but the electric current is in the opposite direction, as shown by the arrows."

Fig. 10.

He has also shown that electrolytes can conduct a current of electricity of an intensity too low to decompose them, and has given his support to the chemical theory of galvanism. We wish much we could enter at length into Faraday's views with regard to the magnetism of metals. He considers all metals as magnetic, in the same manner as iron, though not at ordinary temperatures or under ordinary circumstances. His opinion is that there is a certain temperature for each metal (as in the case of iron where it is well known) beneath which it is magnetic, and above which temperature it is devoid of magnetic power. He thinks too that there is a relation between such point of temperature and the magnetic intensity, which the body can acquire when reduced beneath that point.

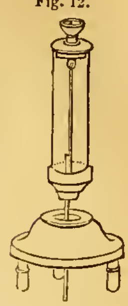
Upon the subject of magnetism, Dr. Faraday, reasoning on the relative motions of the needle and electrified wire, "Conceived that the pole of a magnet ought to revolve about the conductor, and the conductor about the pole of a magnet, and by the following ingenious apparatus he succeded in proving this to be the case:—Into the centre of the bottom of a cup, as in the vertical section, Fig. 11, a copper wire *e*, D, was inserted, a cylindrical magnet *n*, *s*, was attached by a thread to the copper wire *c*, and the cup was nearly filled with mercury, so that only the north pole of the magnet projected. A conductor, *a*, *b*, was then fixed in the mercury, perpendicularly over c. On connecting the conducting wires with the opposite ends of the battery, a current was transmitted from one wire, through the mercury to the other. If the positive current descended, the north pole of this magnet immediately began to rotate round the wire, *a*, *b*, passing from east through the south to west, i. e., in the direction of the hands of a watch; but if the current ascended, the line of rotation was reversed. Conversely, a magnet was fixed in a vessel of mercury, and the conducting wire hung from a hook above it, the end just dipping into the fluid; the electric current being then transmitted through the moveabl conductor, Faraday found

Fig. 11.



that the free extremity instantly began to revolve round the pole of the magnet, in a direction similar to the last. A good contrivance for exhibiting this is shown in Fig. 12."

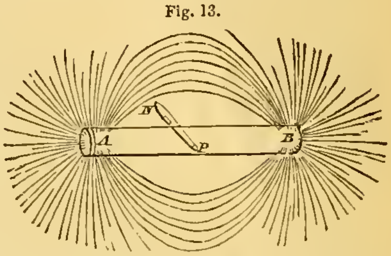
Fig. 12.



To conclude—

"The direction of the current of electricity which is excited in a metal when moving in the neighbourhood of a magnet is shown to depend upon its relation to the magnetic curves. Faraday, with his usual happy method of illustration, has given us this popular expression of it. Let A B, Fig. 13, represent a cylinder magnet, A being the marked, and B the unmarked pole; let P N, be a silver knife-blade, resting across the magnet with its edge upwards, and with its marked or notched side towards the pole A; then in whatever direction or position this knife be moved, edge foremost, either about the marked or unmarked pole, the current of electricity produced will be from P to N, provided the intersecting curves proceeding from A, abut upon the notched surface on the knife, and those from B upon the un-notched side; or if the knife be moved with its back foremost, the current will be from N to P, in every possible position and direction, provided the intersected curves abut on the same surfaces as before. A little model is easily constructed, by using a cylinder of wood for a magnet, a flat piece for the blade, and a piece of thread connecting one end of the cylinder with the other, and passing through a hole in the blade for the magnetic curves; this readily gives the result of any possible direction."

Fig. 13.



We must observe that Dr. Faraday has given to the world a laborious work, entitled Experimental Researches on Electricity, embodying the results of the papers he published from 1831 to 1840, and he is a constant contributor to the Philosophical Transactions of the Royal Society, and to the scientific periodicals.

DESIGNS.

Original Geometrical Diaper Designs. By D. R. HAY, Decorative Painter to the Queen. London: Bogue. Part I.

Those who take up this work must closely attend to its title, for it purports to give no more than what it does give, geometrical diaper designs. Those therefore who may fancy that they are to have examples of general decoration will be disappointed, and have only themselves to blame. The restriction of the work to diaper designs shows the importance which is beginning to be attached to decoration in this country, a movement which has been in a great degree forwarded by Mr. Hay himself, and before which movement it would have been quite hopeless to have expected a work on a single branch of decoration, and still more hopeless to have brought it out. As it is there are many who will look at Mr. Hay's lines and circles, and marvel what there can be in them, or why people should ever buy such worthless trifles. Design however in no department can be safely neglected in a commercial country, and still less in this country, where we have suffered and are yet suffering in a high degree the consequences of our disregard for art. The mechanical genius of our countrymen, their unequalled manual skill avail us nothing, the moment any degree of taste is required in the production of a marketable article, and we have as it were abandoned many of the most lucrative branches of manufacture to foreigners who labour with our own machinery. The foreign trade of France in manufactured goods entirely consists of articles of taste, fine silks, fine cottons, jewellery, ornaments, stained paper and decorated articles of every description, of which they have the monopoly in foreign markets. So it is with the Swiss, the Prussians, the Belgians, and other competitors, they exist mainly by our ignorance and our neglect, at the same time that they absolutely import largely into this country. The consequent loss is not to be reckoned by thousands or hundreds of thousands, but by millions, which, had we the requisite instruction, might be spent in the employment of our own operatives of every description. Here too we see that this is no matter, dependent for its importance on the whims of connoisseurs, or the fancies of dilettanti, but one which affects all classes of art. In truth the Nasmyths, the Bramahs, the Rennies, have a much deeper interest in it than Sir Martin Archer Shee or Sir Richard Westmacott; the latter indeed have rather a jealousy as to the field of art being still more overcrowded, but it is evident that if we increase our production of textile or other fabrics in the same ratio must a demand be created for steam engines, for power looms, and for the various machinery by which manufactures are in this country carried on. With the same feeling, we say, it is a matter of interest even to the machine makers that sound instruction in art should be given in the schools of design. They form their pursuits, and with the idea, as they imagine, of benefiting their own workmen, have a prepossession for mechanical drawing, drawing from objects à la Butler Williams, and all the various artificial cork-swimming contrivances which convert designs into a matter of rules and compasses. On the other hand we maintain that they have the strongest interest in supporting instruction in design on the basis of art, and we hope that in Manchester, Glasgow, Liverpool, Edinburgh, Newcastle, Birmingham, and other places, the machinists will not only be forward in subscribing to the schools of design, but that they will be foremost in promoting the due cultivation of taste in design, which, although it is to be aided by geometrical study, can never be attained on such a basis. The independent instruction of the eye is the grand thing, and lines and compasses so far from effecting that absolutely detract from it most seriously. Nay so strongly do we feel this that we say it is better for the mechanical draftsman himself to begin with the delineation of the human figure, and that he will profit more by such studies in his own branch than he would under the ordinary curriculum. Here however the change is hopeless, for if you could convince the employer, you can never convince the self-satisfied mechanic, whose preconceived ideas are an invincible obstacle.

It is with such impressions of the importance to all classes of our readers of the study of design, that we are pleased to see Mr. Hay's work as one useful in itself and gratifying as an evidence of the progress which has been made. These designs are intended for the use of decorative painters, weavers of carpets, damasks and shawls, printers of calico, paper stainers, stained glass manufacturers and others, and will, we have little doubt, prove of value, for Mr. Hay has paid particular attention to this branch of design, which is of extensive application, and as to which few accessible examples exist. For the classes to whom it is addressed it is essential that such a work should be in a cheap form, and in this respect Mr. Hay has not been neglectful, while it will from its intrinsic interest prove an attractive work for the study and the drawing room. Each plate is of a large foolscap size, and each design in duplicate, one plate being an outline and the other with tinted compartments. The outline plates will of course be found useful for filling up as coloured patterns in different branches of decoration, and we should recommend Mr. Hay to publish the outline plates in a separate form for this purpose. The filling up of these plates in colour may be made to serve as a very useful study both for private students and in schools of design. A very good exercise and an appropriate means of competition would be to require the emblazoning of a plate in a particular key colour, say blue, or orange, or purple, from which competitions great advantages would accrue, for according to the relative taste and instruction of the pupils, many diversities of treatment would result, which would become the subject of comment and the means of improvement.

Prefixed to the present part is the commencement of an essay on ornamental design, which has many points of interest, and which subsequently is to be directed to the discussion of the practical points of decorative study. In the following extract from this essay, we fully concur, and we think many will agree that its applicability to architecture is not its least merit.

"There has been much said and written upon purity of style, and it may startle some to see it asserted, that this has had only one tendency, and that has been to retard the progress of the art of ornamental design in this country. But many of the kinds of ornament called styles being themselves impure, in so far as they are destitute of the first principles of beauty, a servile adherence to them is not only a very questionable kind of purity, but calculated to corrupt the taste, while it retards originality of conception.

"If an ornamental designer were asked to imitate another in the same profession, he must either be conscious of his own inferiority, or feel his reputation compromised by the request. And the same may be said of any other profession where conception or originality of design is required, to constitute excellence. If a poet imitates the works of another poet, he thereby acknowledges his own inferiority; and so does the artist who copies the work (either ancient or modern) of another artist. But in neither case can the works copied constitute or supersede the laws or first principles of art. The greatest merit of all works of art, either in poetry, music, painting, or sculpture, consists in their being unlike the style of any that have preceded them; for there are no limits to the inventive powers of genius; and indeed it is only invention and originality that prove the possession of that divine gift. But the mode of proceeding in regard to tuition in the ornamental arts has, in this country, been of a very opposite character. What has hitherto been understood by purity of style, is nothing more than servility of copying, and if we were to inquire very closely into the origin of what are termed styles of ornament, we should find their claims to this distinction to rest on a foundation of a very slight and unsatisfactory kind."

Before we leave this subject, we may remark that we are glad to hail the formation of a Society for the Promotion of Decorative Art, for much good must accrue from such an institution. It will tend to make decorative art a respectable pursuit, and respectability, as a matter of political economy goes a good way towards cheapness, and it will be the means of strengthening good impressions and diffusing new ideas. It will also, we hope, serve to brush up other departments of art. The architect, the painter, and the sculptor, want the exercise of a wholesome influence upon them, until they duly feel which they will never put forth the energies which, as Englishmen, it behoves them to exhibit, nor leave the fleshpots of Egypt, the servile imitations of the works of antiquity. What dwarfs do even our mighty appear when we come to compare them in any respect with the great men of old. Our people have no love of wisdom for her own sake, a love of her as a holy thing, but all they care about is just the smallest amount of knowledge in their own particular pursuits that will give them a money-mongering proficiency. Where are we to look for a Michael Angelo—architect, sculptor, poet, engineer, anatomist, mathematician, great in every pursuit; and who has acquired fame in each where a Leonardo da Vinci, whose engineering discoveries were not less admirable than his pictorial triumphs, where a Titian, a Raffaelle, a Rubens, an Alonzo del Cano, a Holbein, men who considered art a Catholic pursuit, who not merely acquired manual proficiency in every branch of it, but thought it could not adequately be studied, if literature and science were neglected, men who commanded esteem by the extent of their acquirements, were entrusted with the most varied employments, and looked up to with respect as the rightful ministers of the public, wherever the highest degree of instruction, and the most extraordinary talent were to be displayed. To such a mean pass, have, we come that painters are regarded as next to musicians and actors, that class which has the least sympathy with learning, and architects, defeated in every competition, are threatened, with invasion by the engineers. To seek a painter who could read a page of Homer would be a hopeless task; to find one decently acquainted with our own literature, or our own history, would be scarcely more easy. We need hardly say that art has suffered much from these facts, art and learning have become dissociated, and art has become a poor relation, so neglectful of appearances as not to command respect. Undoubtedly one main reason why you have not lecturers in art at London, Oxford, or Cambridge, is because you have not got painters, sculptors, or architects, who have the decent rudiments of letters to qualify them for the task they would have to perform. What an expositor of Homer, of Sophocles, or Herodotus, would he be who could not read him, and how could one, fathoms in acquirements below the dullest freshman, command respect. Lectures from such men would be farces, in which students would be more occupied in criticizing the ignorance of the exhibitors than in acquiring any other degree of instruction from them. We have heard attempts within a metropolitan college, and we must say they were sickening. It is very true, the lectures were not attended by the body of the college, or there would have been much to disgust. Now, it is under these circumstances, we conceive any kind of brushing up will do good, and even the humble students of decorative art, having healthier sympathies, and a greater love for knowledge, will be able to read a useful lesson to their sophisticated superiors. We sincerely hope this will be done, for we wish well to art, and should not have laboured so many years for its advancement, if we had not felt that there are the elements of improvement, and that art is not at the present moment duly pursued, nor its possessors in that elevated position which, from the right exercise of their acquirements, they would derive.

RAILWAY ADMINISTRATION.

A Letter to the Right Hon. W. E. Gladstone, M.P., President of the Board of Trade, on Railway Legislation. "Nitor in Adversum." London: Nickisson, 1844.

We have seldom seen a more masterly exposition on the subject of railways than is to be found in this brief pamphlet; if, therefore, we dissent from its reasonings and the remedies it proposes, it is because we draw different conclusions from the same premises, and regard premises upon which our author has not argued. At a time when rant and cant are so prevalent with regard to railways, and a pretext is earnestly sought to hunt them down, it is matter of great consolation to find an advocate so staunch come forward to defend them, one earnest to do them due justice, at the same time too impartial to defend their errors. Those, however, who have deeply studied the subject, and been intimately connected with them as our author has been, know that railway bodies have been much more sinned against than sinning, and will feel cautious in what way they interfere with an institution which has shown and possesses such elements of good. The railway system of England is both a moral and physical phenomenon of the age. A connected chain of public ways extending over 1800 miles, and in the construction of which 60 millions sterling have been embarked, the largest sum ever yet applied in any country in bulk to any other purpose than that of war, naturally excites attention to the colossal magnitude of the enterprise, but the moral features are still more deeply interesting. Not only has this vast sum been raised by private means, and expended under private direction, but difficulties of the most serious character have had to be contended with. At every step experience had to be acquired, invention exerted to overcome difficulties and establish new precedents, the immense amount of money required and expended, enhanced the cost of procuring it, and the price of every kind of labour and material. No colony, no new political institution, was ever formed with such difficulties and such success as the railway system; financiers, engineers, contractors, had to be created, while, as we have said, the very vastness of the works have enhanced the cost of their execution. It is well, at the present time, and with our present experience, to turn round and say the railways could have been executed for less. It is true if, as our author says, there had been no parliamentary contests, no law, no extravagant landed compensation, that much might have been saved, but we are not quite so sure as he is that the future lines to be executed will cost only the present moderate rate, and we deny, therefore, the propriety of measuring things by the present standard. At this time money is abundant and interest low, so is the price of labour and materials, and as many contractors have been ruined, and none have too much work, a line can be let at a very low price. Prices are however rising, and will rise; labour will cost more, timber will get up, iron double in price, to say nothing of a crisis by and bye, and the serious consequences of depression in the money market, which it is in the nature of events to bring about from time to time. We would not have contractors or engineers blind to these facts, for it was to such facts that many difficulties were owing at a previous period. The much vilified estimates of Stephenson, Brunel, Rastrick, Braithwaite, &c., were founded upon works actually executed, but, in the interval, a most serious difference in prices was created by the number of contracts in the field. While, however, we expect prices to rise as a matter of course, we do not anticipate the serious excesses of the old system, because many of the difficulties have been overcome. In the infancy of the railway system, as the development of traffic was not foreseen, so neither was the cost of stations duly provided for, then it must be remembered that in those days contractors were not used to works so gigantic, and were not so competent to undertake them. Now, the weight of locomotives is ascertained, and the rails will not have to be increased in weight 50 per cent. above the estimate, as was the case previously in consequence of the experience gained in the course of the working. Now, many and economical arrangements are well known, people are not afraid to lay down timber bridges, as to which formerly much prejudice and misconception prevailed.

We say that this experience, now so advantageous, had then to be gained and to be bought at every step, and that the old system instead of being chargeable with blame, is deserving of the highest degree of praise and admiration. Few know the burthen which weighed on the minds of railway managers in those days, and rarely have exertions so great been made, and received so little appreciation. Our author graphically describes the difficulties of the panic.

"Still worse was the condition of some other lines two years later. The commercial embarrassments that weighed so heavily upon the country bent them to the ground. The proprietors were totally unable to answer the calls upon them. No credit could be given—no money could be obtained. Contractors failed—works were stopped—loans were raised at usurious interest—capital was provided at a sacrifice of one-third of its amount. Whatever censure boards of directors deserved in other matters, at this time they stood forward manfully to face the storm. Many of them supplied large sums from their individual resources, and pledged their credit to a frightful extent. They risked ruin for the benefit of their fellow-proprietors, which they never would have hazarded for their own. Few know the perilous state of some of these now flourishing concerns, or of the anxious days and sleepless nights of those who had to provide the sinews of war, to uphold a sinking credit, and ward off impending bankruptcy and ruin."

We disagree with him, however, as to railway directors pushing on the works at any cost, *because* they were deeply imbued with the gambling spirit of the day. They pushed on the works as a matter of financial necessity, to which they were in the strongest degree urged by their proprietors. To the bulk of the then holders on the realization of a traffic and a dividend depended the tenure of their property, often whether they were to be rich men or beggars. When the panic came the resources of many became inadequate to meet the heavy calls; they had to borrow or to hold on by any means. To go into the market and sell was ruin, to hold was their only chance, until the opening of some portions of the line made their shares a better security, or until the subscription of two-thirds of the capital enabled the companies to postpone the calls, and to raise money on debentures. Any sacrifice of capital to gain time was preferable to throwing shares on the market, where scarcely any description of property was at par, while the perils of forfeiting everything by non-compliance with the act of parliament made shares without a traffic totally unavailable as a security for raising money. When all these circumstances are taken into consideration, railway managers will not be censured for excesses of estimates, which circumstances alone produced.

The evils produced by the legislature the pamphlet before us well shows, it particularly dwells on the legalized extortions of landowners, and the prohibitions of level crossings of common roads, which, of course, it proposes to remedy.

We have now, therefore, to consider the present state of the railway interest. We have so many hundred miles of railway, costing so many millions, and as a new institution has arisen, new public wants have been created, first and foremost of which is cheap travelling. In a national point of view there can be no question upon this subject; cheap travelling is in the highest degree desirable: how is it to be obtained? Every one has his remedy; and the legislature is called upon by many well-meaning individuals to cut the Gordian knot, and to buy up the whole of the railways: others, among whom our author is one, propose modifications of this principle. For our own parts we are most free to admit, that on the leading lines of traffic the charges for travelling are absurdly high, and the accommodation for the labouring classes totally inadequate; still we are inclined to say that it is better to let the matter alone than to legislate upon it. The mischief hitherto has been in legislating for questions of public enterprise, imposing restrictions and giving privileges, which are the fertile sources of mischief, and we anticipate little good therefore from any legislative remedy, the most efficient in such cases being in our opinion to legislate as little as possible, but to proceed upon the broad economical principle of leaving industry to regulate itself. Not that we doubt the right of the legislature to interfere in this specific case or in any similar case. Apart from the question of rails and locomotives, shares and shareholders, the railway system is an institution having the same public relations as a bank, a college, an hospital, or a public house, and in which any rights of private property exist subordinate to the public objects. On the equity of the case, it must be remembered, that if railways have been allowed a maximum fare, it was on the express condition that any body should be allowed to compete with them on their own lines. This, however, is found to be injurious to the public, and the legislature have, therefore, the equity of requiring some other equivalent security for a reasonable rate of fare. Our ground for letting the railways alone on the subject of fares is, that it is more remunerative for railway companies to charge low fares than it is to charge high fares, and that this principle is making satisfactory progress, and must and will be adopted by all companies.—The following observations from a very able article in the *Railway Record*, will be read with interest. "A very large amount of manufacturing business has been created by the railway system, for the supply of railway stock, and this will be ever on the increase, not merely for England alone, but for her colonies, and for foreign lands. We are prepared to see railways rise in value, in the same proportion that canals have risen. For although it be true, that the price of making railways has been reduced very low of late, it is quite certain that, with increasing traffic, those prices will rise. When railways shall commence in the East and West Indies, in Australia and China, English capital will find so many vents, that the intense existing competition will be lessened, and assuredly the value of land will rise as our population thickens. The greater the numbers of the community the more valuable will the roads become. England will be virtually the metropolis of the continent, by means of free communication throughout all lands.

"Nothing can defeat railway prosperity, but, at the same time, nothing can check it so much as injudicious high fares. We cannot too strongly insist on this point. The increase of expenses in railways is great in proportion to the diminution of traffic, and the increase of traffic is followed by a very slight increase of expenses on the annual amount, while the proportionate decrease is very great. People are gradually getting used to travel, the circle continually widening, and as they get used to it, it becomes a necessary of life. They can no more do without it, than they can forego their provisions. But they must be inoculated to it, and this inoculation will not take place while they are frightened by high fares. We are of opinion that it would be a wise thing for Railway Companies to establish some rule in lowering their fares in proportion to the increase of their passengers. It is the largest number that will pay best, in all cases, and we apprehend that the lowest fares will also pay best, unless where the number of passengers is limited." The author before us certainly does not go far enough for us in his proposed legislation, for he is content to have open third class carriages at ¾d. per mile attached to all trains. Now we think as a matter of public health it is desirable that all trains should be covered as in Belgium, and that sufficient distinction in comfort will always exist between the several classes of carriages. Third class carriages should be provided with seats, covered with tarpaulin, and have curtains; and second class carriages be first class carriages without the cushions. In practice this arrangement has worked well, and will work well. On short omnibus lines, however, open stand-up carriages do no harm. On all lines a step remains to be taken, which may be pursued with advantage, we mean the running of slow, cheap trains, going at the rate of some ten miles an hour. Such trains can be worked much cheaper than high speed trains, and there are large classes of the public to whom time is of less importance than money, females in particular. All these things, however, may be safely left to experience, and experience is beginning to show that a high fare is the wrong system for extracting the greatest revenue from a railway. The cheap fare system is satisfactorily progressing, and will establish itself without legislative aid. A great many experiments are also being made as to excursions, return tickets, weekly, monthly, season and yearly subscriptions, the results of which are promulgated by the railway press to the general information. Here, too, we may observe, that it is not one of the least remarkable features of the railway system, that it has created a press, by the competition and energy of the members of which a degree of information is diffused which has been productive of the greatest benefits, and which under no central administration could exist. By the means of this agency upwards of a hundred reports of directors and engineers are yearly brought under the scrutiny of the great body of railway capitalists, while the comments of the shareholders at the meetings are recorded at a length, and with a degree of accuracy only surpassed by the reports of the Houses of Parliament. This is totally independent of the weekly communication of every kind of intelligence, and the keen investigation of a number of editors experienced on the subject, and solely engaged in such discussions. Indeed it is not one of the smallest marvels of the railway system to see one of these papers with more than thirty of our pages of close type recording the minutest details of railway management, and the most trivial observations of the humblest shareholder or official, for the perusal of many hundred railway directors, secretaries, engineers and functionaries. The loss of such auxiliaries consequent on the centralization of the railways by government, would deprive us of an engine of improvement which no other machinery could supply, even supposing the government to be willing at its own risk to keep up for the benefit of its functionaries a *Railway Journal*, *Railway Record*, for even if it found the money it could not find the materials. Seeing the influence which this press has in the diffusion of intelligence and the propagation of truth, we are quite satisfied that the directors still holding out against low fares will not be for long.

The grand remedy, however, we think lies in improving the arrangements for obtaining Acts of Parliament. This our author has also turned his attention to, but we think he has not struck at the root of the evil. In common with many other individuals he has the customary horror of projectors and share jobbers, and for the sake of remedying any evil connected with share jobbing, he is willing to sacrifice the interests of the community. We say give every facility for obtaining acts of parliament for railways, harbours, docks, bridges, and all useful works, take no trouble about whether the work will pay, or whether the parties have money to carry it on, leave them to look after that themselves, and do not for the fear of encouraging share jobbing prevent people from carrying out useful works. Let such parties also have the power of raising as much money as they can upon the works, and let the parties lending the money look to their own investigations for the security and not to the legislature. We know these are views diametrically opposed to the prevailing practice, but let them be canvassed and they will be found to be right. Depend upon it, the more trade is left to regulate itself, and the more it is carried on by private enterprise, the better. The public is very well able to protect itself, and to form its own judgment as to the advisability of an investment without any legislative aid on the score, which after all is totally erroneous—for have not many of the lines guaranteed by parliament to pay five per cent., been for years without a dividend, and others on the contrary surpassed all parliamentary calculations. As to the bubble companies, we have no fear on that head; West Middlesex swindlers may exist as they have existed, but a whole community is not to be fettered to prevent the perpetration of crime. Give every facility for obtaining railway bills, relax the standing orders, do away with all deposits, and you need entertain no fears about existing lines charging high fares. Here, too, we may observe that nothing could be more absurd than the doctrine lately held in the legislature that no new line should be authorised to compete with an existing railway, for the more railways the better for the public at large. The idea, too, of the vested interest of a railway in the traffic between particular towns is supremely ridiculous, for it is evident that it did not regard the vested interest of the turnpike road it superseded. No one can have a vested interest in abuse, and it is an abuse to subject the public to a high rate for travelling, when they can be carried more cheaply.

The suggestions of the author, that the 5 per cent. government tax on railways might be appropriated as a tax for buying them up, is an exceedingly good one, and we think such a fund might be advantageously applied in the gradual purchase of shares at the market value without involving any great interference with the grand principle of private enterprise, for after all, what we have to look to is not what we shall do with the present railways, but how we shall keep up the national energy, by which such great works have been prosecuted and by which still greater things can be effected in our own country, and in our vast colonial empire.

Ricerche sull' Architettura piu propria dei Tempi Cristiani, e Applicazione della medesima ad una idea di Sostituzione della Chiesa Cattedrale di S. Giovanni in Torino. Del Cavaliere Luigi Canina. Roma, 1843, gr. folio, con 58 Tavola.

'Luigi' seems to be a baptismal name of good omen for architects, it being that of three of the most eminent modern Italian ones, Cagnola, Canonica, (very recently deceased), and Canina. The last has contributed largely to the literature and history of architecture, first by his "Architettura Antica," (1832, &c.,) and now by this second splendid folio work, whose full title we have given above. While the work itself deserves the epithet magnificent, there is something even princely—not at all likely te be imitated in this country—in the mode in which it is given to the world; the term "given" being to be understood literally, since all the copies are for private donations and presents. That there should be none at all for sale, is, however, to be regretted; still the bringing out so costly a work—all the more costly in proportion as the impression is a limited one, contrasts more strikingly than flatteringly with the niggardly trading-like doings in this country on the part of opulent professors and patrons of art. Instead of presenting his medals and coins either to the British Museum or to one of the Universities, to be there deposited as the Devonshire Collection, one of the wealthiest of our English Dukes, sends them to an auctioneer's sale-room,—perhaps because he has found a royal visit to be a very expensive sort of honour.—This, however, is an *apart*, which the reader is not obliged to notice.

In regard to this new work of Canina's, we are sorry to be obliged to confess that we cannot speak of it from perusal or autopsy, but can report of it only according to what is said by a foreign journalist, who has had an opportunity of inspecting a copy deposited in the University Library at Leipzig. Had we ourselves been able to obtain a sight of it, we should most assuredly have made a somewhat different use of the opportunity, for we should have paid especial attention to the Canina's own designs for a new Cathedral, which, it seems, it is in contemplation to erect at Turin, in the immediate vicinity of the Royal Palace, in lieu of the present old one of San Giovanni; which is all the information the journalist affords us on the subject, since he does not even so much as say if these designs are a mere volunteer *projét* on the part of the architect, or were prepared in consequence of an intimation that his ideas would be acceptable. As to what they really are, we are left entirely in the dark, not a single particular of any kind, relative to them, being stated in the journal we speak after; —nothing even to convey so much as some general idea; not even a syllable expressive of either approbation of, or dissatisfaction at, this attempt to revive the Basilica style, or that of the early Ecclesiastical Architecture of Italy, in a modified form, so as to adapt it for churches at the present day, in preference to the style which has been in vogue in that country during the last three or four centuries.

This silence on the part of the reviewer does not augur very favourably for the merit of Canina's designs: at any rate, it would seem that those plates are the least striking of all in the volume; yet it certainly would have been interesting to learn how far the original character, as shown in the historical examples of that class of buildings, which forms the subjects of the other plates, had been retained and kept.

Whether the chapters on the subject of the Basilicas which are brought forward as examples, contain anything new in the way of historical information, or aught instructive in the shape of original comment, is also one of the reviewer's secrets. Still we do not suppose there can be much in regard to fresh information—unless Canina has entered unusually fully into the subject; because it has been treated at considerable length by Bunsen, in his text to Gutensohn and Knapp's "Basiliken des Christlichen Roms;" and by Mr. Gally Knight in the introduction to his splendid pictorial and antiquarian work, entitled "The Ecclesiastical Architecture of Italy." Founded upon this last mentioned publication, is a paper in the current number of the "Westminster Review," headed the "Basilica style of Architecture," which enters into a consideration of that style—its elements, qualities, and capabilities; and recommends the application of it among ourselves. We confess that it does seem to us far better suited for adoption at the present day, than the first Early English or Lancet style, which is now so greatly affected, although its comparative cheapness seems to be its chief, if not its sole recommendation. Most assuredly this last cannot be received as the perfection of the pointed style, more especially when—as is generally the case—the degree of finish it admits of is not kept up, but its details are so slurred over that all qualities disappear save those of meagreness, tameness, and insipidity. Much more, we conceive, might be made of the Basilica style, particularly for interiors; we say "*made of*" it, because it requires some mind to be brought to it, and not merely taken and copied just as it is found.

Canina, we are told, is disposed to classify early Ecclesiastical Architecture, into three leading divisions or families: viz., 1. The *Eastern*, or Byzantine, strictly so called; 2. *Western*, or Romanic Byzantine, otherwise termed—and not without great propriety—Lombardic; 3. The *Northern*, the Pointed or Gothic style: further, however, our deponent sayeth not.

The Architectural Nomenclature of the Middle Ages. By R. Willis, M.A., F.R.S., &c.

In this essay, which forms the ninth number of the publications of the "Cambridge Antiquarian Society," Professor Willis has treated, in a manner entirely new, a subject of great interest to the architect. In connexion with the study of the architecture of the middle ages, it is impossible to appreciate too highly the numerous existing documents relative to the original construction of the buildings of that period, and considering how long such documents, and the works of our old writers, have been in request as a means of illustrating the antiquities of English architecture, it is extraordinary how little has hitherto been done in good earnest toward the indispensable measure of collecting and explaining the technical terms with which they abound, and which are indeed their very pith as regards this purpose. The fact is, the course of study requisite to conquer the difficulties of reading and construing the jargon of ancient MS. rolls, is seldom to be found in union with the practical knowledge necessary to digest and apply them, and when documents of this nature have, from time to time, found their way to the public, it has too often been in forms so crude and imperfect, as to have rendered "*black-letter man*" almost a term of reproach. The labours of Professor Willis in the essay before us, differ from those of either the collector, the glossarist, or the etymologist. "My object, in the following pages," says the author in his preface, "has been to draw up an account of the mediæval nomenclature of architecture, as far as it can be deduced from the remaining documents, and from the comparison of them with existing buildings. The words are principally to be found in indentures and accounts relating to the expenses of buildings and monuments, which are necessarily expressed in the language of workmen. Other terms, but not so strictly technical, may be picked out of the monastic chronicles and biographies. Several well-known collections of these terms have been already made, of which the first strictly architectural one was that of Mr. Willson, appended to Pugin's "Examples of Gothic Architecture," in 1823, and which is a most admirable performance, to which I am under great obligations. But many documents have come to light since the appearance of this Glossary, and the subject has been more closely investigated. Also, the alphabetical form of these collections is not the best adapted for the illustration and comparison of terms like these, which are commonly of a strange and capricious kind, defying the usual processes of etymology, and some of whose meanings can only be deduced by collating every passage that contains the term, and comparing it with the entire nomenclature of the architectural member in question." And he adds in conclusion, "that he proposes not to construct a complete nomenclature, but to elucidate those words that either remained in obscurity, whose meanings were doubtful, or which had been misapplied."

The first chapter, and not the least interesting, is on the nomenclature of mouldings, and is principally directed to an examination of the terms to be found in the "Itinerarium of William of Worcester," the most complete specimen of the nomenclature of the mediæval mouldings which has been preserved to us. This work, the MS. of which is preserved in the Library of Corpus Christi College, at Cambridge, contains, among other interesting matter, a detailed description, illustrated by diagrams, of the doorways of the Churches of St. Mary Redcliff, and St. Stephen, at Bristol; but although this work has been in print ever since 1778, and has been abundantly used as an authority by glossarists, no one has hitherto thought of comparing these descriptions with the existing buildings. Much new light has resulted from the employment of this process by Professor Willis, the accuracy of whose deductions from this source are confirmed in a very remarkable manner. Among other particulars relating to Redcliff Church, noted by William of Worcester, we are told that the tower pier contains 103 members, a statement which appears to be in perfect conformity with the fact.

From the explanation of the mediæval names of mouldings, Professor Willis passes to those in use at the present day. It might be supposed that at the "renaissance" of the classical style of architecture, either that the old words would have been appropriated, or that they would have been exchanged for classical terms, but this is by no means the case. The history of the present nomenclature is so curious that Professor Willis traces it at some length, and shows it to be a medley derived from the different languages through which we obtained our first knowledge of Vitruvius and the modern Italian masters, during the 16th and 17th centuries. *Apropos* to Vitruvius, we have the following excellent comment:—

"Vitruvius has not written expressly upon mouldings; he merely names them when they occur in the course of his description of other architectural members. But a name may in this way be given to a moulding, either in the general sense, from the form of its section, as when he terms the hollow or casement a *scotia*, from the shadow which it holds; or the name may be assigned to the moulding only from the peculiar function which it performs, or from some form which it derives from that function: as for example, the same scotia, when it occurs in the base of a column, is also termed in conjunction with its fillets *Trochilus*, the pully; for it exactly resembles a pully in this use of it, but not when it is straight. Now when we attempt to pick out a nomenclature from this author, we are often in a doubt whether a given term be a *sectional* name or a *functional* name; and this distinction has not been sufficiently attended to. It will presently appear that the same functional name may be given to two different mouldings, if they are each capable of performing the office to which the name alludes."

The following chapters treat on masonry, walls, and *tablements*—pillars, arches, and vaults—windows—pinnacles, and tabernacle work. We cannot pretend to follow Professor Willis through the mass of curious information developed in the investigation of the nomenclature of these elements of our Gothic buildings, amounting to upwards of three hundred and forty technical terms, not including the Vitruvian words or mouldings of the *renaissance*. And here we may notice two words which have an appearance so classical that their etymology may not be generally suspected. Entablature, which is derived from the mediæval word tablement, the term for horizontal mouldings in general, and pediment, upon which Professor Willis observes—

"As I am upon the subject of these additions to the classical terms, I may as well mention another word, which although English, and confined for a long while to the workmen, has now assumed the place and resemblance of a good classical term—I mean *Pediment*, which we now universally apply to the triangular gable of classical architecture, the 'Fastigium' of Vitruvius and of the Italians, who also, together with the French and English writers, employ Frontispicio—Frontispice—Fronton—Frontispiece, respectively. Evelyn says, 'those roofs which exalted themselves above the cornices had usually in face a triangular plain or gabel within the mouldings (that when our workmen make not so acute and pointed they call a *Pediment*) which the ancients named Tympanum.' Evelyn's 'Account of Architects and Architecture,' 50. The earliest example of the word that I have been able to discover, is in the English translation of the Hypnerotomachi, 'the Strife of Love in a Dreame,' 1592. The original passage, describing the façade of a temple, 'Al frontispicio overo fastigio,' &c. is translated (and with the marginal note) as follows:

"'And to return to the view of the whole frame, in the disposing thereof as aforesaide, the Coronices by a perpendycular lyne were corrospondent and agreeing with the faling out of the whol worke, the Stilliced or Perimeter, or vtter part of the vppermost Coronice, onely except,' (p. 22,) ('il' stillicidio della suprema cornice.') The 'stillicidio' is generally 'gocciolatoio' in Italian. The insertion of the word *Perimeter* seems to show that this writer derived *Periment* from it, as a space surrounded or bounded by a perimeter of mouldings. *Pedamento* in Italian is used by Scamozzi for the Stereobate.'"

The marginal note referred to is, "A periment in corrupt English."

In pursuing our notice of this valuable contribution to the literature of architecture, we must confine ourselves to a few examples illustrative of Professor Willis's mode of investigation, in which it has either produced new results or corrected existing errors. The term *orb*, which has puzzled Mr. Willson, and another equally obscure, which he has confounded with it, viz., *cross quarters*, are both explained thus—

"It is well known that in the later periods of Gothic architecture the use of stone panelled tracery increased gradually to so great an extent, that in the more elaborate buildings the walls and vaults, and every space unoccupied by actual windows, were covered by them. I shall proceed to show that these panels were termed 'orbs.' This I shall do by comparing three independent passages, in which the word occurs, with the existing buildings to which they refer.

"The Indenture for the tomb of King Richard II. and his Queen, in Westminster Abbey, covenants that there shall be niches for statues on each side having *orbs* between them to match. 'Et les ditz masons ferront measons (maisons) pur xii images, c'est assavoir vi a lune coste et vi a lautre coste du dite toumbe, et le remenaunt du dite toumbe sera fait ove (avec) *orbes* accordauntz et semblables as dites measons."

"Accordingly the tomb has tabernables *(maisons)* at the sides between which are placed blank panels *(orbs)* corresponding to them, as may be seen from the drawing of the tomb of Edward the Third, which is exactly similar, in Blore's 'Monumental Remains.'

"William of Worcestre describes the tower of St. Stephen's at Bristol in the following words;

'Habet 4 storyes et ibi in quarta stori sunt campanæ.
In superiori historia tres orbæ in qualibet panella.
In secunda et tercia historia sunt duæ orbæ in qualibet panella 4 panellarum.
In inferiori *historia* sunt in duobus panellis in qualibet panella south and west fenestræ, in aliis duobus panellis ex parte boriali et *orientali* sunt duæ archæ.'"

"If orba be translated 'a blank window,' the above becomes a correct description of the existing tower. For its decoration consists not so much in stone panelling as in literal blank windows, which are formed in each story. The lower windows are open as usual, but in the upper story, where the bells are, the blank tracery is not pierced, but a window-opening is formed between part of the mullions only of the central blank windows of each side. The description, if translated thus, will agree perfectly with the tower as it stands:—

The tower has four stories, and the bells are in the fourth or upper story.
In the upper story there are three *blank windows* on each side.
In the second and third stories are two *blank windows* on each side of the four.
In the lower story there are *windows* on the south and west sides, but on the north and east there are *arches*, (for on these sides the tower joins the church.)

"There exists an indenture for the furnishing of one tower at some one of the corners of King's College Chapel (probably as an experiment); for in the same document it is covenanted that all the fynyalls (pinnacles) of the same Chapel shall be made according to one that had been set up. It is agreed that the said tower is to have 'fynyalls, rysant gabbletts, batlements, *orbys*, and crosse quarters, and every otherthynge belongyng to the same—accordyng to a plat thereof made.' This description corresponds very well with the existing tower."

"I shall return to this in the next section, and shall now merely point out the *orb*, or blank panel, with its cinquefoil head, observing that this is not opened with tracery for glass as usual, but that the tracery, or string of *cross quarters*, is so introduced, as to be a mere piercing of part of the stone panel, without destroying its character as a blank panel.

"As in all these examples the word so plainly applies itself to a blank or blind window, I imagine it must be derived from the Norman French *orbe*, 'qui est caché, secret, priveé de quelque chose, aveugle. *Orbus*. Lat.'

"The fact that stone panelling was first called by a name that implies a blank window, would explain the history of its introduction into mediæval architecture, even if the existing examples did not show it."

The familiar terms *mullion* and *tracery* seem to be traced no higher than to Sir Christopher Wren. The original form of the former word (sometimes written munnion) seems to be *monial*, derived from the French "*moyen*, qui est au milieu," the old form of which is *meian* or *menel*. They are called "menaux or croisillons des fenêtres," in that language. "These words (mullion and tracery) were adopted by Bentham and Milner, both evidently deriving them from Wren, from whom they quote largely with admiration. Dr. Plot, his cotemporary, also uses the word; and from these authorities the words derive their present universal employment. Other early antiquarians make use of awkward circumlocutions for tracery. Thus Warton, one of the first admirers of Gothic architecture, can yet find no better terms for this beautiful and characteristic principle of decoration than 'Ramified windows divided into several lights, and branched out at the top into a multiplicity of whimsical shapes and compartments.' But soon after he introduces a description of 'fret-work thrown like a web of embroidery over the old Saxon vaulting of Gloucester.' Instead of tracery every mediæval account relating to windows contains an abundance of stones called *form pieces*, and allusions to *forms*, which, as I shall proceed to show, was their proper word for the tracery.

"In France the stone frames of Gothic windows are to this day termed *formes de vitres*, forms or seats for glass; for, as is well known, the word form (pronounced with the long *o*) bears, amongst others, the sense of a seat or receptacle, as a long bench or the seat of a hare. Bailey defines *form* (in mechanics) to be a kind of mould whereon a thing is fastened or wrought; and we have examples of this in the printer's forme of types. In French and in the mediæval Latin the stalls of a choir are so termed, and the French use it for a stone dry dock."

Professor Willis approves of Sir James Hall's term of *cusps* for the points in tracery, which Rickman has misapplied to the curve, and not to the point, the mathematical cusp being the point formed by two parts of curves meeting. On the authority of William of Worcester, *genlese* appears to be the mediæval term for these points. The application of this term was first made by Mr. Willson, but he writes the word *gentese*, being misled by the printed edition of the "Itinirarium." Finial is proved to apply to the entire pyramidal portion of a pinnacle, and not to the extreme termination. The proper mediæval name for the latter seems to be the *croppe*, which means also the top of a tree, and *corse* or body, is the square shaft.

We must not, however, extend the limits of this review. The paper concludes with some very curious particulars respecting the *herses* or canopies placed over the coffins at royal obsequies. A complete account of four herses erected at the funeral of Anne, Queen of Richard II, is extant, from which they appear to have been elaborate architectural compositions modelled in wax. Every part of the work is minutely described, and the terms evidently apply to a profusion of tabernacle work, to which the immense quantity of four tons and a half of wax was applied, independently of that consumed in tapers and links, amounting to above two tons more. The herse set up on that occasion at Westminster is described as containing "280" buttresses of different sizes, 72 "botants," or arch buttresses, and 96 bodies, besides housyngs, &c., and 428 tapers.

We must conclude by thanking the author for this valuable addition to the many obligations under which he has already laid the friends and professors of architecture, by his researches and publications.

ROYAL EXCHANGE CLOCK.

Sir—A copy of a letter in reference to the clock and chimes making for the New Royal Exchange, dated Brighton, 21st July, and signed E. J. Dent, of 82, Strand, and 33, Cockspur-street, addressed to Mr. Whitehurst, of Derby, having been very generally circulated among the members of the corporation of London, in which it is stated that I was a competitor to be employed to make the clock and chimes for that building, I beg to say that statement is wholly incorrect, the direct contrary being the case. In a letter I had occasion to write to R. Lambert Jones, Esq., the chairman of the building committee, so long since as the 8th of February, 1843, I stated my determination not to be a candidate, and repeated the same to Mr. Tite, the architect to the building, in a letter dated the 27th ofu Jly, in answer to an application from that gentleman to furnish a tender and estimate; and in a letter dated two days subsequent, he expressed his regret at my determination. Your insertion of this communication will much oblige,

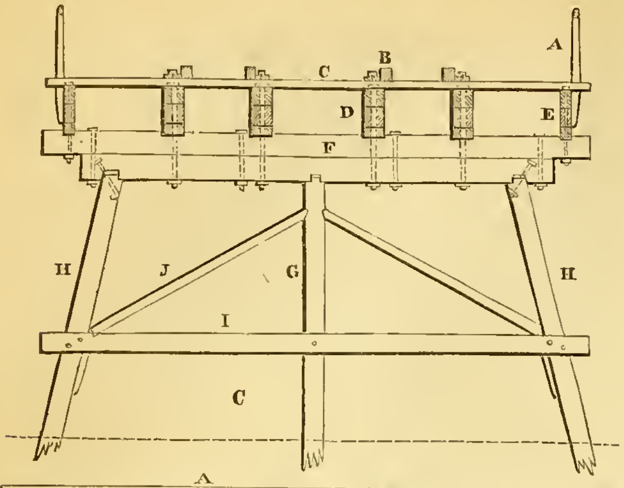
Sir, your most obedient servant,

B. L. Vulliamy.

Pall Mall, April 16, 1844.

TIMBER VIADUCTS ON THE SOUTH EASTERN RAILWAY.

Fig. 1.—Transverse Section.



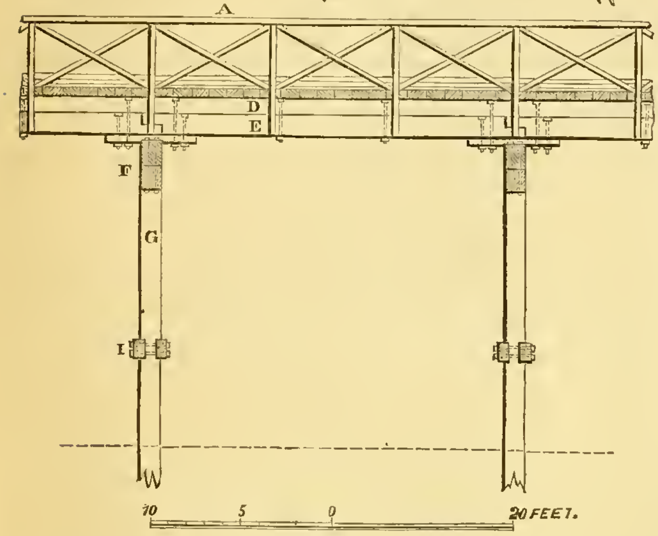


Fig. 2.—Elevation.

The annexed engravings show a transverse section and elevation of the timber viaducts adopted at the South Eastern Railway on the branch from New Cross to the Bricklayers' Arms, and also at the Shakespere Viaduct, between Folkestone and Dover, under the direction of Mr. William Cubitt the engineer in chief.

The parapet or railway A stands 4 ft. above the platform, the top rail is 4 in. by 3 in. rounded on the top, the upright posts 4 in. by 4 in. with intervening cross-rails; the guards or timbers B, lying alongside the iron rails, are 6 in. square. The platform *c* on the top is 30 ft. wide out to out, and consists of timber laid close together 4 in. thick. The 4 longitudinal bearers in the centre D consist of 2 pieces of whole timber 13 in. square, and 1 piece of half timber 5 ft. long, 13 by $6\frac{1}{2}$ in.. lying on the top of the transverse beams; the two outer bearers E are half the scantling horizontally and the same vertically. The transverse bearer F consists of 2 pieces of timber 30 ft. and 26 ft. long, and 13 in. square. The posts or piles G, H, are 13 in. square, the two outer piles H are placed 23 ft. apart from out to out on the top, and are driven in with a batter of 3 in. in a foot. The piles are prevented from spreading by two horizontal ties I, 30 ft. long 12 by 6 in., and are bolted on each side of the piles; there are also 2 diagonal struts J, above 9 in. square abutting at the feet on cleets nailed on the inner side of the outer piles.

It will be perceived that the whole of the timbers are well secured with iron bolts.

The distance in the middle on the top of the platform, between the centre of the rails is 6 ft. $2\frac{1}{2}$ in., and between the centre of the railings 4 ft. 11 in.

The horizontal dotted line at the bottom is Trinity Datum.

DECORATIONS OF THE PALACE AT WESTMINSTER.

WOOD CARVING, STAINED GLASS, &c.

The present exhibition, under the authority of the Royal Commissioners of the Fine Arts, is held in the St. James's Bazaar, King Street, St. James's, a very convenient room. Notices, it will be recollected, were issued last year calling for specimens of designs in relation to the decoration of the new Houses of Parliament, under the several heads of wood carving, stained glass, arabesque, and heraldic decoration, ornamental paving, metal casting, &c. The call seems to have been well responded to, so far as number is concerned, and proves the existence, in this country, of an adequate number of artists engaged in such pursuits; but although the works sent in are respectable, they do not impress us by their originality of conception, or by their superior merits in execution. Much evidently remains to be done, though a great good has been effected by calling public attention to departments of art little known, much neglected, and not adequately appreciated. If we look to the designs, we find a want of historic appreciation, an inattention to political and historic propriety, and the most common-place sources of illustrative detail. One artist brings Lycurgus into the English Houses of Parliament, another Moses, a third King David of Scotland, and the Princes of Tara, while more than one artist has made the Queen's husband, Prince Albert, a prominent personage, introducing his statue or his arms.

We may observe of the wood carving that it shows great respectability of attainments in the exhibitors, and the extent to which the art is now cultivated, owing to the increased encouragement of ecclesiastical decoration. Exhibitors have sent in from many parts of the country, and particularly from the cathedral towns, the wood-carvers being about 25 in number (the designs and specimens 57), the glass painters 20, and the decorative painters pretty numerous. Most of the leading artists in each branch are contributors. To resume the subject of wood carving, the subject of which is a door for the House of Lords, the general defect we observe, beyond the want of originality in the designs, is the appearance most designs convey of being copied from tombs, altar screens, and west windows, having an air too ecclesiastical, neither have the appliances of Gothic art been well directed. The resources of varied tracery, have, except in rare instances, been neglected, while many works exhibit a poverty of ornament; few artists seem to be aware what a door ought to be, and some have covered their doors with panels in high and low relief, representing various events; none seem to have studied the numerous and interesting specimens which are to be found in Holland, Belgium, and Germany. Those of Italy do not, we think, afford such good studies.

We shall not speak of the carved specimens generally, as they are for the most part respectable, and no more.

No. 1 is a poor affair of peer's coronets, and mitres, a wretched idea, which several artists have adopted as their sole emblems and illustrations:

No. 3, by William Ollett, of Norwich, has four compartments with decorated headings, surrounded by a bordure of the shields of English sovereigns. Mr. Ollett, as well as some others, has, without discrimination, introduced the arms of the Saxon kings, which are an invention of the mediæval monks, and armorial bearings also were of much later introduction. If they must represent the early princes, as indeed they ought to be represented, let the white horse of the Saxons and the raven of the Danes be employed.

No. 5, by John Steel, is in a modern style, quite out of character.

William Freeman, jun., has the Barons demanding the Charter of Liberties from King John, a constitutional subject, but one of a violent character, and calculated to meet with little favour from the Royal Commissioners, who have it is said refused to place among the statues of chief magistrates. that of Oliver Cromwell, the acquirer of Jamaica.

No. 9. by Samuel Pratt, jun., is a very original design, and one of the most gratifying. He has shown that something may be done with tracery. The coronets are, however, a poor idea.

S. A. Nash's, No. 11, is a very good subject. On the panels of the doors are on one Henry III. (from his tomb in Westminster Abbey) under whom the first traces of a Parliament in the present form exhibited themselves, on the other panel her present Majesty, appropriately uniting the present and the past. In a panel over the door is represented the sitting of 3rd May, 1253, in Westminster Hall, when the peers obtained from Henry III. a solemn confirmation of the Great Charter of Liberties.—No. 13, by John Thomas is a good work, the details rich.—John Wolstenhome, of York has contributed No. 15, which is modelled from York and Beverley Minsters, and is too much like an altar screen or tomb.—No. 17, by F. W. Brown, is in a florid style, bad and inappropriate. His carving is however good.—Wm. Thomas, in No. 19, has some strange work, twelve panels in which figure the Death of Ananias, the Inquisition, and similar un-English imaginations. This artist has been led astray by works of the time of the revival. His bas relief of Trial by Ordeal, we must say is well executed.—Henry Ringham, of Ipswich, has a thing like the mullions of a parish church window, and paltry.—The carve to the Cambridge Camden Society, Joseph Rattee has an affair with modern details, and Prince Albert's arms. His carving is better.

William Allan, of Edinburgh, has a design very ill chosen, comprising

Cranmer and his Bible, David I. King of Scotland administering justice, and St. Patrick before the Kings and Princes of Tara. His wish to illustrate the union of the several countries is a laudable one, but he should have selected events in which each has a common interest, not the transactions of local chiefs of no constitutional import. Mr. Allan's commemoration of Robert Fitzwalter is a very proper idea, and we are surprised that no one on this occasion has thought of Simon de Montfort, Earl of Leicester, to whom, and not to Henry III., we owe the institution of the representative system — The design of No. 29 is bad.—Some of the carving in Messrs. Colling and Vincent's, No. 80, is good, but it is ineffective as a whole. No. 33, by the same artists is a superior work, with good applications of tracery.—No. 34, by R. B. Boyle, of Dublin, is in a mixed modern style.

No. 36, by Samuel Nixon, is too much in the painted window style of Sir Joshua Reynolds. The subjects of his No. 37, show a proper appreciation of history, but we do not approve the effect of a dozen panels of sculpture. The life of Alfred the Great, to whom many of our institutions are attributed, is a proper subject, as the first flotilla defeating a Danish squadron, trial by jury, the assembly of the Witan. His carved work we like.

No. 39, by William Steel, is poor. He is more successful with his chisel than his pencil.—Thomas Drew has sent in the most wretched work in the room, No. 43.—The effect of the niches and statues in No. 44, by Henry Ringham, is not in our opinion favourable.—Mr. Samuel Pratt certainly makes the most favourable figure among the contributors. We have approved of his No. 9, and we must express approbation of his No. 45, though we could wish for something still better.

The carving, No. 46, by W. S. Williams, is bad. Stephen Prebble is the ingenious individual who introduces Lycurgus as a representative of English legislators, whether as a satire we know not. It is a pity he had not room for Draco. No. 49, by Benjamin Baker, is out of style. The effect of No. 51, by John Lees, is poor; so is that of No. 52, by W. S. Williams.

John Black has chancemedleyed the Hanoverian Sovereigns, Church and State, St. George and the Dragon, Fame, Britannia and Peace. This would have done for St. Paul's 30 years ago, but we hope such absurdities are now exploded.—James T. White has an idea still more exquisite, No. 54. His ornaments are portraits of members of the late and present ministry—we should suggest in addition those of the future ministry.—Peter Cummins has an ill-conceived collection of Swords of state, Stars and Garters, Coronets, Britannia, and Magna Charta.—No. 57, is also in the allegorical style, having Wisdom, Prince Albert, Virtue, Power, Magna Charta, and Moderation. Why is *Punch* left out?

The stained glass affords the next series of designs and specimens. We are sorry that we cannot speak most favourably of the specimens of painted glass exhibited, too many of them are smudgy. We should recommend Hay on colour to these gentlemen, as a useful study.—No. 58, by John Summers, is very bad.—No. 59, by Ward and Nixon, is in a purple key, and is well carried out.—C. E. Gwilt owns No. 60, which is in a crimson key. It is a good piece of colouring. No. 61, by Spence and Co., of Liverpool, is too confused, though the idea is good. No. 62, by Charles Clutterbuck, is a good work of its class. Daniel Higgins owns No. 63. The figures are bad, and the shields relating to Henry VIII. show want of research and poverty of idea.—No. 64, is seemingly unfinished.—Ballantine and Allan, of Edinburgh, have sent in No. 66, which shows much instruction and a laudable desire to produce a good work, but the colouring is patchy and the tone wants ensemble —No. 67, is a superior work, by Cobbett and Son, well carried out.—No. 68, is also a work of high class. It is by W. Warrington, and the general tone is well attended to.—The design by James Warrington, No. 69, is fair.—The design by Henry Pether, No. 70, shows a want of conception.—No. 71, by Edward Corbould and George Hoadley, has a good effect, but it opens the question whether pictures should be attempted on glass. The subject, though one of historical interest, conveys a national reflection, and should be avoided. It represents Edward I. entering Westminster after having vanquished the Welsh in 1282.—No. 72, by Edward Baillie, is good, though we doubt the effect of the medallions.—We are afraid No. 73, by Cobbett and Son, is too picturelike, while we certainly deprecate the compartment with Prince Albert in the robes of the Order of the Garter, introduced upon an equality with the sovereign. The battle of Bosworth and the triumph of the usurper Henry VII., is not quite complimentary to the legislative body.—No. 74, by J. A. Gibbs, is glittering, but no more.—The design, No. 75, by Messrs. Chance, Brothers, and Co., wants tone; and the introduction of bishops, warriors, judges, statesmen, Piety, Valour, Justice, &c., is in bad taste, as is the introduction of Prince Albert's arms, unless he is brought in as a member of the Commission of the Fine Arts.—No. 76, by Thomas Wilmshurst, has good drapery, but there is a want of ensemble in the composition.—No. 77, by John G. Crace, is not in colours, and is devoted to a religious subject offensive to the majority of the inhabitants of the English empire. A piece of stained glass we must notice is the introduction of Duke Ernest the Pious of Brunswick, ancestor of the Queen and Prince Albert, but having nothing to do, we presume, with the Houses of Lords and Commons.

Having gone through the stained glass, we come to numerous and varied specimens of decoration, the whole of which we cannot enumerate.

No. 78, is a very fine design, by Richard Popplewell Pullan, which we regret we cannot notice in detail. It shows much study, much labour, and a firm hand.—The frieze, by the same artist, No. 79, is very gorgeous.—No 81, by R. A. Harrison, in the style of the ninth century, is in a good tone.—Richard Prosser, C.E., of Birmingham, has realized the idea suggested by us just now; and in a design for ornamental pavement, No. 82, has represented the arms of the Commissioners of Fine Arts. We now beg to suggest those of Messrs. Grissell and Peto, the contractors, and Mr. Bellamy, housekeeper to the Commons. Another design for a pavement, No. 83, by J. Bowron, is poor and complicated.

In No. 85, designs for inlaid flooring, by Austin and Rammell; the material is good, but the design poor. The series of drawings, marked No. 89, by Owen Jones, are most laborious. One of them, a tremendous cartoon, exhibits a plan for all the pavements of the Palace. We do not, however, like the designs so well as many we have seen by Mr. Jones.

The materials proposed for the several pavements we regret we have not time now to notice.

Specimens of metal casting, by Messrs. Bramah and Co., are very fine.—Henry Pether has a design for a pavement, No. 92, very poor.—A similar design, by Thomas Jago, No. 93, is not well conceived.—The design for a cast iron gate, by Messrs. Paterson and Son, No. 94, is poor and out of style.—The specimens of iron and brass castings, by Messenger and Sons, exhibit a high degree of skill. We do not, however, think any castings here come up to the Berlin work.—Messrs. Elkington have shown some favonrable examples of electro-bronzing, gilding, &c.

The castings exhibited are too numerous for us to specify, but we may repeat we do not think they are so good as they might be.

The inlaid, tesselated and encaustic tiles of various kinds seem good as materials.

A number of specimens of fresco, encaustic, tempera, and various decorative paintings come next, by Crace, Simpson, Moxon, Sang, Collman, Bohn, &c. These are mostly in modern styles, and can only be regarded as specimens of manipulation and material if and not as designs appropriate to the Houses of Parliament. On the staircase are some good cartoons.

Next month we shall enter more fully into an examination of some of the articles, at which we have only just had time to take a rapid glance.

Several railways are to be opened in May. On the 1st, the Bricklayer's Arms branch to the Croydon and Dover Railway will be opened, also the extension of the Bristol and Exeter Railway, which will be completed the whole distance, forming a direct communication of 200 miles from London to Exeter; the Norwich and Yarmouth Railway, and the Liverpool and Derby junction line.

The disaster which lately occurred at the Bricklayer's Arms station of the Croydon and Dover railway, by the falling of the roof, was occasioned by too great exertions being made by the contractors in proceeding with the works, and laying the boarding and slating, before the framing was completely fixed. Although the iron work appears to be very light, the roof has been proved in the presence of General Pasley and others, to bear a breaking weight of 62lb. per foot super. double the pressure a roof is ever likely to be submitted to. Notwithstanding the extent of damage, the whole of the works of the station have been completed, and will be ready for the opening on the first of May; we hope in the next *Journal* to be able to give a drawing of the roof.

Newcastle-on-Tyne.—The church of the Hospital of St. Mary, Newcastle-on-Tyne, lately used as a grammar school, has been pulled down by order of the corporation. It was founded in the reign of Henry II., by Aselack of Killinghowe, or Killingworth. Brand, the historian, 1788, says, "The grand eastern window, now entirely built up, contained in its painted or stained glass an image of the Virgin Mary with her child on her knees, and that the present floor covered a pavement of Dutch tiles of different colours laid lozenge-wise. Mr. John Dobson, architect, prepared a fine plan for its complete restoration; the whole of the antiquity lovers are sore at the unaccountable and unwarrantable proceedings of the Council in pulling it down as it is not contemplated to erect any building upon the site.

Mr. Bain has had an opportunity of practically testing the capabilities of his electric printing telegraph, described by us in the *Journal* Vol. VI. pp 284 and 300. It has been fixed at the terminus of the South Western Railway at Nine Elms, and the station at Wimbledon, a distance of six miles, at each of these places is a similar apparatus, as shown at p. 300, and a communication formed between them by a single wire through which the electric fluid is conveyed. By the aid of the apparatus a printed correspondence may be kept up between the two stations.

The whole of the works of Trafalgar Square, excepting the steps round the Nelson column, are completed, and will be opened in course of a few days.

SEVERN STEAM BOILERS.

Sir,—I have had my attention only just called to your review in a recent number, of Mr. Macqueen's pamphlet on the subject of the Royal Mail Steam Packet Company, and from it I perceive that you have inadvertently been led to adopt that gentleman's unsupported and oft refuted statements, and in consequence to pursue a course of argument, in reference to the directors which, when acquainted with the facts, your sense of justice to all parties will induce you to withdraw. I allude particularly to the imputation of their having allowed boilers to be put into their ship *Severn*, the malconstruction of which caused that vessel to take fire. I have frequently denied and disproved not only her having caught fire from any fault of the boiler furnaces, *but her having caught fire at all*, that I am surprised at Mr. Macqueen's blind and pertinacious repetition of a purely malicious an invention. I have, however, no wish to make your columns the field of contention upon a subject, that in the opinion of all unbiassed readers of our correspondence, has long been set at rest, and therefore content myself with referring you to my letter upon this subject to Mr. Macqueen, in *Herapath's Railway Journal* of the 16th instant.

Relying on your impartiality, I am, Sir,

Your obedient Servant,
John Croome.

Bristol Iron Works,
March 29, 1844.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTE OF CIVIL ENGINEERS.

April 2.—The President in the chair.

The discussion on the subject of slips in cuttings and embankments of railways was renewed, and extended to such a length as to prevent any papers from being read. Some observations were made by Sir H. T. De la Beche, the Rev. Mr. Clutterbuck, and several members, on the geological features of the slips, whether occurring naturally in cliffs, as at the back of the Isle of Wight, or in the artificial cuttings of railways. It was contended, that, in both cases, the reduction of the lower and softer beds to the state of mud, by percolated water, rendered them incapable of bearing the weight of the superincumbent strata, and that the mass, when saturated, slid down by its own gravity; but that slips in railway work, were accelerated by the vibration caused by the passage of the trains. The vibration of the air from the discharge of a gun, had been known to cause an avalanche; and the cases were almost analogous. More attention both to surface and bottom drainage of the slopes was much insisted upon; and it was urged, that the back drains, so close to the top of the cuttings, were prejudicial; that in the dry season the bottoms cracked, the rain found its way through, and it had been frequently noticed that the slips commenced at a few feet below the level of these drains. The dry shafts which had been sunk in the slopes of the Eastern Counties Railway, by Mr. Braithwaite, with the concurrence of Sir H. T. De la Beche, were instanced as successful in rendering wet and treacherous strata comparatively dry and secure. A section was exhibited of the embankment at Hanwell, on the Great Western Railway; this embankment, which was of gravel, was 54 feet high; it was laid in a marshy valley traversed by the river Brent; the London clay, upon which it was laid, inclined towards the river, and at one of the numerous fissures with which that stratum abounds, a subsidence occurred squeezing up at the same time on the lower side to as great an extent as the embankment sunk, which was stated to be nearly as much in one year as the entire mass of the embankment. This subsidence was stopped by loading the foot of the slope, and thus restoring equilibrium, and it was stated to be at present quite secure. It was urged that, in the earthwork of canals, where there was no vibration, the slips generally occurred in the first few months after the formation of the embankments; but that, on railways, they occurred quite as frequently after the lapse of several years. It appeared, therefore, that much was due to vibration.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

April 15.—W. Tite, V.P., in the Chair.

A paper was read by [illegible]ley, the Honorary Secretary, giving "*An analysis of a Work o[illegible] Pr[illegible]*' [illegible]esented to the Institute by M. G. Abel Blouet, of Paris. The con[illegible]deration of the subject of Penitentiaries having of late occupied the public mind in France, the Government, in 1836, commissioned M. de Beaumont and M. de Tocqueville to proceed to America, for the purpose of inquiring into the general working of the Penitentiary system in that country, who on their return made a report which met with a favourable reception by the public. Subsequently, the Minister of the Interior commissioned M. Demetz to visit America, to make himself acquainted with the moral results, obtained in the United States, from the system, since the visit of M. de Beaumont and M. de Tocqueville, and M. Blouet accompanied him, charged to study the architectural part of the question, that is to say, the advantages or inconvenicnces of the arrangement of the Principal American Penitentiaries; their condition with respect to discipline, and more especially with reference to the expense incurred in their construction; with a view to the ultimate adoption of a modified general system throughout France for such structures. M. Blouet subsequently visited England, Switzerland, Rome, and most of the departmental prisons in France. It is well known that in America there are two different systems in operation, known respectively as that of Auburn and that of Philadelphia. M. Blouet gave at considerable length his reasons for preferring the last-mentioned system, and combatted the objections that have been made to it. The design particularly described, and illustrated with drawings, was the result of M. Blouet's studies for a prison with solitary confinement, by means of spacious cells, for 585 prisoners, (in his opinion the maximum number of the population of a prison,) with the requisite offices and appurtenances, houses for the governor, inspector, chaplains, and other inferior officers, together with yards for exercise, &c., wherein the prisoners are constantly under the supervision of the governor and turnkeys, and so arranged as to afford the means of walking one hour in the day to each prisoner. From a central inspection station, the governor has a view of all the doors of the cells, the galleries, the turnkeys' rooms, yards, and indeed all the points where he may wish to exercise a supervision.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM MARCH 30, TO APRIL 24, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

John Robert Dicksee, of Old Compton Street, Soho Square, artist, for "Improvements in the manufacture of mosaics."—March 30.

William Crosskill, of the Iron Works, Beverley, for "Improvements in machinery for making wheels for carriages."—March 30.

Henry Clayton, of Upper Park Place, Dorset Square, Regent's Park, plumber and machinist, for "Improvements in the manufacture of tiles, drain pipes, or tubes and bricks."—March 30.

John Biggs, of the borough of Leicester, manufacturer, and Richard Harris, the younger, of Leicester, aforesaid, manufacturer, for "Improvements in the manufacture of looped, woven, and elastic fabrics."—March 30.

Leonard Bostwick, of Fen Court, Fenchurch Street, London, merchant, for "Certain improvements in machinery or apparatus for sewing all kinds of cloth or other materials."—April 2.

William Stace, of Berwick, Sussex, farmer, and Philip Vallance, of the same place, farmer, for "Improvements in applying power for drawing or working ploughs and other implements and carriages used for agricultural purposes."—April 2.

John Parsons, of Selwood Terrace, Brompton, gentleman, for "Certain improvements in machinery or apparatus for cleansing or sweeping chimneys and flues."—April 2.

James Murdoch, of Staple's Inn, London, mechanical draughtsman, for "Certain improved apparatus and processes for preparing the Phormium tenax, or New Zealand flax, so as to render it applicable to various useful purposes." (Being a communication.)—April 2.

Frederick Brown, of Luton, Bedford, ironmonger, for "Improvements in stoves."—April 10.

James Murray, of Garnkirk Coal Company, Scotland, for "A new method of using and applying artificial gas made from coal, oil, or other substances, for lighting and ventilating caverns, pits, or mines, or other pits where minerals or metals are worked or extracted."—April 10; four months.

Richard Barber, of Hotel Street, Leicester, confectioner, for "Improvements in apparatus for giving quick rotary motion to mops and such like instruments."—April 10.

John Aitken, of Surrey Square, for "Improvements in water machines, or engines and steam-engines, and the mode of traction on, or in canals or other waters or ways."—April 10.

George William Lenox, and John Jones, of Billiter Square, London, merchants for "Improvements in the manufacture of sheaves and shells for blocks, and of bolt rings or washers, for the purposes of shipwrights and engineers."—April 10.

James Kennedy, of the firm of Bury, Curtis, and Kennedy, of Liverpool, engineer, and Thomas Vernon, of the same place, iron ship-builder, for "Certain improvements in the building or construction of iron and other vessels for navigation on water"—April 15.

John Lawson, of Leeds, engineer, and Thomas Robinson, of the same place, flax-dresser, for "Certain improvements in machinery for heckling, dressing, combing, and cleaning flax, wool, silk, and other fibrous substances."—April 16.

Edgar Heale, of Brixton, gentleman, for "Certain improvements in the construction of carriages for the conveyance of passengers on roads and railways."—April 18.

Donald Grant, of Greenwich, esq., for "Improvements applicable to the ventilation of apartments in which gas and other combustible matters are consumed by ignition."—April 18.

John Bailey Denton, of Gray's Inn Square, land-agent, for "Improvements in machinery for moulding or shaping clay and other plastic substances, for draining and other purposes."—April 18.

James Murdoch, of Staple's Inn, mechanical draughtsman and civil engineer, for "Certain improvements in the construction of vessels for holding aërated liquids, and in the means for introducing such liquids into the said vessels, and retaining them therein." (Being a communication.)—April 18.

John Smith, of Bradford, York, worsted spinner, for "Improvements in machinery for tentering and stretching cloths or fabrics."—April 18.

Richard Roberts, of the Globe Works, Manchester, engineer, for "Certain improvements in machinery or apparatus, for the preparation of cotton and wool, and also for spinning and doubling cotton, silk, wool, and other fibrous substances."—April 18.

Joseph Woods, of Barge Yard Chambers, Bucklersbury, gentleman, for "Improvements in regulating the power and velocity of machines for communicating power." (Being a communication.)—April 18.

William Hodson, of New King Street, Kingston-upon-Hull, estate agent, for a machine for "Making and compressing bricks, tiles, square pavers, and ornamental bricks."—April 18.

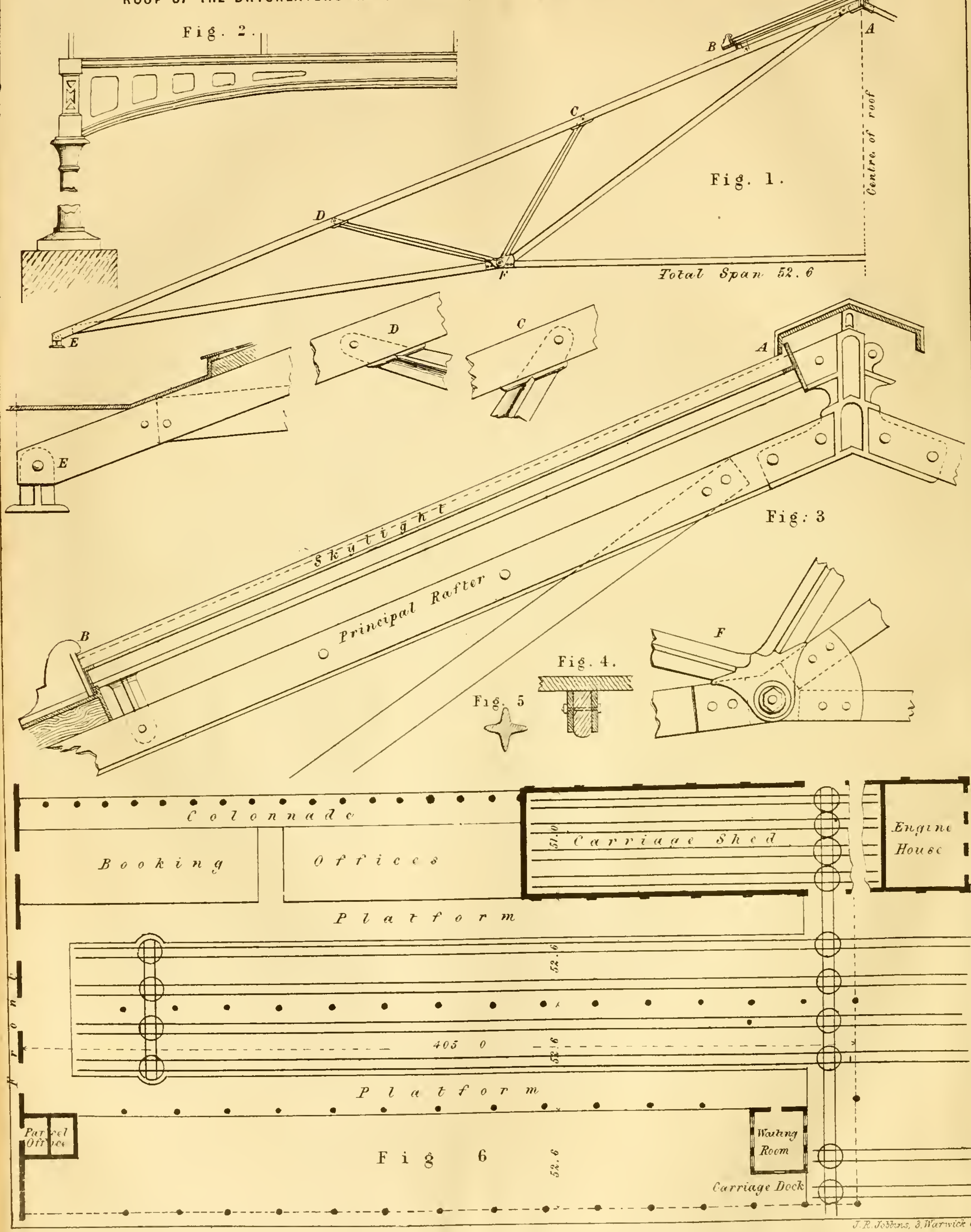
Henry Frearson, of Arno Vale, Nottingham, lace manufacturer, for "Improvements in the manufacture of warp fabrics."—April 23.

Peter Lear, of Boston, Suffolk, of the State of Massachusetts, America, gentleman, for "Certain new and useful improvements in machinery for propelling vessels through the water."—April 23.

William Taylor, of Birmingham, door spring manufacturer, for "Improvements in the manufacture of axle pulleys, and in pegs or pins for hanging hats or other garments."—April 24.

René Allaire, of Charlotte Street, Fitzroy Square, dyer and cleaner, for "Improvements in cleansing gentlemen's garments."—April 24.

ROOF OF THE BRICKLAYERS ARMS STATION, DOVOR & CROYDON RAILWAY.



J. R. Jobbins, 3, Warwick Ct.

THE IRON ROOF

AT THE BRICKLAYERS ARMS' STATION OF THE DOVER AND CROYDON RAILWAYS.

(With an Engraving, Plate VII.)

REFERENCE TO THE ENGRAVING.

Fig. 1. Section of roof; and Fig. 2. Girders or bearers, both figures drawn to a scale of ¼ in. to 1 ft. Fig. 3. Parts at large, drawn to a scale of 1½ in. to the foot. A, King head, with ridge piece over. A B, Skylight. B, Flashing piece foot of skylights. C and D, Abutments of stays at the principal. E, Foot of principals, with half of a gutter, and a shoe. F, Abutment plate of stays, showing the connexion of the feet of the two stays and the tie rods. Fig. 4. Section of principal rafter. Fig. 5, Section of stays, D F, and C F. Fig. 6. Plan of station.

In our last month's number we mentioned that, notwithstanding the accident, which had destroyed a considerable portion of the roofs of the sheds, that the station would be opened on the 1st of May, the day appointed; this was realized, by the spirited exertions of the subcontractors for the roofs, Messrs. Fox, Henderson and Co., of the London works, Birmingham, and the indefatigable energy of Messrs. Grissell and Peto, the contractors for the whole of the works of the station.

In the annexed plate fig. 6 is a plan of the station which sufficiently explains the general arrangement. The arrival shed is paved with wood and the platforms laid with the Seyssel Asphalte in a very superior manner; the Colonnade columns are of the Tuscan order, and support a heavy entablature, the roof over the booking offices is covered with large Italian tiles, and the front of the building is in the Italian style with massive iron gates in each of the openings opposite the ends of the rails. The roofs which cover the arrival and departure platforms, rails, and carriage shed, extend in length 405 ft. by 157 ft. 6 in. wide. The space is formed into 3 divisions with iron roofs spanning each which it is our present object to explain.

The roofs are of a remarkably light construction, but by a judicious distribution of the material; they have been found, upon actual experiment hereafter reported, to be of ample strength. Fig. 1 shows the framing of the roof, one half of one span is only shown as the other half is but a repetition, the total span is 52 ft. 6 in., and the rise above the springing at E, is 11 ft. and above the centre horizontal tie bar 9 ft., the framing of the principals or trusses shown in fig. 1 are placed 6 ft. 4 in. apart from centre to centre without any intervening rafters, the covering as will be presently explained is laid upon this framing. There are 195 pair of principals; each may be divided into five distinct members. (1) The two rafters A E; (2) the two outer tie bars, E F; (3) the central tie bar, F F; (4) the two suspension bars, F A; and (5) the four struts, F D and F C. The rafters are composed of two wrought-iron bars A E, each the whole length of one side of the roof, and are 2¾ inches deep by $\frac{5}{16}$ thick; between these two bars, a flitch of deal 3 in. deep by 1⅝ thick (four pieces are got out of a 2½ inch batten) which projects below the iron work and forms a bead as shown in fig. 4, these iron bars and deal are bolted together with iron bolts 15 inches apart; the deal not only stiffens the rafters, but affords a nail hold for securing the boarding, the rafters abut at the top on to a cast iron king head as shown at large at A, fig. 3, and at the foot they abut on iron shoes to which they are bolted as shown at E., these shoes are merely bedded on the wall or girders and are not in any way bolted down, this allows for the free expansion of the metal. The suspension bars A F, and central tie bar F F, are of wrought iron 2 inches deep by ⅜ thick, and the outer tie bar is 3 in. deep by ⅜ thick; the struts C F and D F, are of cast iron 5 ft. 6½ long of a section as shown in fig. 5, three inches diameter in the centre, and two inches diameter at the ends, the ends of the bars it will be seen by reference to fig. 3, A, C, D, and E., pass in between the two iron bars of the rafters, and are there rivetted together by ⅝ rivets; the ends of the two tie bars at F, and the suspension bar are first secured by means of wrought iron cheeks with two ⅝ and ½ inch rivets to each end as shown at F, and over these is a cast iron abutment piece which clips the wrought iron cheeks, and allows the ends of the two cast iron struts to pass between; a ¾ inch nut and screw bolt is then passed through the eyes and secures the whole together; it should be here observed that these struts together with the abutment pieces, are all made alike so that it makes no difference whether the diagonal struts be for either the right or left hand abutments—at the top and under the skylights, there are ⅝ wrought iron stay bolts between each pair of rafters which cross each other, and give great stiffness to that part of the roof.

Between each pair of principals is a skylight, 6 ft. 3 in. wide and 4 ft. 2 in. long, of cast iron, A B, Fig. 3, the bars are 2 in. deep and 1 in. wide, across two rabbets, and between each skylight is a cast iron gutter 2½ in. wide and 2½ in. high; the top of this gutter is secured by a bolt to the king heads, and at the foot by an iron stud bolted to the principal: on each side of the skylights there is a rabbet cast which turns down into the gutter just described, and at the foot are cast iron flashing pieces, which are overlapped at the top edge by the skylight. Over the top of the skylights is a ridge piece, of cast iron, as shown at A, in length of about 5 ft.; each end has a fillet cast on the top, these ridge pieces leave a space between the ends, over which is fitted a cast iron ridge capping with a fillet on the underside of the ends so as to clip over the fillets cast on the ends of the ridge pieces, and in the centre is a boss with an eye which passes over the end of a bolt eye cast on the top of the iron king heads, and there secured by means of a key passing through the eyes as shown at A fig. 3.

By a little attention to the description of the construction, it will be seen that although the parts are put together with great simplicity, considerable judgment has been bestowed upon them to allow for the free expansion and contraction of the metals, and at the same time to give stiffness to the several parts.

The covering of the roof consists of 1⅛ inch boarding, (out of one-cut battens,) planed, grooved, and tongued with hoop iron, and nailed down to the principal rafters; they are laid longitudinally, and are stiffened by plates of fender iron 4 in. wide by $\frac{3}{16}$ths. nailed on the top of the boarding in a diagonal direction: the external covering is of queen's slating; the gutters between the roofs at the eaves are of cast iron, as shown at E, the joints of which are secured with iron cement. The feet of the principals, as we before stated, are secured to iron shoes, which are of various forms, either for bedding on the walls or the iron girders. The roof is supported on cast iron girders, as shown in Fig. 2, of an elliptical form; the centre is 12½ in. deep, and the ends 2 ft. 8 in.; they are let into grooves in the standards over the iron columns, and there secured longitudinally by iron bolts. The distance between the columns is 25 ft. 4 in. from centre to centre; the standards above the columns are 6¾ in. square in the middle and 8 in. square at the base and top, and are 2 ft. 8 in. high; they are let into a socket cast on the top of the column. The columns are 13 ft. high and 6½ in. diameter at top, and 8 in. at bottom: they stand on iron bases 2 ft. square and 4 in. thick, bedded on brick piers 3 ft. square, taken in all cases down to the gravel; 12 columns are cast hollow and form pipes to convey the water from the gutter to the drain.

The carriage shed and engine house have a similar roof, as just described, excepting that they are not covered with boarding, consequently there is no flitch of deal between the wrought iron bars of the principals, but they are kept apart by small pieces of cast iron, and a rivet passes through it and both bars; the slates are laid on iron laths 1 in. deep by ½ in., placed edgeways. Instead of the skylights over the engine house being laid on the principals they are elevated 2 ft. to allow for the free escape of the smoke and steam from the engines.

The experiment.—In order to prove that the accident occasioned by the falling of the roof was not in the slightest degree caused by defective construction, the contractors ordered two principals to be framed and boarded, and so placed that railway bars could be turned from an overhanging scaffolding placed on the other side of the wall near which the experimental rafters were placed; the bars were then gradually lowered so as to evenly load one of the two principals until the load was equal to 40 lb. upon the square foot, that being double the load intended to be carried by the roof in question; the principals were then left for 24 hours for the inspection of the Inspector General of Railways (General Pasley) and other gentlemen interested, when their ultimate strength was to be tested; which was done on the 16th of April, in the presence of General Pasley, Messrs. J. and L. Cubitt, Messrs. Grissell and Peto, Mr. Ranger, Mr. Fox and other gentlemen connected with the railway; the same plan of lowering the bars was adopted, and they were loaded until the weight of 65 lb. per square foot broke the cast iron king head, the wrought iron rafter then buckled, but did not sustain the slightest fracture. Every one present expressed the greatest satisfaction at the result of the experiment which fully carried out the statements of the contractors, respecting the sufficiency of the roof.

Engineering Honours.—It is with great satisfaction we have to announce another engineer, Dr. MacNeil, has been honoured by a knighthood, there is not a member in the profession who is more respected than Sir John MacNeil, and we feel assured it will be a great gratification to the profession generally. We have long since advocated for honours being granted to the Engineering Profession, and it now affords us much pleasure to see that our desires are being gradually fulfilled.

TO FIND THE MAGNITUDE AND FIGURE OF THE EARTH, WITH THE ASSISTANCE OF RAILWAYS;

Without presupposing it to be any particular form.[1]

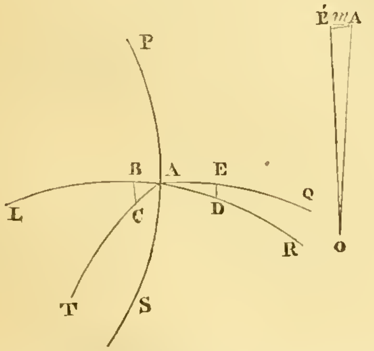
By OLIVER BYRNE, Mathematician, &c.

To find the length of a degree in any position on the surface of the earth, with the assistance of railroads, presents no obstacle whatever to the mathematician.

In England, America, and on the Continent, there are at present a considerable number of railroads long enough for the purpose, so that we can have a sufficient number of examples. The lengths, bearings, elevations, and depressions, &c., of the several planes which compose each railroad, may be had from different companies or their respective engineers, and if the dimensions thus obtained, are not considered accurate enough, they can be easily taken over again. When this information is acquired, the length of the arc on the surface of the earth between any two given points in the line of road may be very readily determined, on account of the approximant of the general line of most railroads to levelness. By astronomical observations the latitudes of both ends of the road, or any point in it may be determined, and also the length of a degree upon any arc passing through either extremity, and a point in the line of road; as the bearings and length of such arc can always be found.

Then supposing a railroad selected of such a length, that from a point in it the length of a degree is known on the arc passing through that point and the beginning of the road, and also that of a degree on the arc passing through the said point and the termination of the road, and the arcs to be oblique; or it will answer the purpose as well to have two roads in the same latitude or nearly so, such that the length of a degree on the arc passing through the extremities of each is ascertained; from which it is required to find the length of a degree on the meridian, and also that of a degree on an arc perpendicular to it, at the same point.

This may be done as follows:—



Let L A R be an arc of the meridian, S A P an arc of the curve at right angles to it, A T one of the arcs upon which the length of a degree is known $=$ L; and A Q the other upon which the length of a degree $= l$; also, let the bearings of these arcs, or the angles L A T and Q A R, which are known $= a$ and b respectively; again, let $g = 57°{\cdot}295779,5$ the arc equal in length to the radius, therefore the radius of curvature at A in the arc A T $=$ Lg; and that at A in A Q $= lg$. To find the radius of curvature of the arcs R A L and S A P, let the radius of curvature of the meridian at A $= x$, and that of its perpendicular or of the arch S A P at the point A $= y$. Take A C, an indefinitely small portion of A T $= s$, and A E, an indefinitely small portion of A Q $= s'$.

Then A B $= s$ cos. a, and B C $= s$ sin. a, as A C is supposed to be indefinitely small.

Now from the nature of the osculating circle at A, in the arc R A L, the distance of the point B from the horizontal plane passing through A,

$$\text{is } \frac{s^2 \cos.^2 a}{x}:$$

for A′ B′, fig. 2, stands in the same position as A B, fig. 1, and may be considered as a perpendicular from the right angle at A or A′, falling between radius of curvature O B, and the depression m B′ of the point B′ below A′, or that of B below the horizontal plane passing through A; and the depression of C below B is $= \dfrac{s^2 \sin.^2 a}{y}$, for the radius of curvature of the arc B C is ultimately the same with that of S A P at the point A, the total depression of C below A is equal,

$$\frac{s^2 \cos.^2 a}{x} + \frac{s^2 \sin.^2 a}{y} = s^2 \left(\frac{\cos.^2 a}{x} + \frac{\sin.^2 a}{y} \right).$$

Again, by the property of the circle above quoted,

$\dfrac{s^2}{s^2 \left(\dfrac{\cos.^2 a}{x} + \dfrac{\sin.^2 a}{y} \right)} =$ the radius of curvature of the arc A T, at the point A $=$ Lg;

$$\therefore \text{L}g = \frac{1}{\left(\dfrac{\cos.^2 a}{x} + \dfrac{\sin.^2 a}{y} \right)} = \frac{x y}{y \cos.^2 a + x \cos.^2 a} \ldots \quad (1.)$$

By the same process of reasoning, we find,

$$\frac{x y}{y \cos.^2 h + x \sin.^2 h} = l g \quad (2.)$$

In (1) and (2) for the sine and cosine of a, substitute s, and c respectively; and s' and c' for the sine and cosine of h; let L$g = r'$, and $l g = r'$. Then equations (1) and (2) become

$$\frac{x y}{y c^2 + x s^2} = r \quad (3.)$$

$$\text{and} \quad \frac{x y}{y' c^2 + x' s^2} = r' \quad (4.)$$

$$y = \frac{r s^2 x}{x - r c^2} \text{ from (3)} \qquad y = \frac{r' s'^2 x}{x - r' c'^2} \text{ from (4)}$$

$$\therefore \quad \frac{r s^2 x}{x - r c^2} = \frac{r' s'^2 x}{x - r' c'^2}, \text{ hence we find}$$

$$x = \frac{s^2 c'^2 - c^2 s'^2}{r s^2 - r' s'^2} \times r r' \text{ and } y = \frac{s'^2 c^3 - c'^2 s^2}{r c^2 - r' c'^2} \times r r.$$

By restoring the values of r and r', we have

$x = \dfrac{s^2 c'^2 - c^2 s'^2}{\text{L} s^2 - l s'^2} \times \text{L} l g$, and $y = \dfrac{'s^2 c^2 - c'^2 s^2}{\text{L} c^2 - l c'^2} \times \text{L} l g$, the radius of curvature of the meridian, and that of the arc perpendicular to it at the point A.

$\dfrac{x}{g} =$ length of a degree on the meridian $= \dfrac{s' c'^2 - s'^2 c^2}{\text{L} s^2 - l s'^2} \times \text{L} l.$

$\dfrac{y}{g} =$ length of degree on arc perpendicular $= \dfrac{s'^2 c^2 - c'^2 s^2}{\text{L} c^2 - l c'^2} \times \text{L} l.$

By restoring the values of s, s', c, c', we have

$\dfrac{\sin.^2 a \cos.^2 h - \sin.^2 h \cos.^2 a}{\text{L} \sin.^2 a - l \sin.^2 h} \times \text{L} l, =$ the length of a degree on the meridian: and, $\dfrac{\text{in}.^2 h \cos.^2 a - \cos.^2 h \sin.^2 a}{\text{L} \cos.^2 a - l \cos.^2 h} \times \text{L} l =$ the length of a degree on an arc perpendicular to the meridian at the point A.

By the help of this problem the true figure of the earth, with very little trouble, might be ascertained, as we are not obliged to imagine the earth to be any known form, because be it of whatever form it may, the planes which compose a line of railroad must be in its surface or very nearly so: nor is it very hard to find a degree or more of road in the same direction.

[1] This articles is extracted from Mr. Byrne's extensive unpublished work, entitled, 'A New Theory of the Heavens and Earth."

AN EXPLOSION OF SUBTERRANEOUS WATER took place lately in the district of Vizeu, in Portugal, by which the soil was torn up, and earth and atones flung to a great height into the air, for the distance of more than a league, between the small river Oleirns and the Douro. All the cultivated land over which the water flowed waa destroyed, and in many places it created ravines forty feet in depth, and thirty fathoms wide. It carried away and shattered to fragments in its course, which was of extreme rapidity, no fewer than fifty wind and water mills, choked the Douro with rubbish, and caused the death of nine persons, including one entire family. On the same day a similar explosion took place in the mountain of Marcelim, in the same district, arising from the same source, but branching off in the direction of the river Bastanza. It carried away a farm-house, four cows, and some sheep and goats. A similar occurrence took place here last year and the year before, and 18 months since in Madeira.—Times.

ALTAR-SCREENS.

(From the Ecclesiologist.)

There are two ways of ornamenting the Eastern wall of a Chancel, which we had not space enough to mention when arguing in our last number against the admission of stone or wooden Altar-screens in a parish church.

First, there is ample authority for hangings of costly materials and suitable colour.

There can be little doubt that this was a very common way of relieving the plainness and ugliness of plaistered walls: the use of tapestry and embroidered work is mentioned repeatedly both before and after [1] the Reformation. Many of our readers will remember, that a hanging of crimson is at this day to be seen behind the Altar in Jesus College Chapel: would that the present state of that beautiful structure could be quoted, for any other particular, with approbation by the *Ecclesiologist.* Hangings are in use also in Merton College chapel, Oxford. It is obvious how simple and inoffensive this plan would be; a rich effect of colour will be obtained without any solecism; shall we add as an additional advantage, at a trifling cost? The chief excellence, however, of such a plan is, that it is but temporary; it inflicts no permanent blemish or absurdity on the church. The hangings, easily varied or renewed, will be always rich and in keeping; and can at any moment give place to a more correct (if it may be) or a more substantial method of decoration.

We have before had occasion to observe, that at present our wish to restore has gone beyond our knowledge: as was remarked in a paper read before the Society at its last meeting, the restorations of the nineteenth century may be classed with the sacrilege and indifference of the preceding, as scarcely less dangerous to the consistency and original beauty of our ancient churches. To connect this with our present subject. We doubt if there is anything so hard to design as a screen. Assuming the usual axioms of reality and the like, we believe that many *ancient* and universally admired screens will be found faulty when tried by such canons. And this is the place for another caution; staunch as we are for adhering to precedent, bigoted as we are called in our admiration of ancient works, we protest strongly against being supposed to admire irrationally and indiscriminately all that is clearly original or even of the pure period. We believe, indeed, that in perhaps all exceptions and anomalies of the old church-builders, some great genius, some counteracting and preponderating principle, something even to be admired will be found. But in the attempt to revive ancient architecture, we have no safe course but to find out by induction some (at least) general rules, and to lay down some general principles: by which we must try our own attempts at imitation; by which, should they be confirmed by use and experience, we may test the truthfulness and excellence even of the ancient remains themselves. It will therefore be of small use to bring forward a solitary example of a detail or arrangement as authority for its imitation. Is it right according to canons which have been carefully drawn up, and are as yet undisputed? Is it defensible upon the principles which we believe to be the life of ancient art? If not, it is no more to be followed than any exception in the Æneid, however striking or beautiful, is allowed to be parodied in a school-boy's copy of verses. But if even ancient screens, in particular, may be thus criticized, it is easy to infer the great difficulty of designing modern specimens; a difficulty much increased by our unwillingness to introduce, or our ignorance in executing, the fair imagery which is necessary to the proper effect of a stone reredos. Can anything be more absurd than to make deep niches, with canopies complete, to hold a brass plate engraved with the Commandments? It were even more sensible to enniche the officiating clergy, as we mentioned in our last paper. We would refer to the expensive stucco reredos lately placed in Holy Trinity church, Brompton, as peculiarly open to such objections of principle. For a failure in stone parclose screens, take that of the choir at Canterbury. Until then we know more about designing in this branch, what is more reasonable than to adopt the temporary arrangement of tapestry and hangings?

We next come to the consideration of pictures, as "Altar-pieces." We premise by expressing our own great preference of fresco or distemper-work for the decoration of churches to the use of paintings on canvass. The latter are almost always incongruous, and often become, by their unwieldy size and frames, rather eyesores than ornaments. What, for instance, can be worse than the setting of the Altar-piece in St. John's College chapel; or the huge picture of St. Michael, with its cumbersome pagan frame-work in the Trinity College chapel? But where there is no other reredos, and where the church has an oil-painting, we wish strongly to recommend the re-introduction of triptychs. A triptych will always give a fitting dignity to an Altar, and besides keeping the size of the picture within bounds, provides it with a suitable frame. An ancient example is preserved at St. Cross's hospital, though now removed to the Hall.

Triptychs are still to be seen in two churches in Worcestershire. One advantage consequent on the revival of triptychs, would be the cultivation af a severe school of painting. Far less money than is expended on many showy screens, would procure a good devout picture, the leaves of the triptych, in ordinary cases, being simply diapered. A demand for ecclesiastical painting would soon command a supply. And if such encouragement did not find out some English disciples of Overbeck, (though there is little doubt of this in the present improved state of feeling,) what should hinder that foreign artists of the new Catholick school should supply us with what we want? How simply by means of a triptych and hangings, could the barest East end be made not decent merely, but rich and dignified. The triptych will stand behind the Altar, forming alone a sufficient background; on each side, hangings, plain or embroidered, from a moderate height, will hide the rough wall, with no disguise, and add beauty and colour to the whole.

Connected with this is the consideration of fresco or distemper painting as applied to internal walls. We are persuaded that decorative colour will ultimately win its way even with the most obstinate. It is sincerely to be hoped that the example may be soon and well set. Take the worst East end, which the removal of a revived-Pagan framework has left bare and rough: why not make this good and richly paint it? Thus you avoid solecisms, you make a really substantial restoration, you gain a beautiful coloured enrichment, you encourage one of the noblest of arts. What might not be hoped for, if the Church would once again make Painting her handmaid? Instead of the "portraits" of the "Exhibition," we should have a national school of art working for the holiest of services; and perhaps (it may be) rivalling those English painters, who in 1350, under Hugh of St. Alban's, made St. Stephen's chapel in Westminster, the glory not only of England but of Christendom itself.

There is another point upon which we wish to offer a few remarks. Much difficulty has been felt by church-builders and restorers respecting that part of the 82nd canon, which enjoins "that the Ten Commandments be set up on the East end of every church and chapel where the people may best see and read the same." Let us confess at once that we believe this injunction to have lost its meaning and force; yet at the same time let us boldly declare that we have no wish to evade, on our own responsibility, what may be shewn to be its real obligation. The difficulty is to know what is really enjoined. There are indeed many at this time, who, despising the one hundred and forty other canons, are forward in putting forth the claims of part of this one. For ourselves, we merely intend to suggest some considerations, which may help to explain this ordinance, and hasten on perhaps the adjustment of what is certainly a difficult question. What we chiefly, however, wish to shew is, the impropriety of niches, or any permanent construction, *behind the Altar*, to receive the tablets.

Firstly. This is the *only* place where the arrangement is ordered. It is an incidental detail, rather than part of a system. It is not reconcilable with what we know was the usual treatment of the East end at that time. It is not ordered (we believe) either in the Irish or Scotch canons.

Secondly. It is doubtful what part of the church is meant—whether the East end of the Chancel or the Nave. 'Church' has often been interpreted to mean the Nave, as distinguished from the Chancel; which latter is a technical name recognized in the rubrick. Now, if the Chancel were meant, the object of the injunction is defeated; for how can "the people best see and read the same" when they are excluded—as there is ample evidence our Church intended them to be—from the Chancel, and are kept off by the Rood-screen some thirty or forty feet from the Tables? If the Nave be meant, then there is not the shadow of an excuse for placing them behind the Altar, or for spoiling reredoses in order to admit them. Again, if the Nave be meant, where is its East end? It can only be above the Chancel-arch; so high, in most cases, as to be out of people's sight.

Thirdly. Is it not reasonable to suppose that this order was meant only to be temporary; like others of the canons, such as those relating to preachers, to canonical dress, &c.? For *now* almost every poor man that can read—and if he cannot read what is the use of painting up the Commandments for him?—has his Prayer-book: so that, to re-enact the Canon, with the practical reason there assigned, would be absurd; as if now, when Bibles are so common, we should still chain a large Bible in the church for publick reading.

Fourthly. If we set them up in obedience to the canon, it is clearly

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[1] We may refer to the "Hierurgia Anglicana" for a copious and interesting collection of extracts in proof of this assertion.

necessary to write them in plain Roman type, "that the people may best see and read them." To use the extraordinary alphabets in which we now so often see them, illegible black letter rendered ingeniously still more illegible by rubrications and flourishes innumerable, is a mockery. We may observe also that it is not easy to see how people should be able to read Roman type, when set up over the Altar; since the Altar itself, and in most cases the rails, must hinder a sufficiently near approach; in cases even where the Chancel itself is accessible.

Fifthly. There is no rule *how* they are to be set up; so that there can be no excuse for making niches to receive them a part of the *construction*. But Archbishop Grindal and Bishop Cox recommend them to be "written on fair sheets of paper, and pinned up against the *hangings* of the East end." If the canon may be thus complied with, the stone tablet system becomes still less excusable.

Sixthly. Our own belief on the subject is that the Commandments were intended to supply the blank left by the demolition of the Great Rood. In all probability the head of the arch above the Rood-loft was often, however bad this arrangement certainly would have been, blocked up. The ancient painting of the Doom still preserved in St. Michael's, St. Alban's, was *originally* in this position. So in Bettws Newydd, where the Cross remains, and in Llangwm Ucha, Monmouthshire, the head of the arch is panelled up. Now something was wanted to supply the place of the defaced Rood or Doom; and thus we believe the Commandments came to be set up. This, be it remembered, would be at the East end of the church (Nave), and would be within sight of the people both from position and height. But we should scarcely defend the boarding up of the head of the Chancel arch, either as a point of taste or expediency. This plan really would seem to shut the Chancel off from the Nave, which is never the effect of the Rood-screen, however high. In short, the boarding remaining, the Communion-service must still be read from the reading-pue; as was almost universally the case a short time since. At any rate, if we block the heads of our Chancel-arches for the Commandments, we must have the service intoned again: or the people may read the Commandments, but will not hear them from the Altar.

Seventhly. Confirmatory of the last theory is the fact, that the oldest tables of Commandments are found blocking the head of the Chancel-arch and not at the Altar. For instance, a very early example is so found at St. Margaret's at Cliffe, near Dover. Indeed it is little known how few examples of any antiquity are to be found at the Altar. In looking through twenty-five church-schemes from different counties, in which the article "Commandments" is filled up, the writer finds twenty in other positions, of which nine cases are over the Chancel-arch. In one, St. Mary's, Lambeth, an old copy exists in this situation, and a more modern copy at the Altar—a significant fact. Two of these churches have *none*: in five they are north and south of the Nave; in one, north and south of Chancel; in one, north and south of Chancel-aisle: in one, north of north Transept; in the last, *west* of Nave. So much for uniformity in the interpretation of the canon. It is well known indeed that many churches, and particularly cathedrals and college chapels, never had them; also that in many they have disappeared without question; and that many new churches have been consecrated without them.

Eighthly. It is remarkable that in any early pictures, known to the writer, *e.g.* the curious engraving given by Mr. Markland of the desecration of a church by the Puritans, the Commandments are not represented as over the Altar: in the case referred to, indeed, there is a triptych. On the other hand, Mede (folio, 1677, note, p. 396) interprets the canon to mean "over the Communion-table," but seems to wonder at the Injunction. Finally, for the setting up of the Creed and Lord's Prayer there is no authority whatever.

In conclusion, were we called upon to suggest a course to church-builders to whom this subject presented a difficulty, we should recommend that the case be submitted to the Ordinary. We can scarcely believe that the canon would be enforced, or at least be ruled to mean the East end of the *Chancel*. In either case the Ordinary would probably sanction the distempering the Commandments in scrolls upon the wall: thus making no construction necessary for them, and allowing them to bear a part in the decorative colouring of the building.

ATMOSPHERIC RAILWAY SYSTEM.—Herr Sichrowsky, Secretary of the Emperor Ferdinand Railway, who was last year in Ireland studying the atmospheric system, has just obtained a grant for the execution of a railway on that system, uniting Vienna with the beautiful palace and gardens of Schoenbrunn, the Windsor of that locality. It will follow the banks of the river Wien, on which are a number of large commercial establishments, and which route during the summer is much frequented by the holiday folks. The distance is five miles, and the estimate, including seven stationary engines, is 2,000,000 florins (£200,000), in 200 shares of 10,000 florins (£1000) each, and which were subscribed in 36 hours.

FOREIGN QUACKERY AND BRITISH CREDULITY.

It appears that in so far as decorative Art is concerned, the people of England are destined in all ages to be the dupes of Foreign quacks and quackery. Fifty years ago an Italian, who assumed the high sounding name of Michael Angelo Pergolizi, was extensively employed in decorating the palaces and mansions of the English nobility and gentry. And in this present year a German adventurer, ycleped Mister or "Herr Sang," to naturalize whom a bill has been hurried through Parliament, has been employed to decorate the new Royal Exchange—and rumour whispers that it is not unlikely he may also be employed to Germanize the pure English Architecture of Barry in the New Houses of Parliament.

The resemblance between Pergolizi and Sang is remarkable, and it may help us to form an idea of what effect the productions of the latter is likely to have in the present day, if we revert to the debasing influence which the works of the former had at the time when he exercised unbounded sway over his patrons and admirers.

A glance at Pergolizi's book of ornamental design, which by the way was dedicated to a number of his noble patrons, will show what a wretched imposter he must have been. He compounded and distorted ill-drawn patches from Raphael, Watteau, and others, and produced an admixture of bastardized abominations which he had tact enough to palm upon his employers as original and novel designs, and through the extensive influence and patronage which he commanded he was enabled to poison the stream of English Decorative Art, and sweep away every portion that then remained of pure national taste, in connection with decorative house painting. Instead of the massive and graceful geometric and foliated ornament, with which in ancient times cathedrals and palaces had been decorated, there were now to be seen incongruous assemblages of trumpets, drums, vases, and monsters interwoven with meagre and unnatural foliage. Every ornament introduced, whether on ceiling, walls, or wood, was of the smallest, the leanest, and the most unsatisfactory kind, and architects, plasterers, wood carvers, and iron masters, imitated the style and aped the manner of the *great Italian master, Signor Angelo Pergolizi.*

Thus by the introduction into England of this trifling and meretricious style of ornament was the national taste depraved; and it was not until within these few years that there were any symptoms exhibited of a desire to return to the first principles of design, or any prospect of us being able to invent ornamental decorations in keeping with the characteristic features of our own country. Just, however, when we had begun to move onward in the right direction, Mister Sang was imported from Germany, with a spick and span new set of German patterns, or tracings; and he and his pupils have commenced to adorn the interiors of some of our principal buildings with a superabundance of German leaves, plants and flowers, together with German conceits and monstrosities, as far removed from the indigenous plants and flowers of Britain, and as alien to the feeling of Englishmen as were the productions of Michael Angelo Pergolizi. Is this to be tolerated with impunity? What are our native Artists and Decorators about? Are they so lost to every sense of shame as to sit tamely down under such an insult? What have our Schools of Design been doing? Was the late magnificent display of Cartoons not a proof of the rising character of British Art? Does not the present exhibition in St. James' Bazaar, wherein the celebrated Herr Sang cuts so poor a figure, triumphantly prove the superiority of our home bred House Decorators? In that exhibition, those London houses who have employed French artists to execute their designs must see the poverty of their Anglo-French productions, when compared with the specimens of British Art by which they are surrounded. In the Club Rooms and other places of fashionable resort, the decorative house painting is equal to what can be found in any country; while to a house painter in a provincial town (Mr. Hay of Edinburgh,) we are indebted for the most complete and satisfactory digest which has yet been given of the primary laws that govern form and colour. Notwithstanding all this, however, native talent is thrust aside to make way for German humbug and quackery. Shame on't! shame on't! Let all interested in the cultivation of the national intellect protest against such a practice. Let a demand be made for genuine British decorations, ornaments composed of forms or subjects peculiar to the country, and we will soon not only equal but surpass other nations in Art, as we have already done in Science and Literature.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

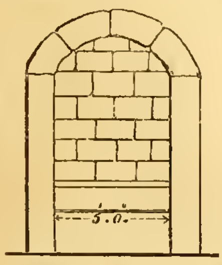
By Henry Fulton, M.D.

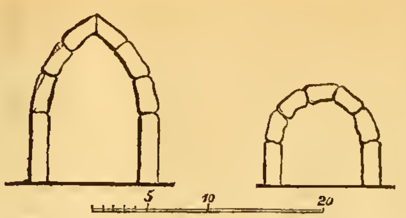
No. 9.

In Observations No. 3, Vol. VI., page 403, I had the honour to call attention to the circumstance of the British Institute of Architects being engaged in forming a collection of the different editions of the works of Vitruvius; and to express a hope that as soon as the collection was complete, it might, with the addition of Palladio and Sir William Chambers' works, be committed to the flames. We could mention other works published since "the end of the reign of George III.," did we not fear that by so doing we might, as Mr. Gwilt says, "come into contact with our contemporaries and their connexions, and that our office if not dangerous and fearful, might be unpleasant." The Institute and our readers generally can be at no loss in making a numerically respectable list of culprits for this literary *auto da fé.* As to the propriety of the measure there can be no doubt. Has not Professor Hosking unanswered, stated that geography and history might be as well learned from Gulliver and the Seven Champions of Christendom, as architecture from Vitruvius? But in order to satisfy the most sceptical, we beg now seriously to propose that a subscription be made for the purpose of giving a medal for the best essay on the subject, and if the Institute will have the kindness to receive the subscriptions and act as judges, we shall gladly contribute our mite. Institutions as well as individuals often involve themselves in dilemmas, and if the Institute should take in Vitruvius, they must turn out Professor Hosking himself, which, "if not dangerous and fearful, might be unpleasant," as there are those who esteem Mr. Hosking's works, and yet are so purblind, as not to be able to recognise any merit in those of Vitruvius or his admirers; besides, the Professor has already engaged the services of Captain Gulliver and the Seven Champions, who no doubt will prove themselves to be valuable auxiliaries in the event of hostilities.

Of course especial care must be had not to include in the *index expurgatorius,* those orthodox works which attempt to write down "mere amateurs" and "literary idlers," if it must be, let them have a milder sentence, on their covers let "flames be represented *points downwards,*" and the rather as it is desirable not to add too much fuel to the flame, let them then be consigned to the trunk makers according to the suggestion of Horace, not Horace Walpole, but the other one, (Quintus H. Flaccus:) Walpole's panegyricks on Lord Burlington's architecture have already performed the grand tour in trunks. If authors themselves do not find it convenient to go on their travels, by these means they can send their works as proxies. There is one author, however, to whom I would beg to recommend a trip to Germany, either in person or by proxy, if only to see the edifices erected by Schinkel and Klenze, some mention of which he may find in the article at page 445 of the 6th vol. of this *Journal.* But if the Institute be averse to discarding their collection of the works of Vitruvius, fortunately they have still an alternative, namely, to collect the travels of Gulliver and the exploits of the Champions, for the purpose of brushing up their knowledge of geography and history.

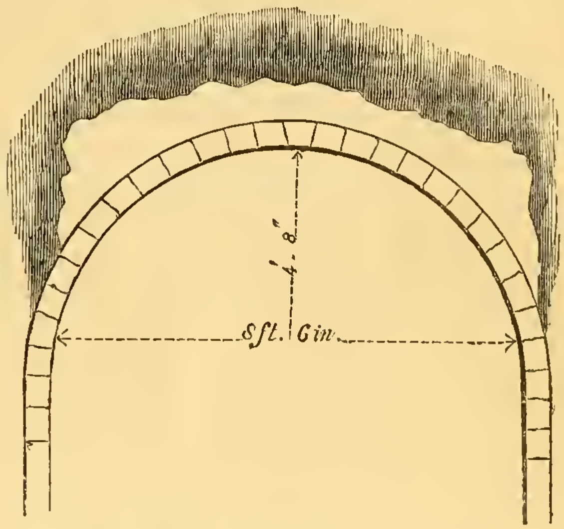
II. Mr. Frederick East, at page 354 of the third volume of this *Journal,* on the authority of Strabo states that, the earliest record of the existence of the arch relates to those supposed to have supported the hanging gardens at Babylon, which were constructed about twelve hundred years before our era. Mr. East is followed by another writer in the fifth volume, page 251, under the signature of O. T., who takes the same view. I have not found any writer who seems to be aware of the discoveries of Mr. Hoskins in Ethiopia and Egypt, which throw much light on this long disputed question. At Meroe, the ancient capital of Ethiopia, and the ruins of which he fairly supposes to be of much greater antiquity than any of those existing in Egypt, he found in one of the pyramidal tombs, the stone arch, of which we give a diagram, it is taken from the vault or porch of the entrance, and this vault consists of alternate courses of four and five blocks; of course, where, as in the annexed cut, there is only four, there is no keystone: the arch at the spring measures five feet, and the joints are truly given.





The next are a circular and a pointed arch, from the interior of pyramids at Gebel el Birkel; the date of which Mr. Hoskins does not suggest, although he considers them of great antiquity; they are situate near the fourth cataract. The pointed arch consists of six stones slightly hollowed out to the shape of the arch, and are supported by lateral pressure; they are not joined by cement, but above the roof are a quantity of small stones, which are kept together by a soft cement. The scale of both these is an inch and a quarter to twenty feet.

We give, in the annexed cut from the same author, a view of the



brick arch from the tomb of Amunolph I. at Thebes, who reigned 1550 years before our era. There is a vacant space between this elliptical arch and the rock, as may be seen in the cut. The span is eight feet six inches; its height is four feet eight inches.

As the Ethiopians taught architecture to the Egyptians, who instructed the Greeks, from whom the Romans derived their knowledge of the art, by the discoveries of Mr. Hoskins, the question of the claims of the Greeks and Romans is in a great measure set at rest. It remained in abeyance almost with the Egyptians, and with the Greeks also, except as a mere shadow in the corbelled roof of the tomb of Agamemnon at Mycenæ; still the Romans may be entitled to be called inventors just as Europeans were the inventors of gunpowder, printing, and the mariner's compass, although all these were previously long known to the Chinese.

In the second series of Sir William Gell's Pompeiana, Vol. II., Plate LXV., House of the Dioscuri, a doorway is given in the background, which has a close resemblance to the lancet arch. I do not recollect any thing of the kind at Pompeii: perhaps some person whose eye this may meet can throw some light on it, or may have the means of making enquiry on the subject.

A very general feeling exists against the introduction of arches and columns in the same composition; certainly, as far as the columnar arcades of the Palladian School go, nothing can be worse: but this arises more from the wide, straggling, and unequal intercolumniations than any thing else, and also from the practice of imposing arches instead of architraves, and also placing them on other and lesser columns; when these anomalies can be avoided the objection would loose most if not all its force. Arches behind insulated columns would have a better effect than either pilasters or square headed windows.

I agree with Mr. R. C. Long, of Baltimore, Maryland, (see fifth volume, *Journal,* page 370,) in his very judicious remarks relative to the capabilities of the Roman arch, which he considers has not yet been fully developed as a beautiful feature in architectural composition. What in the architectural world can exceed in sublimity and grandeur the long unbroken line of arches in the Roman wilderness? But there must be no higgling, sniggling, paring, frosting, tinkering, and the rest of the little *ings* and things with which our modern arches are ornamented. I verily believe that the man who spoils an arch with a dropping keystone could be guilty of inserting a ring in the nose of the Venus de Medici, and although it might be merely his own bright idea, he might think all the while, persuading himself that others thought so too, that it had been selected by the fair hand of science to set off the Queen of Beauty to advantage. I have seen, or perhaps only think I have seen, sculptured keystones which had a good effect, the sculpture alone being in relief. By the bye, sculpture is too seldom called in aid by architects to embellish their works, I do not mean the Paul Pry intruding or protruding keystone with mere glyphs, but something like what is to be found in nature relieved on a smooth ground, appearing like a single star in the firmament, or to speak of things terrestrial, a single and well selected ornament on the arched and unwrinkled brow of beauty.

For the history of the arch one naturally looks for information to the Encyclopædia of Architecture, but the information there given is scanty enough. Who indeed would suspect Mr. Gwilt of taking a leaf out of the travels of any "mere amateur" or "literary idler?" No, no, such small fry must not be encouraged to travel, or at least to write, with the object of throwing light on the history or practice of the art; besides, Mr. Gwilt seems to have been seized with a Rip Van Winkle sleep commencing at the end of the reign of George III., (which he says was also the end of the 18th century,) and to have remained from that epoch in a state of imperfect *clair voyance*, from which he has aroused at the end of nearly half a century, for the purpose of compiling his Encyclopædia: but although he seems to have slept profoundly, he did not sleep soundly, for he appears to have been disturbed by dreams of mere amateurs and literary idlers thoughout: it is to be hoped that he is now wide awake and has thrown off the night mare from his breast. If not, the sooner he does so the better.

III. In a very sensible letter written by Censor, page 147 of this volume, it is stated that very few of the profession purchase foreign architectural works; it might have been added, or domestic ones, or even read one or the other. I did not wish to be the first to call attention to this subject, but I firmly believe that there are many architects who never read professional works. Vitruvius gives a goodly list of accomplishments which he considered necessary for an architect, but he carries it to one extreme by requiring too much—modern practice to the other by requiring too little. Although it be unnecessary that an architect should know everything, which the professors of other branches of science and art should respectively be acquainted with, yet it is absolutely necessary that he should read every thing which bears on his profession; and if he do not, he might as well, like Mr. Rip Van Winkle or Mr. Joseph Gwilt, be asleep, whilst all the rest of the world are wide awake; and after sleeping orty years, rouse up and think he could compile another Encyclopædia without filling up the hiatus. One man or one profession cannot stand still whilst other men and professions are progressing, without being left behind in the race of knowledge. I know that in some professions those who in the estimation of their brethren are placed at its head, are amongst those who consider themselves only students. Nature gave to Hogarth a genius which was calculated to make him the finest painter the world every saw; but the gift was marred by education, (or rather the want of it,) and vanity, fostered by ignorance, prevented him from profitting by the knowledge and labours of others, whilst, by availing himself of these advantages, he might have eclipsed them all.

"Knowledge is power," said a person called Bacon, or some such name. Buy books of merit, gentlemen, and read them; let it not be said of architects—

> "But knowledge to their eyes its ample page,
> Rich with the spoils of time, did ne'er unroll;
> Chill penury repressed their noble rage,
> And froze the genial current of the soul."

Depend on it a good use of a good library is essential to make a good architect. "The more extensive your acquaintance is with the works of those who have excelled, the more extensive will be your powers of invention; and what may appear still more like a paradox, the more original will be your conceptions," (*Sir Joshua.*) From what I have myself seen of the nakedness of the land, I greatly fear that if some "Devil on Two Sticks," were to escape out of his bottle, he would give a sad account of the empty shelves in the studios of modern architects. I have heard that in a city which I could name, there is only one architect who possesses a respectable professional library. As Sir Joshua says, "It is indisputably evident that a great part of every man's life must be employed in collecting materials for the exercise of genius. Invention, strictly speaking, is little more than a new combination of those images which have been previously gathered and deposited in the memory; nothing can come of nothing: he who has laid up no materials, can produce no combinations." Every man is not born a genius; but no man who has not talent and desire to profit by the works of others, has any right to consider himself an architect. No doubt it is owing to a want of the right perception of this, that architecture does not *now* occupy in the scale of art the commanding position which it should. A knowledge of the disease is a step to the remedy; on the profession depends its successful application.

Clonmore, Dublin,
May, 1844.

CAMDENISM AND PAGANISM.

Such is the ultra intolerance and bigotry of the Cambridge Camden Society, that it professes almost a mortal hatred for every thing partaking of classical architecture, and would not only henceforth exterminate all such styles in practice, but even interdict all inquiry and discussion relative to them. That the Ecclesiologist should be sadly wrath with the article "On the present condition and prospects of Architecture in England," in Part III. of Weale's Quarterly Papers, is natural enough—is no more than was to be expected, because the writer has been not a little bitter in his remarks upon the Camden and similar societies. Yet wherefore it should protest against as "mischievous" another paper entitled "Outlines and characteristics of Styles," is not so apparent; or it is apparently for no other reason than because it treats of the Characteristics of those styles which the Camdenists regard as profane. For having accomplished well, as much as he undertook to perform, and for having explained more lucidly than is generally done, a great many seemingly insignificant but really important matters in classical architecture, the writer obtains no credit from the Ecclesiologist; which not only severely condemns all practical application of classical architecture, but would even suppress the study of it, and no doubt, would commit to the flames all publications and writings connected with such study.

If therefore Mr. Weale is at all solicitous to propitiate the Camdenists, he will in future exclude all similar heretical essays and topics from his "Papers," and confine them exclusively to subjects of Ecclesiastical architecture and decoration. That being done, the next step on the part of the Camdenists may be to take the Royal Academy to task for rewarding architectural *paganism* with "gold medals," and for admitting designs in any other than the ecclesiastical style, into its exhibitions. Luckily the Ecclesiologist does not pretend to interfere in matters of Painting, or it might exclaim against the enormity of exhibiting subjects from heathen mythology,—perhaps might object to the somewhat too liberal display of female loveliness in Etty's pictures. Neither would the pictures in the National Gallery escape reproach for their naughtiness,—for instance, Rembrandt's lady paddling in the water, which was formerly in the collection of a *clergyman!*

If the Camdenists are quite right, then the nation has been exceedingly wrong, and has acted very foolishly in purchasing the Elgin marbles, and in now endeavouring to obtain a fresh stock of paganism of the kind from Lycia.

But to come to the main point,—it is pleasant to hear Pugin inveigh against the scandalousness of an architect's daring to paganize at the Universities, and University men thundering against pagan architecture, since of all persons in the world, such reproaches do not come with the very best grace possible from them. It is not to be denied that Paganism does infect modern literature and art to a very great extent, and sometimes very fantastically. The odour of it mingles even with the strains of Milton; the taint of it is imbibed with almost the very first elements of education, at least of *gentlemanly* education. And whom have we to thank for this? truly, no other than our venerable ecclesiastical institutions—our so greatly extolled seats of piety and learning—our Universities, Colleges, and endowed Schools, which have made Heathen Literature not only a part, but one of the most essential parts, the absolute *sine qua non* in liberal education!

Now, to our dull apprehension, this sort of actual Paganism, which mixes itself with our very thoughts and feelings, is infinitely more dangerous and mischievous than that which Camdenists and Puganists so lustily complain of. If we can tolerate Paganism in poetry, in painting, in sculpture, all of which bring more or less vividly and actually before us the gods, and the idols, and the extravagant, often shockingly impure, fancies of Greek and Roman mythology, it becomes over-acted, farcical prudery to be scandalized at our admitting anything partaking of, or reminding us of Paganism into our architecture. In this last all the moral uncleanness and pestilential virus of heathenism either evaporate or are neutralized. It may be very bad taste to prefer Grecian—which we ourselves do not do, otherwise than as we prefer a good Grecian design to a bad Gothic one; but that is chiefly matter of taste—certainly does not amount to a very flagrant moral delinquency.

However, we are quite ready to join the Camdenists, and that too most cordially, in a crusade against Paganism; but then we do not agree to their half measures, but insist upon 'going the whole hog!' If Paganism is really to be rooted out from the land, let us lay the axe to the stem of the tree, and that right vigorously. Let not pagan poets be any longer made the studies, and the corruptors of Christian youth; let us have no aspirants to episcopacy employing themselves in editing Greek tragedies; let us not hear Homer spoken of with as much reverence as if the Iliad were a book of Holy Writ and Christian doctrine. Let us purge not only our libraries, but also our galleries, both public and private, of the rank paganism there hoarded up as precious works of art. If art sanctifies what is heathen and profane, when it comes in such shape, it may also render us tolerant of such comparatively innocent paganism as that of Greek and Roman columns and entablatures;—and now, to make use of a not very polite expression, we have flung the *Ecclesiologist* "a bone to pick;" but dare say that it will consider it altogether beneath its notice; the most convenient and prudent course which Tartufferie and pharasaical hypocrisy can take. After all, too, the *Ecclesiologist* is not even tolerably consistent as far as it goes, for if its anger be stirred up against mere literary articles, which according to its own account, are too dull to do any mischief, it ought to empty the vials of its fiercest indignation upon those *monuments* of architecture which, by their *Paganism*, (a mighty pretty bug-bear word,) must so shock the pious feelings and the orthodoxy of Camdenists:—for instance, that flagrant example in Cambridge itself, the Fitzwilliam Museum. With what sort of sincerity the Camdenists, and their organ the *Ecclesiologist*, take the interests of architecture to heart is sufficiently apparent from the studious suppression of all mention of or reference to the beautiful little cemetery chapel lately erected at Cambridge by Mr. Lamb. No doubt, they would if they could abuse it, as they have done Mr. Blore's church at Hoxton; for it may, in their eyes, have a far greater defect than even that of Paganism, namely, of heterodoxy, the building belonging to Dissenters; and the Camdenists are wonderfully orthodox, and no less wonderfully liberal,—quite *pattern* people, and amazingly consistent to boot. Their orthodoxy extends even to their orthography, in which they display a singular affection for, a silly affectation of the now exploded *k*, in such words as Catholic, Gothic, &c., spelt by them Catholic*k*, Gothic*k*, which may be very proper, yet seems to us very finic*k*al and very comic*k*al.

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ARCHITECTURAL DRAWINGS, ROYAL ACADEMY.

Almost might we stereotype the remarks with which we have hitherto opened our notices of the architectural department of the Academy's Annual Exhibitions. But it would seem that the *corrigenda* are also *incorrigibilia*: in regard to them, there are not the slightest symptoms of amendment;—not even of there being any desire to effect improvement, notwithstanding that it is so obviously needed. We must therefore, per force, conclude that the architects belonging to the Academy are mere cyphers in it, without authority, influence, or interest of any kind; and that their zealous endeavours to abate the grievances and inconveniences complained of, and to obtain for architecture more liberal treatment at the hands of the Academy—so long at least as it continues to form any part of their exhibitions,—have been quite unavailing. If we do not account for matters this way, we are driven to a very ugly alternative—that of supposing that those gentlemen who represent the interests of Architecture—their own profession—at the Academy, leave it entirely to shift for itself, well knowing that their own drawings are certain of being hung to advantage.—To give them their due, however, they are tolerably considerate, and do not monopolize a very great deal of space. Only three drawings constitute the entire quota of those sent in this year by the Academician Architects—namely Barry and Hardwick. As to the Architectural President, Professor Cockerell, instead of doing the honours of his own department, he again keeps away altogether, which may be very dignified, but is not particularly gracious or encouraging on his part.—Like Sir John, he is ashamed to march with the ragged rogues through Coventry; so puts himself to Coventry.

Besides the Professor, there are many others whose names we this year miss from the Catalogue, although hitherto they have generally exhibited something each season. No wonder therefore if the average merit of the present Exhibition is below, rather than at all above that of some preceding ones; especially as we do not find old acquaintances supplied by new ones of any note or promise.

We will break off from our general remarks—crusty ones?—and turn at once to Barry's splendid pair of drawings Nos. 1186 and 1196, the first a "View of the New Palace at Westminster, as it *will* appear from Lambeth;" the other a view of it "as it *would* appear from the Surrey side of the river, near the foot of the new Hungerford Bridge, in connexion with a suggested new Bridge at Westminster." As to the "*will appear*" promised for the first subject, that we somewhat doubt, unless Mr. Barry be a second Joshua, and can prevail upon the sun to tarry in the East and light up the river front of his edifice in the same manner as is here shown. Neither will the building ever display itself from Lambeth in the same manner as is represented in the drawing, the station selected by the artist—and extremely well selected it is in itself—being very much nearer. There must also, we apprehend, be some mistake or miscalculation in regard to the point from which the other view is taken, it being immediately close to the "suggested" Bridge, showing the latter as it would be seen from upon the river, therefore not near to Hungerford Bridge. This will probably be thought hypercriticism; and such indeed it is in regard to the drawings, for there artistical licenses of the kind in order to show the subject to the greatest advantage, are allowable enough; but the case becomes somewhat different when, as in this instance, it is above all things important to calculate beforehand the precise effect of the structure when completed, without any exaggeration or flattery. That Mr. Barry himself professes to be very exact, is evident enough, else he would hardly by particularizing the precise stations from which they are taken, have led us to question the veracity of the drawings in that respect. Be the mistake however either on his part or ours, there can be no mistake as to the magnificence of the architectural ensemble which Mr. Barry here displays to us. He has not at all reined in his imagination, but it is not so certain that John Bull will not apply the curb to it, for we now perceive to what prodigious extent the architect proposes to carry out his plans. According to what is here shown, we find that all the houses on both sides of Bridge Street are to be swept away; and that the South side of that street will be formed by another extensive range of buildings, similar in character to the other elevations of the "Palace," and entirely enclosing behind it Westminster Hall and New Palace Yard. Then are we to have terraces and shrubberies on the other side of the street, at least along the river; also other terraces, and a splendid pavilion or Water-gate, extending from the south end of the River Front. Neither does Mr. Barry stop short here, for there are now additional towers, and the original Clock-Tower, is now prodigiously enlarged and converted into a lofty upright mass, whose ensemble has more of the character of Foreign than of English Gothic, and which is withal somewhat heavy in outline in its upper part, where there is a most enormous clock-dial—not unlikely to obtain the name of the "Prince of Wales' pocket watch." In comparison with what is now contemplated—at least by the architect himself, the edifice will be expanded to about double the extent of the original plan; therefore what with the prodigious increase that way; with fresco-painting and other closely decorations in the interior; with a vast deal of additional external decoration also; and lastly with the suggested Bridge,—the sum total will be truly startling.

Without wishing any ill to the Palace of Westminster, we should not like to see it entirely swallow up all disposable resources, when some are much needed for other purposes. Mr. Barry's ideas are so *elastic*,—he has such a superabundance of imagination and invention that we wish he would out of charity's sake, bestow a little of it—some of the mere crumbs and sweepings—upon Sir Robert Smirke, they would surely be acceptable to an architectural Lazarus. It seems, however, that Sir Robert will accept nothing, not even advice: although he takes very coolly a pretty large stock of reproaches, and it must be confessed that he does not take them without having fairly earned them. After so much has been said about the Façade of the British Museum, many persons may have supposed that there would certainly be either some drawing or the model of it in the present exhibition. So far from looking for any thing of the kind, we should have been as much startled by it as if we had found the Museum itself in Trafalgar Square. Were all others in the profession to take pattern by Sir Robert Smirke, and we may almost add the "Professor" himself, there would be a *finis* to architectural exhibitions altogether.

As to Professors, they are rather shy of exhibiting; we get however this year a subject from one of them, whose name is almost a stranger in the Catalogue, and what is more, a subject which challenges direct comparison with Barry; viz., Professor Hosking's design for "Remodelling the superstructure of Westminster Bridge upon the present piers," as shown by plans, constructional drawings, &c., in Nos. 1143 and 1148. "The main object of the design," the Catalogue tells us, "is the illustration, in a familiar manner, of Mr. Hosking's suggestions, in his 'Treatise on Bridges,' for reducing the weight and cost, and increasing the rigidity of the superstructure of an arched bridge, by the introduction of an inner transverse arch, groined to the usual longitudinal arches." The idea is ingenious, and would be attended with a pleasing effect; but we cannot say much in favour of the taste shown in the design itself, which is not likely to find many admirers, seen as it is almost in juxta-position with Mr. Barry's. In adopting Gothic, Mr. Hosking had evidently no intention of attempting to vie with the Palace of Westminster, or even to conform at all with the style of that edifice; the Bridge "suggested" by him, being quite contrary to the principles of decoration observed in any one of the various styles of Pointed Architecture. What should be panels and other ornamental details, are upon a monstrous scale in comparison with the structure itself. In fact, as far as appearance is concerned, the bridge might just as well remain as it is, without any attempt being made to assimilate or accommodate it to Mr. Barry's edifice. Mr. Hosking seems to have designed his Bridge without taking into consideration at all the excessively ornate character of the adjoining "Palace;" whereas had he wished to convince us how well his Gothic would harmonize, or how agreeably it would contrast with that of Mr. Barry, he ought to have exhibited a perspective view, showing not only the bridge, but some portion at least of the other edifice. If we have been rather prolix in our remarks on Westminster "Palace" and Bridge, it is partly because there are very few other designs for public buildings and improvements—churches excepted—that claim notice. One *projét*, however, there is for what would form a very desirable and no less feasible improvement at Whitehall, viz., Messrs. Wyatt and Brandon's design (No. 1219) for erecting on the site of Gwydir House, a building (either for government offices or a Club establishment), corresponding with the "Banqueting House," and uniting the whole into one general façade by means of a central compartment flanked with pavilion towers and cupola turrets. It is somewhat curious that, notwithstanding the excessive admiration—almost might we say veneration that has ever been professed for the only part of Inigo Jones's project for Whitehall Palace, that was executed, it has never been thought worth while to finish up the exterior consistently as far as it goes, continuing the design at the ends—which now present only bare brick walls,—and keeping the building quite clear from any others. In its actual state, that piece of Jones' architecture has always struck us as looking somewhat lumpish and monotonous, and evidently intended only as a portion or feature belonging to some larger edifice. Whether the project emanates entirely from themselves, or whether aught of the kind is contemplated in other quarters, we know not, but Messrs. Wyatt and Brandon now propose to make such addition to Jones' building as would form a well arranged architectural composition of considerable extent. It is true the centre would be the narrowest division of the façade, and would also recede back a little, but this is almost inevitable, for as it cannot be allowed to project forward unto the pavement, it must either be set back a little, or there could be no break at all in the line of front, consequently no motive for introducing the towers,—which are well imagined characteristic traits adopted from Jones' ideas for Whitehall.

After this design there is scarcely another in the room, which shows any thing either proposed to be done or lately erected in the metropolis, if we except No. 1101, Mr. Turner's "Façade buildings of the Joint Railway Terminus at London Bridge," which design has appeared in our journal. We meet indeed with a design *for* the new Conservative Club-house (No. 1218, T. Hopper), but it is not the one adopted, nor does it rival it by many degrees; but of course Mr. Hopper thinks differently, or he would not have challenged comparison. There are a good many other designs in the same predicament, having been put *hors de combat*, but how far they have been superseded by any thing better we are unable to judge, there being no drawings or models of the approved ones. For the "Leicester Memorial" alone there are four or five designs,—all of them columns—made according to *order*, we suppose—and all so exceedingly poor and insipid that they seem to have been sent to the Academy for no better eason than that they were ready to be sent. By way of producing something less hackneyed than the eternal Doric or Tuscan column, one of them substitutes the capital from the Tower of the Winds at Athens! Of Mr. Donthorn's column, which is the one to be executed, the capital is described as being altogether a novel composition, consisting of the heads and fore-parts of animals, but whether placed all round, or only under the angles of the abacus, we cannot tell, for he has not thought proper to exhibit the design, or any drawing or model of the capital only.

Of Prize Designs we have *quantum suff.*, things that may deserve the Academy's gold medals, but do not say much for the judgment which proposes such wildly extravagant subjects as are those upon which architectural students are invited to exercise their invention. The one this year is a "Metropolitan Music Hall and Royal Academy of Music," upon such a scale that it seems intended to contain the whole Musical "Million," and to require full a million to erect it. It is quite preposterous to encourage students, to encourage mere beginners to attempt such monstrously out-of-the-way things before they can display any taste and invention in designing a moderate-sized house, or even a single room. Subjects of the last-mentioned kinds are always, we are sorry to say, exceedingly rare: there is not a single design for the front of a street house or a town mansion. Architects seem to be able to make nothing of such subjects: they accordingly favour us only with cottages, villas, country mansions and castles. Of interiors they are equally shy—except they be merely those of churches—notwithstanding that so much has of late been said on the subject of interior decoration and the study of it; that in itself it affords such a wide and varied scope; and that it may be adopted with comparative facility and economy. Promise, however, is now made of what has long been a desideratum among architectural publications, by No. 1134, "The Morning Room, one of a series of designs for Interior Decoration," E. B. Lamb; yet while so many insignificant and paltry things are allowed to stare us full in the face, this drawing is put nearly quite of sight, notwithstanding that it is of a kind to require close inspection. Placed where it is, all the detail—all that constitutes decoration is entirely lost; hardly therefore would it have been a whit more preposterous to have hung it upside down at once. Nothing can be made out except the general forms and masses. Its author's name is however a pledge of its merits, since no one understands better than Mr. Lamb, the application and adaptation of former styles to actual purposes, in such manner as to retain their characteristics, and that, not merely in bits and patches, but consistently and throughout. Accordingly, we trust that ere very long we shall behold his "Series of Designs" in a published form; for it certainly would prove a most excellent companion work to those by Joseph Nash, and would be far more generally useful, inasmuch as the subjects would be designed with express reference to what is required for or capable of being introduced into modern rooms, and in spaces of less extravagant amplitude than ancient baronial halls.

The only other interior of a room—properly so called, is No. 1160, the "Library of the Parthenon Clubhouse," in Regent Street, one of the two mansions built by Nash for his own residence and that of his brother-in-law Mr. Edwards. Never has Mr. Beazley satisfied us so well as in this interior, which although of no great size as a room—in fact a narrow and not very long gallery, is unusually scenic in its architectural character. It consists of three divisions or compartments covered by as many domes and their pendentives, which constitute the chief architectural decoration, the walls being nearly covered by book cases, on which are placed busts. Each of the end compartments is lighted by a *lunette* or semicircular window over the book-cases on the left hand side; but the centre one is enlarged by a bay window on that side, which gives greater space to the room, and variety to the design. We speak doubtingly, but we suppose that this Library is not an entirely new addition to the house, but a remodelling of the small gallery shown in the plan of it in the "Illustrations of the Public Buildings of London."—This design is not only more than ordinarily interesting as a subject, but also as being suggestive of further ideas, and as affording an agreeable "episode of plan."

(To be continued.)

MR. J. TOWNSEND'S LECTURE ON THE FINE ARTS.

SEVERAL of the Greenwich and Kent papers have spoken in terms of very high admiration of this Lecture, which was delivered at the Greenwich Literary Institution, on the evening of May 1st.; and in so doing some of them have indulged in sharply satirical remarks—not it would seem without reason—on the want of taste and also of good feeling shown by the people of Greenwich, who instead of encouraging talent in a fellow townsman, left him to address almost empty benches. This is all the more extraordinary, because the room would have been very decently filled, had there been but a tolerably fair attendance on the part of the members belonging to the Institution. But after what fashion it is that they bestir themselves in promoting intellectual taste either in regard to literature or to Art, is now pretty manifest. It will be lucky for them should not the very pointed and caustic remarks of some of the newspaper editors obtain for the people of Greenwich, the title of the Kentish '*Bœotians*.'

By the few who were present the lecture was exceedingly well received, for it abounded in original and striking observations, and in highly eloquent passages, which drew forth frequent applause. This will hardly be questioned after perusing the following extracts from it, which appeared in the "Kentish Mercury" of May 4th, and we think that our own readers will thank us for affording them the opportunity of judging for themselves of the Lecturer's style, and mode of handling his subject.

"*Influence of Forms of Government on the Fine Arts.*

"It is the same with regard to that other knotty question—how far the Fine Arts are influenced by forms of government;—whether they thrive better in republics or in monarchies,—whether the spirit of liberty, or that of despotism invigorates them most,—whether they themselves tend to encourage and keep alive the spirit of either the one or the other; or whether forms of government have nothing to do with the matter.

"Those who take the side of republics, and also lay stress upon the influence of climate, will of course, triumphantly refer us to Athens as affording most incontestible evidence in confirmation of their doctrine. But then the instance of another Grecian republic upsets it all again; for wherefore did not the Lacedemonians distinguish themselves in literature and art just as much as the Athenians? They were republicans, they were Greeks, and as far as climate is concerned, were placed in a more southern latitude. Their temperament and disposition, their manners and institutions, indeed, were different, therefore we may well account for the other difference, but this last also shows that republican form of government—for such was virtually that of the Spartans and Lacedemonians—has very little to do with the matter.

"Louis XIV has shown the world how much may be achieved by royal despotic will, and how very *little* that much is. He affected the fame of a second Pericles—or rather that of being Pericles, Augustus, Leo, all in one; and as the world is not over vigorous in examining into similar pretensions, he for a time, obtained it. Pericles and Louis Quatorze!—certainly they resemble each other just as much as do the Parthenon and Versailles.

"Taken under the auspices of Louis, art was compelled to attire itself in a court-dress, and the muses to wear hoop petticoats. It was also expected from art that it should pay in kind for the patronage so bountifully and graciously bestowed upon it. It was hospitably received as a guest, on condition of its playing the part of a parasite also, and celebrating *a l'outrance*, the bountiful *mu*nificence and the boundless *mag*nificence of the Grand Monarque.

"*The Church and the Fine Arts.*

"As the Church of Rome increased in wealth and power, she added pomp to pomp, and splendour to splendour, superstition to superstition, till it seemed as if she wished to absorb within herself all the pomps and all the vanities, and all the allurements, and all the illusions of mundane power. Art was honoured,—religion sensualized; the one was enrobed as a priest,—the other decked like a harlot.

"No wonder therefore that on separating and withdrawing their allegiance from the Church of Rome, and rejecting its traditions and superstitions, the first Reformers—at least their followers, rejected its ceremonies and its pageantries, as mummeries worse than unmeaning; or that the work of destruction began afresh. The grievous havoc then committed either by spoliation or wanton defacement, has been a theme of bitter complaint with antiquaries and artists; but if it displayed it too indiscrimately, popular indignation was not altogether unjustifiable.

"From that period, art has been greatly circumscribed in Protestant countries, and expelled from that ministry in the temple, which it held both in Pagan and Christian times, consequently put upon quite a different footing. Having no occasion for the services of art,—except it be that of architecture, the Protestant church has no employment for, consequently no patronage to bestow on it. This has been deplored—even bewailed; and not without reason—that is, supposing the interests of art are to be held paramount to all other considerations. But with the example of what sort of services it has rendered to religion, in the case of the Roman Catholic Church, before our eyes, there is some reason for being suspicious of it. Were it admitted into the Protestant Church, it would, no doubt, be sufficiently discreet and unassuming at first; but then, for how long? probably no longer than it had established itself upon such a firm footing that it might bid defiance to those who should endeavour to turn it out again. In such case you have to deal with a servant that will not take warning to leave; you may discharge him, but there is no other way of getting rid of him than by fairly kicking him out of doors, and thereby causing a hubbub.

"In fact, so far from being rendered more solemn and impressive as religious edifices, and devotional in character, many churches in Italy and other Catholic countries, look more like picture galleries and museums of art, and are visited merely as such by strangers. Instead of asking why we do not admit painting into our own churches, the more proper question, perhaps, would be, why do we not exclude sculpture also? Since of the greater part of it as there found, the most that can be said in its favour, is, that there is no danger of its encouraging superstition.

"Many and strong are the remarks which have of late been made upon the public monuments in Westminster Abbey, and St. Paul's, and it must be admitted that while they are but little creditable to us as productions of art, considered as which they are many of them both puerile and bombastic, little better than mere stone-carver's jobs, they are the reverse of Christian in their ideas. They are for the most part, *Paganism* without its poetry,—are made up of frigid and school-boy conceits, where *link-boy genii* figure with their inverted torches among Britannias and lions, which last are sufficiently numerous to stock a menagerie.

"Should it be asked—'what then is to be done? how is sculpture of that kind to be so christianized as to be completely purified from all taint of Paganism?' I must confess that I am not prepared with an answer; neither I believe is any one else. Therefore another question arises, namely, are we justified in persisting to make use of what we acknowledge to be both improper and unsatisfactory, merely because we know not how to render it otherwise? Sculpture is all too corporeal for Christian art and for the expression of Christian ideas; beauty of form is its element; of mental emotion, of spiritual feeling, it scarcely admits any strong expression, without falling into caricature, and theatrical gesticulation.

"Even were such monuments perfectly satisfactory in themselves, both as works of art, and as intelligent and expressive memorials of those to whom they are erected, they would still be objectionable on the score of propriety.

"Great would be the outcry, were it now for the first proposed to place within the walls of a sacred edifice—within the house of prayer and Christian devotion, triumphal effigies—as they may well be called—of our fellow mortals, not of martyrs for the faith,—not of men who have been a guide to others, in the holiness of their lives, and their earnestness in the cause of truth and religion; but of men who have signalized themselves far differently, who have, indeed, proved their claims to earthly laurels and earthly renown, but to no more. Were this, I repeat, now first proposed to be done, great would be the indignation excited: we should be told of the shocking desecration—even profaneness. Although Rome deified its emperors, even heathens did not place statues of their distinguished men within the fanes consecrated to their deities. Custom, however, reconciles us, hardens us to what we should else consider glaring and indefensible improprieties; so much so that the refusal to permit the statue of Byron, by Thorwaldsen, to be put up in Westminster Abbey, has been stigmatized by some as an act of ungenerous bigotry. Yet there to have placed the author of 'Don Juan,' would have been viewed by others as a gross indecency.

"Even the statue of Watt, the *author* of the steam-engine, is not particularly edifying, although characteristic enough of the steam-engine, Mammon-worshipping times in which we live, and in which *steam* obtains far more of our cordial *esteem* than falls to the share of art. No! let us testify our grateful veneration for valour, for heroism, for genius, for intellect; for noble achievements in arms or acts—in the senate or in the field! but while we honour them, let us not dishonour the temples of our faith; let us not, within their sacred walls, be reminded and surrounded by trophies of worldly ambitions—of mundane triumphs and mundane glories, which thereby look only all the more abject and pitiful. No, as there is a time, so, also, is there a place for all things; and a Protestant church is assuredly not the most suitable place to be made an exhibition room for works of art, or even a pantheon of 'British worthies.'

"It becomes a question then, whether it be not more advisable rather to expel sculpture, than to admit painting. It is surely no reproach to Protestantism, that its service needs no such material aids to devotion; that it scorns to entice by amusing the fancy, and addressing itself to the imagination. For a religion of external forms, ceremonies and pageants, of devotiona etiquette and representation, art indeed does much, if only because it is in keeping with, and contributes towards enhancing that sort of spectacle and pomp which is affected in all besides.

"But what need of art, or what can art do for a church constituted like our own, whose solemnities are not intended to impress the outward senses? Otherwise than for monuments—and how objectionable and incongruous they for the most part are, has just been pointed out. Sculpture is almost entirely out of the question; more especially if it aims at being classical, for in proportion as it is antique in gusto, so it is likely to be found Pagan in character and in spirit.

"How, again, is painting to employ itself in our churches, if debarred from all those subjects and representations which Protestantism rejects as superstitious or profane? It does not tolerate portraits—of course imaginary ones—of patriarchs and saints, apostles and martyrs; much less would it tolerate the embodying of the Trinity as indulged in by Catholic artists—even at the present day; and the many other representations which are at once shocking and absurd—under human forms.

"Protestant artists are interdicted—and justly so—from venturing upon purely celestial subjects and scenes; they may not attempt to scale and scan the heaven of heavens—obtruding upon us their own puny phantasies, as distinct revelations, of what eye hath never beheld, and which it passeth mortal intelligence to adumbrate ever so faintly in idea alone.

'But fools rush in, where angels fear to tread.'

"'Last judgments'—'assumptions'—celestial visions—saints sprawling upon clouds, or hovering overhead like balloons—are all interdicted us. Scenes of martyrdom would be objected to as by far too disgusting to be suitable subjects for the pencil at all;—nor have we that almost inexhaustible stock of legendary traditions which Catholic painters have availed themselves of, so largely. Consequently nothing remains for Protestant artists to work up but subjects from scriptural history, and no nobler—no higher walk of art, it will be said, can possibly be desired: with the dignity of history it unites the sublime of religious sentiment. Very true, such is—or rather ought to be the case; but let us for a moment look at the matter as it really stands: now, so far from being what its name implies, historical painting is entirely fiction, without the slightest pretence to literal truth, being worked out by imagination upon no substratum than a bare recorded fact. Be they conceived ever so powerfully,—treated ever so ably, still the images on the canvass are only those of the artist's own imagination. The representation is only a poetic guess—a probability;—therefore, although as a work of art it may be admirable—even ot surpassing worth, its artistic excellence and the vigour of imagination, it may happen to display, do not entitle a work of the kind to be received into the service of the church. At least, if the inspirations of genius, and poetic imaginings are to be admitted in one shape, why not also in another—and that a less material—more spiritualized one? Or would it be too daring—too profane an intrusion were the muse of Milton permitted to enter also? most certainly it would be so considered; yet Milton brought quite as much of pure religious inspiration to his solemn subject as ever did the greatest genius in painting.

"In general, the world looks for some degree of consistency between the character of a man and his productions: it has no great esteem for those who can skip not only 'from grave to gay,' but from the religious to profane, and back again from the profane and sensual to the devout, just as the immediate occasion may demand:

> "'Now deep in Taylor, and the book of Martyrs,
> Now drinking citron with his Grace and Chartres.'

Nevertheless, the utmost latitude in this respect seems to be granted to artists: they are permitted to be alternately Christian and Pagan; to take their subjects from the Bible, and from Ovid the next;—Magdalens or Ledas, Crucifixions or Carnivals,—Bacchanal revels, or the Sacraments of Church,—all are pretty much alike to them, for many of the great masters have displaying equal ability in the two extremes of their art, and perhaps have been quite as sincere in the one as in the other. Hence the operations of art are generally considered to be those of the hand rather than of the mind, at any rate to be influenced by the head, rather than the heart; nor can it be denied that such is to a great extent the case. And this is one tolerably sufficient reason wherefore painting and sculpture should not be allowed to assume in any degree the office of teachers, instructors, and interpreters, in matters religious and spiritual,—intruding themselves into the sanctuary, under such character. If the library—not the church, be the more suitable place for sacred poetry, so also is the picture gallery, for paintings from scriptural subjects. The case might be materially different, were there artists who devoted themselves entirely and exclusively to the service of the church, from motives of piety, and out of sincere religious feeling, conscious that they had a high mission and most responsible office to discharge. During the middle ages of Christian art—before the so-called revival of the arts, such was partly the case. In the productions of that earlier period there was, indeed, of real art too little, of superstition too much, but there was also the spirit of Religious Sentiment. After the Revival, there was far less of this last, art became more perfect, more tasteful, more refined, but also more sensual, more worldly. Protestantism, therefore, acts discreetly in excluding painting from its religious edifices.

"There is, however, one particular species of painting which it still tolerates, and which is just now receiving great encouragement, notwithstanding that it seems to be in some respects quite opposed to Protestant sentiments, inasmuch as it partakes somewhat largely of the *Iconology*, or Image-worship of the Romish church. Having said this, I hardly need explain, perhaps, that I allude to glass-painting and its stained windows; presenting a gorgeous display of Saints and Martyrs, many of them blazing in the most vivid colours. The inconsistency of thus admitting in one shape what we altogether refuse in another, is if not quite removed, at all events much diminished, when we take into consideration the great difference of character between that and other modes of painting, and the widely different manner in which it is employed. Glass painting makes very little pretensions to being an imitative art; rather is it a mere emblematic one and altogether conventional and decorative, for painted windows are to be looked at not as pictures, but as a portion of the general architectonic ornamentation of the edifice. The subject contained in them may have little or no meaning, or if any, it may utterly escape attention, such painting being almost entirely hieroglyphical. The details—the individual figures are unregarded: it is the general effect—the 'glorious confusion' of colours, which sheds an atmosphere of transfigurated light through the whole building, completely filling it, as it were, with an incense of all hues mingling together into solemn radiance—that captivates and charms, and certainly tends to heighten devotional feeling. Such at least is the poetical view of the matter; but it has also another, and, it must be confessed, a very prosaic aspect; because although when looked at through 'antiquarian barnacles,' the figures in ancient stained glass may be admired as so many specimens of art native and undefiled, ordinary optics are apt to discern in the majority of them, more of the grotesque and the ludicrous than is altogether seemly;—to fancy that they bear in regard to drawing a singular resemblance to those in China tea-cups and saucers; besides at the same time a most unlucky likeness to the personages depicted on Court cards—their Majesties of Clubs and Hearts, Diamonds and Spades!

"That Protestantism is decidedly unfavourable to art—that is, in immediate alliance with religion—is not to be denied; but then it must on the other hand, be admitted that art has seldom shown itself worthy of being admitted to such alliance. If superstition be religion, if childish fancies—often most shockingly profane were intended to be most pious, are to be received as worthily expressing the mysteries of our faith, then indeed, the services of art have been both great and many in the cause of the church, but even so not of our church; at least quite unintentionally as regards the latter—only as it helped to build up that accumulated mass of superstitions which eventually led to the Reformation."

We know not whether Mr. Townsend intends to make another trial in some less *Bœotian* place than Greenwich; but whether he do so or not, we hope that he will eventually give this Lecture to the world, in a permanent form, by publishing it as a literary composition.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTE OF CIVIL ENGINEERS.

SCREW PROPELLERS.

"*Account of some experiments on a vessel called the 'Liverpool Screw, fitted with Grantham's engines and Woodcroft's screw propeller.*" *From the Minutes of Proceedings of Institution of Civil Engineers, Feb.* 13, 20, *and* 27, 1844. *With Eagravings, Figs.* 1 *to* 10, *Plate VII.*

The *Liverpool Screw*, upon which the experiments, described in this paper, were tried, is a small iron vessel 65 ft. long by 12 ft. 6 in. beam, and 3 ft. 9 in. draught of water. She is propelled by two high pressure oscillating engines, with cylinders of 13 in. diameter and 18 in. length of stroke. The steam, which varies from 56 lb. to 60 lb. pressure in the boiler, is admitted to the piston for one-fourth the length of the stroke, the remainder working by expansion. The nominal power was 20 horses, but the effective power rarely exceeded $18\frac{1}{2}$ horses. The cylinders are placed diagonally, at right angles to each other, and work to one crank upon the main driving shaft, which runs direct to the propeller without gearing or bands. The propeller, which makes 95 revolutions per minute, is on Woodcroft's plan, with a pitch expanding from 10 to 11 ft.; after being enlarged at three several times, from 3 ft 10 in. diameter, it is now 5 ft. 4 in. diameter by 20 in. long; it is of wrought iron, and consists of four short arms, whose united area is equal to 16 square feet; of this, only about 13 ft. are immersed, a portion of the upper side being constantly above the water: the angle of the centre of the floats is 45°, and about 40° at the periphery. The author then gives the details of a number of experiments, and he states that, although the proportions of the vessel were not favourable for speed, her length being only five times the beam, and the sectional displacement 28 ft., the speed was greater than that of all the steamers on the Mersey, except the large sea going steam vessels. That the "slip" of the propeller, when tried by Massey's log, was less than five per cent. That the action of the screw across the way of the vessel, did not appear to affect the steering, or have the slightest tendency to turn the head of the vessel.

The author is of opinion, that engineers in general, fearing a loss might take place from lateral action, with a long pitch, and that the steering would be affected if the propeller was not immersed, have made the propellers too small, and that the short pitch, which had rendered a high velocity necessary, was detrimental. Several satisfactory experiments, in towing vessels, are also mentioned, and it is stated that in a heavy sea, the superiority of the screw propeller was very visible. The dimensions are then given for vessels of war and of commerce, working with screw propellers, driven direct by oscillating engines, which the author anticipates would prove much more serviceable and sea worthy, than any of the paddle wheel steamers now in use.

The paper is illustrated by a diagram of the propeller of the *Liverpool Screw*, and by plans of the machinery and general arrangements of the proposed frigate and large steamers.

Remarks.—Mr. Rennie observed, that the Institution was much indebted to Mr. Grantham, for bringing forward the subject of screw-propellers; the more particularly as it had now become of national importance, and that every attempt at perfecting the sub-marine propeller merited encouragement. It was difficult, correctly to assign the merit of the first invention of this species

PROPELLERS.

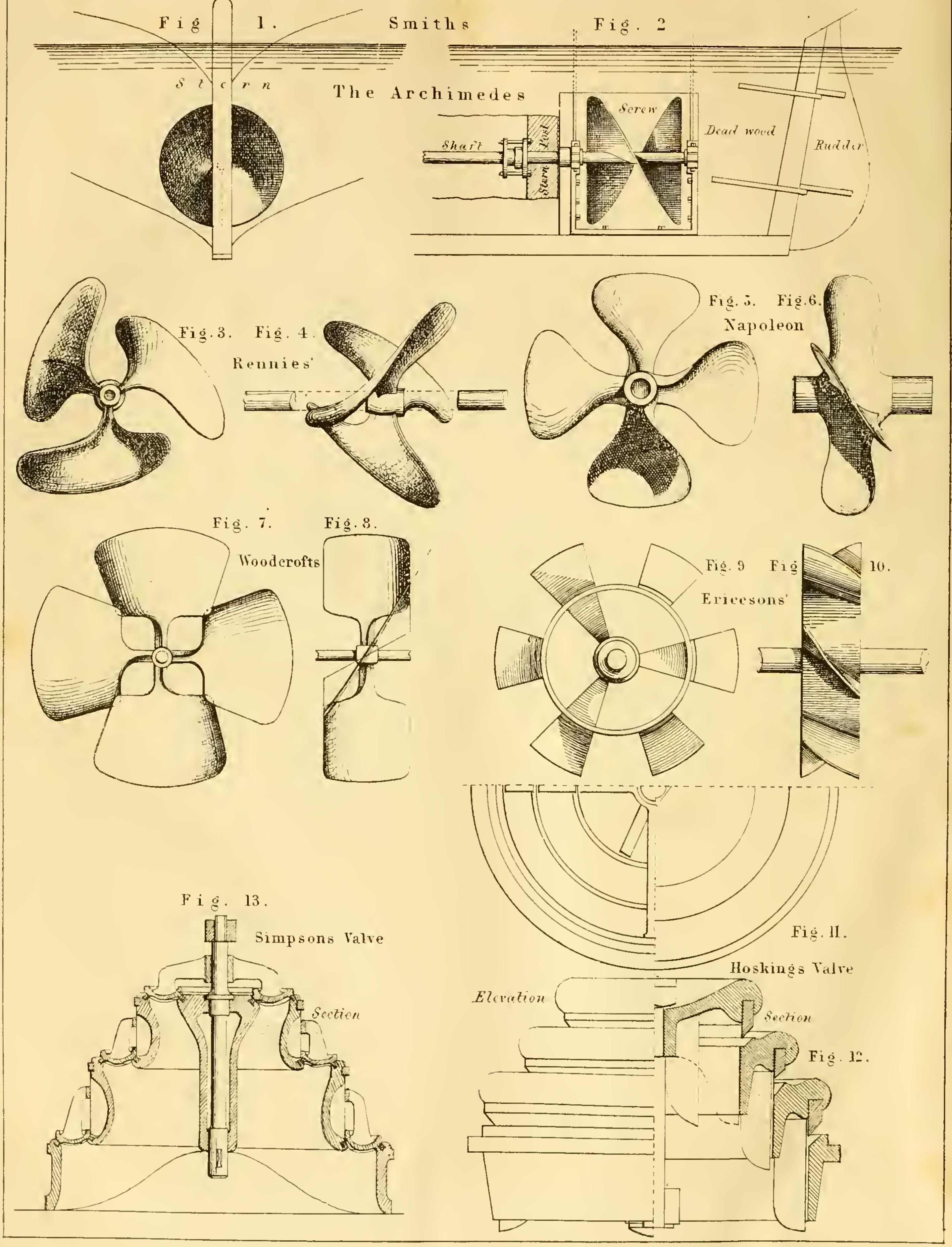
Fig 1.
Smiths
Fig. 2
Stern
The Archimedes
Screw
Shaft
Stern Post
Dead wood
Rudder
Fig. 3.
Fig. 4.
Rennies'
Fig. 5.
Fig. 6.
Napoleon
Fig. 7.
Fig. 8.
Woodcrofts
Fig. 9
Fig 10.
Ericcsons'
Fig. 11.
Hoskings Valve
Fig. 13.
Simpsons Valve
Section
Elevation
Section
Fig. 12.

of propeller, as it had been tried at various periods, and with as varied results, on the Continent, in the United States of America, and in this country;[1] but it appeared certain that Mr. Samuel Brown, the inventor of the gas vacuum engine, was among the first who applied the sub-marine propeller with any practical effect. The propeller used by him was on the principle of a regular screw, and consisted of two blades, which were affixed at an angle of 45° to a horizontal shaft, which was placed in the bow of the vessel, and he believed that it had also been used in the stern. This propeller was driven by a gas vacuum engine, of the nominal power of 12 horses, and actually caused a vessel of 60 feet in length, to move at the rate of six or seven miles per hour. M. Sauvage of Boulogne-sur-Mer, had also made several attempts at propelling vessels by the same means, and it was very gratifying to find that his services had recently been acknowledged and rewarded by the King of the French. It was, however, Mr. F. P. Smith who first rendered the screw propeller practically useful; for his perseverance, being aided by spirited capitalists, induced the building of the *Archimedes* steamer, the machinery of which was constructed by Messrs. G. and J. Rennie, in the year 1839. The results obtained from that vessel were well known, and caused the subsequent construction of the *Princess Royal*, the *Great Northern*, H. M. S. V. the *Bee*, the *Rattler*, and the *Dwarf*, formerly the *Mermaid*, a model of which was exhibited, with the various forms of screws used in the different experiments. The *Great Britain* not having yet been to sea could only be mentioned as a projected experiment. Figs. 1 and 2, Plate VII. are drawings of Mr. Smith's Double Threaded Screw adopted in the "Archimedes."

The *Dwarf* was 130 feet in length, 16 feet 6 inches in breadth, 9 feet deep, and was 164 tons burthen. The power of the engines was 90 horses, making from 30 to 32 strokes per minute. Friction wheels without teeth were first tried for giving motion to the propeller; but on account of their slipping and being very noisy, they were abandoned, and two spur mortice-wheels with wooden teeth, working into iron pinions, were substituted; the speed thus attained was from 150 to 160 revolutions per minute. The propeller was of cast iron, and was moulded in loam without a model, by means of iron templates cut to the required curve, which was formed from a solid cone revolving on its axis, during the perpendicular descent of a tracer. The advantage of this form over the cylindrical screw, was an increasing pitch, so formed, that while the propeller was rotating on its axis, the vessel was advancing and thus producing the least possible amount of "slip." This was exemplified by the form of the various models on the table. The principle point to be obtained in a screw propeller, was a form which should offer but little obstruction to the water, and yet act upon it so as to exert full power in propulsion; a large portion of a complete screw having no useful effect had induced the introduction of propellers with several blades; thus doing away with the useless part of the surface. A great portion of the centre part of the screw of the *Archimedes* had been cut away, but the effect had not been so good, on account of the arms of the screw obstructing the free passage of the water; the propellers with three arms were, he believed, preferred to those with a larger number. The *Dwarf's* propeller consisted of three curved blades, fromed on the conoidal principle, by variable curves approximating to angles of from 27° to 30°, and advancing at the rate of 7 feet 6 inches per revolution. It was 5 feet 10 inches in diameter, by 2 feet deep in the direction of its axis, and the area was about 15 square feet, which was nearly one-fourth of the area of the midship section of the vessel at light draught; but since the *Dwarf* had been transferred to H. M. service, the mean draught had been increased one foot, and the area of the midship section in proportion; her speed had in consequence been reduced from 12 to 11 statute miles per hour. Figs. 3 and 4, Plate VII. are drawings of Mr. Rennie's Conoidal Screw Propeller.

The following were the results of the trials made by Captain Sir Edward Parry, Mr. Lloyd, and Mr. Murray, at the measured mile in Long Reach on the 15th May, 1843:—

				Stat. Miles.	Mean.
1st	Experiment	against tide	..	9·890	12·145
2nd	ditto	with tide	..	14·400	
3rd	ditto	against tide	..	9·756	12·078
4th	ditto	with tide	..	14·400	
5th	ditto	against tide	..	9·890	12·203
6th	ditto	with tide	..	14·516	
	General Average		.. ..		12·142 Stat. Miles per hour.

The draught of water was 5 feet 8 inches.

The *Dwarf*, under the command of Lieutenant Nicholls, left Greenhithe in company with the *Hecate*, Captain Bower, on the 14th January, 1844, and reached Portsmouth on the following day; on the 20th she left Portsmouth accompanied by the *Hecate*, and although it was necessary to reduce the speed of the engines to 26 revolutions, in order to keep with her consort during the night, they reached Falmouth on the 21st, after an additional run towards the Scilly Islands, making a distance of 200 miles in 23 hours, having burned 10 tons of coals in 27 hours, from the time of getting the steam up. The two steamers left Falmouth on the 23rd, and reached Bear Haven on the following day, having run 135½ knots, or 156 miles by the log, in rough weather in 12 hours, and with bad coal; the engines making from 28 to 29½ revolutions per minute. She anchored during the night at Bear Haven, and on the following day, (the 26th,) reached Tarbert, the total distance from Falmouth being upwards of 400 miles.

Mr. Galloway said, that it was extremely difficult, if not impracticable, to arrive at the true amount of the "slip" of the propeller, because from its position abaft, or in what is termed the deadwood of the vessel, it acted in a current which was continually flowing to fill up the cavity, which would otherwise be formed by her progress through the water. The relative motion of a stream through the arches of a bridge, and in the wake of its piers, was an apt illustration of what unquestionably took place, (and from the same law,) in the case of a moving vessel. The screw, therefore, when acting in this current, might be compared to what would occur, if a paddle-wheel steamer was supposed to be moving in still water, while the floats acted in side canals, which flowed in the same direction as the vessel. Whether the benefits derived from this following current giving resistance to the screw, were not counteracted, by the deduction of so much of what is termed minus pressure from the ship itself, was not at present under consideration. His object was to show, that an accurate estimate of the amount of "slip" of a screw, could not be arrived at, until the rate of the following current, was first ascertained. That the "slip" must be much greater than Mr. Grantham assumed, would, he thought, be admitted, both from the circumstance he had stated, and from the fact that screw propellers, when worked with the vessels at their moorings, invariably moved at a ratio at least equal to one-half the speed obtained when running. It was clear, therefore, that the "slip," which was dependent on the proportion of the resistance of the screw, compared to that of the vessel, must always exist in a degree; but that, it might in the screw, be reduced below that of the paddle-wheel, was evident, because in the best modifications of wheels, or where the immersed segment was small, the paddle must turn in the water, in effecting a change of position from its angle of entrance to that of its emersion, and this unavoidable angular action, even when the upper edge of the float coincided with the rolling circle, was still so much "slip" inevitably encountered; this "slip" too became very considerable when the vessel was in a sea-way; but the "slip" of the screw decreased with its magnitude, and in the like proportion, its action approached that of a screw moving in a solid. It appeared, therefore, to him, that if the "slip" was small, the spiral or increasing pitch, would be a disadvantage, because a true screw would under those circumstances create little or no disturbance; while the spiral in that case, would have the contrary effect, for the same reason that a helix would pass with facility through a solid, in which a spiral or untrue thread would become fixed, or would move with difficulty. In the absence of all "slip," or in so small a slip as Mr. Grantham assumed to have taken place in his experiments, the effect of a propeller with an expanding pitch, would be like that of a curved plate, moving through the water in a right line; while the true helix would have acted like a flat plate moving in the direction of its own plane; that is to say, the opposing forces would merely consist of edge resistance and surface friction, which were common to every kind of propeller. The advantage too, which was assumed to arise from this spiral propeller, merely affected the question of magnitude, for it was clear that, whether the screw acted upon a large body of water at once, or gave a second impulse to a lesser quantity, the result would be similar, as to the sum of the effect upon the vessel. It was true that in certain kinds of fish (he would instance the electrical eel), the impulse produced by the ventral fin, was by an increasing spiral, the length of the curves becoming greater towards the tail; yet it appeared probable, as we could only see this eel in confinement, that the peculiarity he alluded to, was only developed in producing a change from rest to motion, for which it was well adapted (because the "slip" was great and the progress small,) and that when in rapid motion, it was probable, that the fin acted in a true spiral.

Mr. Rennie stated that the "slip" of the screw of the *Dwarf* was from $\frac{1}{8}$th to $\frac{1}{9}$th. That with respect to the general question of ths "slip," he conceived that it depended upon the comparative resistance between the vessel and the propeller. The case was similar to the immersed plane surfaces of the paddle-wheels of a steamer and of the vessel itself; the resistance of the midship section was reduced by the forms given to the fore and after bodies, which gave the vessel what might be termed more "mobility." According to the experiments of Mr. Peter W. Barlow, read before the Royal Society, May 29th, 1834,[3] the "mobility" of several of Her Majesty's steamers was found to vary from $\frac{1}{15}$th or $\frac{1}{24}$th of a plane surface, equivalent to the area of the midship sections; or in other words a plane float

[1] The dates of the experimenta on screw propellers are nearly in the following order:—

Baron Seguier	1792	Cummerow	1828
Fulton	1796[2]	Sauvage	1832
Shorter	1802	Woodcroft	1832
Trevithick	1815	Ericson	1836
Milliogton	1816	Smith	1836
Lowe	1817	Lowe	1838
Whytock	1819	Huot	1839
Perkins	1824	Rennie	1839
Brown	1825	Blaxland	1840
Woodcroft	1826	Carpenter	1841

[2] In a letter to Dr. Cartwright, dated Parls, February 16, 1798, Fulton says, "I have just proved an experiment on moving boats, with a fly of four parta, similar to that of a amoke-jack, and I find this apply the power to great advantage, and it is extremely aimple."

[3] "An Investigation of the Laws which govern the motion of Steam Vessels, deduced from Experiments, by Peter W. Barlow, C.E." Phil. Trans., 1834, p. 309.

of 1 foot square was equivalent to the midship section of the vessel, of which the mobilities were from $\frac{1}{15}$th to $\frac{1}{24}$th. There could be no doubt, that the improvements in the forms of the modern vessels, would have produced even less resistance, and he believed that it might now be taken at from $\frac{1}{30}$th to $\frac{1}{40}$th, so that consequently a less area of float or propeller, would suffice to overcome the equilibrium and produce less "slip."

Mr. Smith, of Deanston, observed, that the screw with three blades, which had been used in the *Dwarf*, seemed calculated to produce the best effect. The opening towards the centre of motion, by reducing the arms of the screw blades, as far as the requisite strength would allow, was judicious, as from the comparative slowness of the rotative motion towards the centre, little propulsive effect was produced; whereas the resistance to onward motion, by the arms, if they had not been reduced, might have been considerable; besides, if the arms were in the part broad, there would have been greater tendency to produce centrifugal action on the water. The gradual alteration of the angle of the blade, to the axis of the screw or onward path of the vessel, was also judicious, as it afforded a greater onward action of the blade at the entrance, whilst it gradually curved round to nearly a right angle with the path, so as to leave the water without causing any revulsion; it had thus an action in some respects similar to that of the tail of a fish. The salmon, when it "made a run," put down all its side fins, and solely by the oblique action of the tail, was propelled forward with great force and speed, to which the flexibility and form of the tail, and more especially its curving form to accommodate its leaving the water without causing revulsion, principally contributed. Some years ago, Mr. Smith had made experiments with fans for blowing air, and so far as he could recollect, the form of greatest effect, much resembled in principle, that of the propeller under consideration.

Mr. Farey said, that in order to continue the series given by Mr. Rennie, of steam vessels, which had been recently constructed with screw (or rather oblique-acting) propellers revolving under water, it would be desirable that the meeting should have the particulars of a vessel called the *Napoléon*, which had been built at Havre by M. Norman, and fitted with engines and machinery constructed in this country by Mr. Barnes. Whilst at Havre last summer, Mr. Farey had very minutely examined that vessel, and he considered it equal to anything that had yet been executed of the kind, and a fair specimen of the perfection to which that mode of propelling, had (up to the present time) been brought for sea-going vessels. Mr. Barnes and M. Norman were well known in their respective departments, aud they had been accustomed to co-operate during some years past. The engines which had been made and sent by Mr. Barnes to France, and fitted in vessels constructed by M. Norman had, in most cases, paddle-wheels, with moveable or mechanical paddles, on the plan introduced by M. Cavé, which possessed a decided advantage over ordinary paddle-wheels: the loss of power occasioned by the paddles entering and leaving the water too obliquely, being much diminished. In comparing the performance of the *Napoléon*, with vessels fitted with those mechanical paddles, there was less effect produced by the oblique acting submersed propeller, when considered merely as a mode of employing a given amount of power, to propel a given vessel through the water in a calm; but if the same power, as the engines of the *Napoléon*, had been applied with mechanical paddle wheels at the sides of the vessel, (such as Mr. Barnes had been accustomed to construct,) the vessel would have had more speed in calm weather and smooth water, than had been attained by one revolving propeller, with oblique acting blades, applied under water at the stern; and it was possible that a greater amount of speed might have been attained, even with well-proportioned common paddle wheels. Nevertheless, the submersed propeller at the stern, admitted of the use of sails, in concert with steam power, or in lieu of it (when the wind was strong, and in a tolerably favourable direction) with much greater advantage than could be done in steam vessels, with the ordinary or even mechanical paddle wheels, although the latter were well adapted for acting in concert with sails, because they would perform well, when the paddles were either deeply, or slightly immersed. The proper and most advantageous action of ordinary paddle-wheels was very greatly impaired, by variations of immersion; the mechanical paddles (when properly proportioned) were less influenced, and the submersed propeller still less; in fact, being wholly under water, at all times, its action did not appear to be sensibly affected by any such alterations of the depth of its immersion, as were likely to take place in the roughest waves, or the greatest variations of draught. When all circumstances were considered, it might be safely concluded, that vessels fitted with revolving submersed propellers, would answer well for making regular sea voyages, either in winter or summer; and on an average, he thought, that their passage would be performed at least as well (if not better) than those of any steam vessels now in use, and with an economy of fuel, arising from such vessels making a more advantageous use of their sails, and less use of their engine power.

M. Norman, in reply to questions from Mr. Rennie, regretted that his slight knowledge of the English language, not only precluded him from fully comprehending the narrative of the paper, and the statements of the several speakers, but also rendered it obligatory that he should communicate to the meeting in French, the few remarks which he could not withhold, after the pressing notice of the chairman. Many experiments had been made in France, with screw propellers by numerous inventors, as far back as the latter part of the 18th century, and by M. Cavé and others at recent periods, but the most extensive experiment was that of the *Napoléon*, for which Mr. Barnes had constructed the steam engines and machinery in England, and which he might be allowed to say had given complete satisfaction. The *Napoléon* was built at Havre, and launched at the latter end of 1842, for the service of the French Government Post Office in the Mediterranean. The vessel was built of oak timber, copper fastened and coppered. Its dimensions were as under:—

	Metres.		English. feet.	in.
Length of vessel from stem to stern . .	47·5	=	155	8
Ditto at the surface of the water . .	45·2	=	148	6
Extreme breadth	8·5	=	27	8
Ditto ditto at the surface of the water .	8·32	=	27	4
Draught of water when light loaded, abaft .	3·6	=	11	10
Ditto ditto forward .	2·26	=	7	5
	Sq. metres.		Sq. ft.	
Area of the midship section, at the above draught of water	13·4	=	144	
Ditto of the surface in contact with the water, occasioning friction	401	=	4320	

The revolving propeller, was fixed in a space or opening abaft the usual stern-post, (to which, in an ordinary vessel, the rudder would be hung,) and withinside another stern-post, which was erected on a prolongation of the keel, farther aft, for sustaining the rudder, so as to leave a space between the two posts, for the reception of the propeller. The centre of the propeller was (1·82 metre=) 6 feet beneath the surface of the water; its diameter was (2·28 metres=) 7 feet 6 inches, and the highest point of its periphery was 2 feet 3 inches below the water line, when the mean draught of water aft was about 11·82 feet. Four propellers of the same diameter, but of different forms, were made, in cast iron, under the direction of Mr. Barnes, and were tried with various success during the past year. The propellers had been altered several times, and it was found that within certain limits, by cutting away the ends so as to shorten the length of the screw, (which had also the effect of diminishing the surfaces of the blades,) the speed of the vessel was increased, and the vibration was reduced; a portion of this effect had however been attributed to using four arms. A propeller with three blades, occupying the whole of the circle, was first tried; others which presented less central surface answered better, and the best, which was still in use, had four blades, which occupied $\frac{6}{10}$ths. of the area of the circle, when viewed in the direction of the axis, leaving $\frac{4}{10}$ths. of that area vacant, for the free escape of the water between the blades, whose obliquity was such as to produce an advance of (3·12 metres=) 10 feet 3 inches in a revolution. The steam engines were nominally of the power of 65 horses each,=130 horses together: their cylinders were 45 inches in diameter, their pistons making usually from 27 to 28 double strokes of 3 feet 6 inches in length per minute. The motion was communicated to the propeller by a spur wheel of 126 teeth, working into a pinion of 29 teeth, which gave nearly $4\frac{1}{3}$ revolutions for each stroke of the engine, or about 120 revolutions of the propeller per minute. The ordinary speed of the vessel, without any sails being used, was 10 knots or $11\frac{1}{2}$ statute miles per hour. She had three masts of considerable height, the rigging being that of a brig forward and that of a schooner at the main and mizen masts, with as great an extent of canvass as would be used in any sailing yacht. When the wind was favourable and the sails could be used, the speed increased to 11 or 12 knots per hour. After a series of experimental voyages, the vessel had gone to her station in the Mediterranean, where she was now in constant service, and had gone through some rough weather with great success; her motion was described as being remakably easy, she rolled very little, steered better than ordinary vessels, for the propeller appeared to give increased effect to the rudder, and the propeller had never been observed to show itself above the water even in the heaviest seas, when the pitching was at its maximum. Plate VII. Figs. 5 and 6, are drawings of the *Napoléon* Screw Propeller.

Mr. Galloway remarked, that the properties of a screw with an increasing pitch, had been slightly investigated by Tredgold, in his work on the Steam Engine, p. 310, so early as 1827. The author had briefly referred to the subject of screw propellers, and had given some logarithmic calculations of their properties, from which he drew the conclusion, that the true screw could not be carried beyond a single convolution, with any good effect; whereas by a progressive increase of the pitch, the propelling effort would be continued, until the spiral became expanded into a straight blade parallel to the axis. It was Mr. Galloway's opinion, that more was to be expected from ascertaining the best position for placing the screw, with reference to convenience and effect, than from any slight change in the form or the number of the blades of propellers.

Mr. Samuda said it appeared to him, that the action of the propeller tended to drive the water from it at a right angle with its surface, and as it formed a diagonal line with the keel of the vessel, some portion of the force was not efficiently used for propulsion; he conceived therefore that by a judicious arrangement of shrouding, round the extreme circumference of the propeller, the diagonal currents of the water, might be diverted into a direction parallel with the way of the vessel, and thus cause the whole of the reaction to become available for propelling. Such an arrangement would enable propellers of a much coarser pitch to be employed, and their speed being reduced in proportion, they could be more readily driven directly by the engine, without the intervention of bands or gearing.

M. Norman said, that M. Cavé had tried a series of experiments on screws of various forms working in cylinders; and also, he believed, with shrouding on their extremities, and he understood that no advantage had been found to result from such modifications.

Mr. Cowper presented an instrument, which he had exhibited when the aerial machine was incidentally mentioned; it consisted of a fan composed of three or more blades, set at a regular curve upon an axis. When this axis was placed vertically in a socket, and a rapid rotary action communicated to it, the fan rose in the air to the height of between 100 and 150 feet. On reversing this fan and using the same propelling force, it would not rise at all. This fact evidently showed that the action of the curved fan upon the air, or of the propeller upon the water, was like that of a screw in a solid, every part of the surface of the blade of a well-formed propeller producing its portion of effect. Mr. Cowper directed attention to the contrary effect produced by two fans of similar areas, whose arms were, in the one case, mere planes set at an angle with the axis, and in the other, blades forming part of, and being placed at a given curve around the axis. If it were supposed, that the surface of each blade was divided into a given number of equal parts, when the fan, of the former or angular shape, was set in motion, the first part impinging on the air, communicated a movement to it, and the second and succeeding parts finding no resistance from the disturbed fluid, the body had no tendency to rise; but in the latter, or curved shape, the second and succeeding parts, tended to overtake and act upon an undisturbed fluid, and thus had a tendency to rise upon an irregular inclined plane, described by its gyration through the air. By the law that the resistance increased as the square of the velocity, he conceived, that in adapting propellers to vessels, their dimensions should be proportioned, not only to the area of the midship section, but also to the speed of the engine. At the same time, the consideration of the form of the blades was very important. In experiments with the revolving fan instrument, he found, that although on all occasions, the same rotative force was applied, a fan with three arms, whose united areas were 3·721 inches, when set at a given angle, did not rise freely; the same form and area, when set to a proper curve, rose to a very considerable height; but when a fan of twelve arms, formed from a circle or disc of 28·274 inches area, divided into twelve arms was set in motion, it would not rise at all. With other fans, of intermediate forms, areas, and curves, various results were obtained, which were curious problems for engineers interested in the construction of propellers.

Mr. Grantham expressed his pleasure at finding his paper had so much excited the attention of the meeting, and he hoped it would be followed by communications from members who had devoted more time to the subject; for instance, the numerous experiments made by Mr. Brunel and Mr. Guppy, before deciding on the use of the screw-propeller for the *Great Britain*, and those made in the presence of the Government Engineers, Mr. Lloyd and Mr. Murray, on board the *Bee*, the *Rattler*, &c., would be very interesting. Mr. Grantham exhibited a diagram of the propeller used on board the *Liverpool Screw*, figs. 7 and 8; composed of four blades with broad shovel ends, fixed at a mean angle of 45°. This form, although very successful in this case, could not, he thought, be recommended for large diameters. The results of his observations induced him to think, that the blades of a propeller should not be more than four feet apart; he would, therefore, advise the adoption of Ericson's form, and mode of construction, which he considered the best that had hitherto been introduced; the ring within the arms permitted any number of blades to be affixed, and a large area of acting surface, judiciously disposed, could thus be obtained. He objected to propellers with three arms, chiefly on account of the small amount of surface obtained. As to the "slip," which Mr. Galloway had so ably commented upon, he was aware that it did exist in all cases, but he was of opinion that the amount was exaggerated; he had not only made accurate experiments with Massey's log, but being repeatedly in a small boat, which was towed close astern of the *Liverpool Screw*, he found that there was very slight disturbance of the water, and that there was not any depression behind the blade of the propeller on entering the water; this could be easily observed, as a portion of the upper blade was always above the surface. It had been anticipated that this arrangement would, with so short a vessel as the *Liverpool Screw*, have caused a constant tendency to bear over in one direction, but not the slightest disturbance of the steering was perceived, and the vessel's course seemed to be quite as straight as it would have been with paddle wheels. Mr. Grantham wished it to be understood, that his object in bringing forward the account of the *Liverpool Screw*, was not so much to cite that vessel's powers, as to point out the feasibility of working propellers at a slower speed, and that condensing engines could be applied with advantage, avoiding the bands and gearing, which had hitherto been found so objectionable.

Mr. Braithwaite was of opinion that where deep immersion was not practicable, two propellers would be preferable, in order to prevent any disturbance in the steering. Captain Ericson had adopted that plan in boats of light draught. Mr. Braithwaite then presented a drawing of the midship section of the *Princeton* American frigate, showing the elevation of Ericson's engine on board. The vessel was 164 feet long, with a breadth of beam of 30 feet; the depth of the hold was 22 feet 6 inches, the draught of water was 17 feet 6 inches, and the burthen about 700 tons; the propeller was 14 feet in diameter, with six blades, and made from 32 to 36 revolutions per minute, at which rate the vessel's speed was stated to be nearly 14 miles per hour. The engines were about 400 horses power; they were of peculiar construction, having two steam cylinders or chests, containing vibrating pistons or flaps, with cranks upon the ends of the suspending pivots; both these were coupled by connecting rods to a main crank on the driving shaft; the length of these cranks being so proportioned, that their alternate vibrations should give a rotary motion to the main crank, and thus act directly upon the propeller, without the intervention of bands or gearing.[5] This principle was tried successfully in the year 1839, by Ericson, on the Thames, in a tug-boat named the *Robert Stockton*,[6] after the projector, who had succeeded in introducing the system to the American navy, and now commanded the *Princeton*. The boilers of the *Princeton* were constructed for burning Anthracite; the whole of the machinery was so placed as to be out of the reach of shot, and the vessel was ship-rigged, so that by unshipping the screw, she could be rendered as effective as any sailing vessel, with a fair wind, or in case of accident to her machinery. Mr. Braithwaite hoped in a short time to bring before the Institution, an account from Captain Ericson, not only of the *Princeton*, but of several of the other vessels he had fitted with his engines and propellers, since his residence in the United States. Figs. 9 and 10, Plate VII. are drawings of Ericson's Screw Propeller.

Mr. Galloway said, that during the experiments with the *Archimedes*, a proof had been elicited that the "following current" had a very considerable effect on the action of the propeller. During one of the trials the vessel was backed astern, when it was found, that the speed of the engine increased three or four revolutions per minute, while the speed of the vessel appeared to have diminished. This experiment was, he contended, conclusive as to the fact that the "slip" was greater than would appear by looking merely at the rate of the vessel compared to that of the screw. He did not, however, think that the "slip" ought to be considerable, with a well-constructed propeller. Increased magnitude in a screw, would have the same effect in creating resistance, as increased magnitude in any other submerged body. The utility of the increasing pitch, however, was involved in, and solely dependent on, the amount of "slip" which would be found to be attended with the least disadvantageous results in other respects; and here Mr. Galloway would observe that Mr. Cowper's experiments with the revolving fan instrument confirmed his view; for it must be recollected, that there the "slip" was much greater than the rate of ascent; the only condition being thus developed in which the utility of an increasing pitch could be contended for. The advantage of turning the propeller by the direct action of the engines, was generally acknowledged. The method of driving it was nearly the only problem remaining for solution, and that difficulty being once overcome, screw-propellers must necessarily, from their vast advantage over paddle wheels, in every respect but that, be universally adopted.

Mr. Hawkins said, that about the year 1825, Mr. Jacob Perkins adapted to the stern of a canal boat, a propeller of about 25 feet in circumference, which might be described as resembling two sets of windmill vanes, the solid axle of one set revolving within the hollow axle of the other, the two axles being turned in contrary directions, and the dip of the blades being about half their radius. The propulsive force was stated to have been very effective; the experiments, which were put an end to by the breaking of part of the engine, were never renewed, in consequence of disputes among the patentees; but he considered that propeller as the best that had hitherto come under his notice, and he had endeavoured to draw attention to it by reading an account of it, at the meeting of the British Association at Cork, in 1843.

Mr. Grantham stated, that in order to test the comparative effect of the expanding pitch, Mr. Woodcroft had adapted to the stern of a vessel, two screws of equal area, one being of a regular, and the other of an expanding pitch; they were connected by a cross shaft, and were worked by manual power, and it was found that the vessel always yielded to the impulse of the expanding pitch propeller, and was turned by it from the direct course. With respect to the advantage of a large amount of surface, he had found that the action of the propeller of the *Liverpool Screw*, which had been enlarged three times, was decidedly improved by the alterations; the speed of the engines always remaining the same.

Mr. Galloway said, that the surface of the propeller of the *Liverpool Screw*, might probably have been too small at first, and therefore each increase would naturally improve its effective power. The area of the propeller should be in proportion to the body to be moved; this law was common to screw-propellers and to paddle-wheels.

The President expressed the gratification he felt at the useful discussion, which had been raised on so interesting and novel a subject as the screw-propeller, which had become one of such importance in steam navigation, that the Government had directed the serious attention of their officers to it; and he trusted that the examination of this question, like that of the action of Cornish engines, at the meetings of the Institution, would materially tend to its elucidation. As soon as any new and really useful invention was matured, and brought sufficiently into use, to enable its merits to be calmly discussed, it was one of the main objects of the meetings, to examine it, and he hoped that in a short time a detailed account of the Atmospheric Railway, would be submitted by Mr. Samuda, for the consideration of the Institution.

Oxydation of Iron.

Mr. Perkins stated, that on a recent examination of the *Napoléon* at Mar-

5 Vide Mech. Mag., vol. xxxii., January, 1840, p. 290. 6 Ibid., vol. xxx., January 1839, p. 281.

seilles, the cast iron of which the propeller was composed, was found to have undergone considerable change, and to have become so soft, that it could be cut with a knife.

Mr. Grantham believed, that circumstance was owing to the cast iron propeller, working too near the copper sheathing of the vessel. Iron vessels would not be liable to that objection. The amount of oxydation was apparently increased, by the cast iron remaining in a state of rest; now as screw propellers were usually in rapid rotation, and were also generally so constructed that they could be unshipped, they could be painted and preserved from any injurious amount of external corrosion, although a chemical change might still be induced, when the cast iron was in contact with copper.

General Pasley had observed, in the metal raised from the wrecks of the *Edgar* and the *Royal George*,[7] that the cast iron was generally soft, and in many instances resembled plumbago; that when small pieces were cut from any of the iron guns, or that these pieces were pounded in a mortar, heat was evolved, but after two or three days the metal cooled again! some of the shot which had been found had burst into several pieces, under this heating action.[8] The wrought iron was not so much injured, except when it was in contact with copper, or gun-metal; some of it appeared to have undergone an unequal action, and presented a reticulated surface, as if the softer portions had been destroyed, leaving the harder fibres uninjured.[9] Those portions of the wrought iron, which were used by the smiths in the Dockyards, were declared to be of a better quality than any modern iron. Neither the copper, nor the gun-metal, were much acted upon, unless they were in contact with iron.

Mr. Cottam had observed, with great attention, the iron guns which were brought from the *Royal George* to the Tower; when they arrived, they were soft, and could be easily cut with a knife;[10] but when he examined them some time afterwards, the metal had resumed its original hardness. This was frequently the case with pump-trees, which had become soft, from immersion in mineral water, but on being taken out and laid aside for a time, they became hard again.

Mr. Galloway stated, that this spontaneous development of heat by cast iron, which had been long immersed in salt water, had been frequently observed. A striking instance of this kind occurred at Woolwich, when an attempt was made, to preserve the copper sheathing of vessels from corrosion. Sir Humphrey Davy suggested to the Admiralty, that the decomposition of the copper sheathing could be neutralized, by the application of tin, zinc, or any other easily oxydable metal; the plan was tried on several vessels, by attaching to them zinc plates, and the protection was so perfect, that the ships' bottom became covered with barnacles and weeds. Cast iron was then substituted, on the supposition that the partial oxydation, which would be permitted by the iron, would prevent the fouling of the copper, but that the ordinary rapid destruction would be modified.[11] The *Magicienne* frigate, having been at sea for some time, with cast iron protectors, was docked at Woolwich for examination; when it was found, that the protection instead of being partial, had been local, for while the greater portion of the surface of the copper was oxydized as usual, the parts contiguous to the iron had been perfectly protected and were covered with barnacles. Mr. Marsh (of the Ordnance department) broke off some small pieces of the iron, which presented the appearance of plumbago, was easily cut, was greasy to the touch, and left black marks upon paper;[12] in a few minutes the heat became so great, as to ignite the paper in which the pieces were enveloped. The development of heat, was generally supposed to proceed from the rapid absorption of oxygen by the mass, on being brought into the air, from the water, where it had already received a certain amount of oxygen. The production of heat, being in this case, governed by the same law, as that under which animal heat, and the heat of combustion, were developed.

Mr. Homersham said, that the water of the Thames, up as high as Richmond, had the same effect as sea-water, in rendering cast iron soft.

Mr. Simpson believed, that if hard grey cast iron with a good surface, was used for castings, which were subjected to the action of sea-water, but little injurious effect was to be dreaded; he was so convinced of the fact, that he was about to use cast iron extensively for piles. He hed recently examined some cast iron piles, which had been in sea-water for 16 years, without any detrimental effect being produced.

Mr. Jordan thought that it was very desirable, to mark the difference between the composition of brass, and the alloy of copper and tin, used in casting guns. With brass, in which zinc formed a part of the composition, it was probable, that the iron would have been acted upon with less energy, because it was more electro-negative than zinc; but the gun-metal acted positively upon the iron, and apparently, altered the substance.

Mr. Braithwaite said, that the proportions of the mixture, used for the bearings of machinery, were usually 92 per cent. of copper and 8 per cent. of tin.

The President said, that although the discussion had taken a direction which had not been anticipated, and was foreign to the original subject, he had not attempted to lead it back again, because the question of the causes of the chemical change in cast iron, in certain positions, and the means of preventing it, was of the utmost importance to engineers, particularly as in all modern works so much cast iron was used.

PUMP VALVES.

(From the Minutes of Proceedings of the Institution of Civil Engineers, with Engravings, figs. 11 *to* 13, *Plate VII.)*

Mr. J. B. Jordan exhibited and described a model, showing the principal pump valves, used by mining engineers. Mr. Jordan stated, that the model before the meeting, was intended to illustrate mining machinery, and was one of a series, now in progress of construction for the Museum of Economic Geology. There were eight differently constructed valves in it, each surmounted by a glass valve-chamber and pipe; the large central pump, served to circulate the water through all the valves simultaneously, so as to show their comparative action; the water was then discharged from the collar launders over each valve, into that at the head of the pump, so that by repetitions of the pump-stroke, the circulation through the valves might be kept up at pleasure.

The valves shown in the model might be divided into four classes:—1st. Those in which no attempt was made to counteract, or avoid the violence of the beat, or concussion, on closing the valve. 2nd. Those in which that evil was reduced, by dividing the horizontal area of the valve, into several parts. 3rd. Those in which the same object was attained, by reducing the horizontal area of the moving parts of the valve. 3th. That in which the concussion was reduced to any desired amount, by making one side or portion of the column, to a certain degree, balance the other.

Valves of the first class were so well known, that they required little description; they were the common pump clack, moving on a leather joint, and having generally a very small water way—the improved metal joint clack, in which the water way was much increased—and the 'button clack,' or as it was called in Cornwall 'hcantlebury's clack,' which was a disc of metal with a central spill or stalk, which rose and fell in a guide. Of these valves, the second was considered the best, inasmuch as it had the largest waterway (some portion of which was direct), and it was free from some minor objections, to which the leather-jointed clack was liable. This valve was therefore in very common use in mine pumps, where the area of the pump and the height of the column, were not such as to produce any serious inconvenience from concussion, in closing the valve.

In the second class of valves, the injurious effect of a violent beat was somewhat avoided, by the ingenious expedient, of dividing the valve into several rings, or segments. The simplest of this class, was the well known 'butterfly valve,' in which two semicircular parts opened on a central hinge of leather, and the beat was divided into two parts; but as those closed at the same time, the concussion was principally reduced by the fall not being so great. The next valve was composed of several triangular pieces, opening on leather joints, from the circumference of the valve seating; it had been much used by Capt. Reed, of the Mold Mines, Flintshire, and was reported of favourably, by several other mining engineers. It closed with very slight concussion, on account of the are of each part being small, the base of each triangle forming the joint, while the water way was large, and nearly all direct, admitting the mass of water to pass forward, in line parallel to the side of the pump. In the other valves of this class, no leather was used, a circumstance which rendered them more applicable to large pumps, where continuous working was of the utmost importance, particularly in the case of deep mines.

The two annular valves shown, were invented by Mr. Hosking of the Perran Foundry, and Mr. Jenkyn of the Copper-house Foundry, (Cornwall). The first of these, was composed of a series of rings working on a vertical spill, each ring having its seat on the one beneath it; (see figs. 11 and 12); there rings have different areas, and fell in succession through a small space, compared with that which would be requisite, if the valve were in one piece,

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7 The "Edgar" was sunk in 1711, and the "Royal George" in 1782.

8 A similar action was observed, in the cast-iron shot raised from the "Mary Rose," which was wrecked in the reign of Henry VIII.

9 This appearance was also noticed by Mr. Mallet, and is mentioned in his paper, "On the Corrosion of Iron, &c."—See "Journal," Vol. VI., p. 386.

10 Vide Trans. Inst. C.E., Vol. I., p. 204.

11 Vide Mr. Wilkinson's paper "On the Sheathing of Ships," "Journal," Vol. V., p. 169.

12 In Dr. Thomson's "Annals of Philosophy," are the following remarks:—"Dr. Henry states, that 'cast iron having been in contact with muriate of lime, or muriate of magnesia, most of the iron was removed. The specific gravity was reduced to 2·155, and what remained was chiefly plumbago, and the usual impurities.'

"Dr. Brande found that 'a cast iron gun had undergone a like change, from being long immersed in sea-water. To the depth of an inch it was converted into a substance, having all the external character of plumbago. The component parts were—

Oxyde of iron	81
Plumbago	16
	97

"Mr. Mushet, in his work on 'Iron and Steel,' states, that wrought iron sometimes, though very rarely, undergoes the same change.

"Professor Daniel, in the 'Quarterly Journal of Science,' Vol. II., p. 290, says 'I am inclined, under all the circumstances, to believe that the triple carburet, as it is at first obtained, consists of iron and silicum in the metalline state, united to carbon. When brought into contact with oxygen gas, the metals become converted to protoxydes, giving out heat, without separating from the carbon.'

"By analysis, he found the substance to consist of—

Red oxyde of iron 7·0 = 6·2 black oxyde
4·9 silex
11.2 carbon

"The same author states an important fact, bearing on the present question, namely, 'that it took three times as long to saturate an acid, when it acted on white cast iron, as when it acted on the grey kind.'"

so that the concussion was much reduced, while the water way was increased; but the latter being all lateral, it was requisite to have a large valve chamber. The beats of this valve were formed of tin. Mr. Jenkyn's valve, differed in construction from the one just described, in having the rings connected with each other by shackle-joints, instead of their working on a vertical spill; the mode of forming the beat was also peculiar; it was composed of two thicknesses of leather, between which, wedges of wood were driven, into a groove, cast for their reception in the rings; these materials were so placed, that the edges of the leather, and the end grain of the wood, might form the striking surface of the beat, after being turned off in the lathe.

In the third class of valves, which avoided concussion by reducing the horizontal area of the moving parts, were Messrs. Harvey and West's, and Mr. Hosking's double-beat, (See *Journal*, 1840, vol. iii. page 41 and plate 1,) and Mr. Darlington's cylindrical single-beat valves. The first of these was a modification of the double-beat steam valve, so long used in the Cornish engines; the second named was similar in principle, and was only slightly different in construction. They were both good valves, each giving large lateral water ways, and therefore they required valve chambers of corresponding size, to ensure their perfect action. Mr. Darlington's cylindrical single-beat valve, was contrived for a large set of pumps under his management, at the Alport Mines (Derbyshire.) The rising column of this pump, was 38 inches diameter and 22 fathoms in height; it was therefore desirable in such a pump, to reduce the concussion, as much as was consistent with the power of closing the valve in proper time; this was accomplished, by causing a cylinder to rise over a metal-ring packing in the seating of the valve, so much, as to give a large lateral water way under the beat, formed by the bottom of the cylinder. This valve was found to act well, but it required a very large chamber for the water to enter; the reason for adopting one, instead of two beats, was to avoid or lessen the leakage, caused by chips getting between either of the beats.

The only valve belonging to the fourth class, was that of Messrs. Palmer and Perkins, (See *Journal*, 1841, vol. iv. p. 335); it consisted of an elliptical disc, moving on an axis placed parallel with, and near to, the minor axis of the ellipse, and closing at a considerable angle, against the interior surface of a cylinder. In a valve so constructed, it would be readily perceived, that the concussion might be reduced to any extent, by bringing the working axis nearer to the geometric axis of the ellipse; because the force with which it closed, must depend on the difference of area, between the upper and lower portions of the disc. It possessed an advantage in the extent and character of its water way, over all the other valves described, nearly the whole of the water-passage being parallel to the side of the pump. On the other hand it was objected, that the axis would be liable to rapid abrasion, and consequently the valve would become leaky; but Mr. Jordan did not concur in the opinion, of that being an insurmountable difficulty, and he hoped that the valve would be tried, under circumstances which would put its merits to a severe test.

Remarks.—Mr. Taylor said, that the subject of valves for pumps had been so ably treated, by Mr. Homersham, in his paper, (which was read before the Institution last session, (See *Journal*, 1843, vol. ii. p. 42J,)) and in the discussion upon it, that there remained but little for him to say. He could not, however, allow the model, which had been exhibited by the permission of Sir Henry De la Bèche, to pass without a few remarks.

In Cornwall, after the improvements in steam-engines had made considerable progress, attention was directed to the more perfect construction of the pumps. The plunger was introduced about that period, and the merit of it has been claimed by different parties;[13] its use was attended with many advantages, and had now become almost universal. Some of the benefits derived from its substitution, for the common piston or bucket, had no reference to the subject of valves, and therefore need not be mentioned. In one point it was of great importance; for as the size of the water-way of the valves in the bucket, was necessarily limited by the diameter of the working barrel, an arrangement like that of the plunger pump, which permitted both valves to be fixed in seatings, of which the areas might be increased to any convenient extent, became the more desirable; it was therefore extraordinary that such tardiness had been exhibited, in taking advantage of such an obvious improvement, when the principle had been long known, and the loss of power, consequent on the former system was admitted. The model which had been explained by Mr. Jordan, showed how much the attention of engineers, had now been directed to the subject. In the discussion of Mr. Homersham's paper, Mr. Taylor had mentioned the advantage which had resulted, from the extension of the water-way of some large pump-work, by having two suction-pipes, or wind-bores, and thus doubling the passage through the valves. It appeared important, for all the valves that discharged the water laterally, that more space should be provided, round the seatings in which they were placed, and for want of that precaution, some excellent valves had not answered so well as they would otherwise have done. That which was invented by Mr. Darlington, to avoid some inconveniences in the use of the double-beat valves, would have been improved by an enlarged space around it. As mines increased in depth, and the volume of water became larger; as steam-engines came into use, having a rapid and sudden motion, as compared with that of water-wheels, which were formerly universally employed for pumping, a great inconvenience was felt, from the concussion in the columns of the pumps; this was occasioned by the beating of the valves upon their seats, and in pumps, of the diameter needful for draining some of the mines, this evil became very serious. Almost all the improvements in valves were made with that view; the division of the old butterfly valve into segments was an obvious first step; it had succeeded extremely well, and was still not much excelled. The annular valves of Hosking, Jenkyn, Simpson[14] and others, were based on the admitted principle, of dividing the falling clacks into several parts, that they should not rise so high, and that they might collapse in succession, and thus avoid concussion. Harvey and West's double-beat valve partook of that principle, but was stated to have the advantage, of presenting a small area, to be acted upon by the pressure of the column of water upon it. Darlington's valve, which was contrived to avoid the inconvenience, arising from the leakage, from both the beats of Harvey and West's valve, when any substance obstructed its perfect closing, presented also a small area for the pressure to act upon; but as it discharged the water laterally, it required an increased space around the seating.

The model exhibited a valve, introduced by Messrs. Palmer and Perkins, upon a principle, by which concussion might be considerably reduced, by bringing into action, a part of the superincumbent pressure, to check the descent in closing the orifice. This valve had not yet been tried in large pumps; but the opinions of practical men appeared to be in its favour.[15] In the construction of all valves, it was of importance, not only to attend to the points which had been mentioned, but also to their durability, and their facility of removal and repair. The actual cost of the valves was of little importance, when compared with the labour and hindrance in removing, or changing them, where the influx of water was great. Serious expense, and loss of time, were frequently occasioned by such stoppages, and the deeper parts of the mines, were exposed to obstructions, which were overcome with great difficulty, notwithstanding many ingenious and well-arranged contrivances, to render the process of repair easy and expeditious. Very powerful capstans and other means were provided for these emergencies, and as the labour of fifty or sixty men was sometimes required to work these machines, it would be easily conceived, how important it was, that such operations should occur as seldom as possible, and that the most perfect and durable construction should be aimed at.

Mr. Perkins observed, that although at the first view, a certain degree of resemblance might appear to exist, between Belidor's valve and the disc valve of Palmer and Perkins, there existed in reality, but little similarity between them. The former was placed horizontally, whether used as a clack or as a bucket; in all cases it required to be adjusted to a seating formed of reversed cones, like the ring of a steam throttle valve; and it was always attached to a packed bucket or piston. Whereas the latter worked at an inclination of about ¼ of the diameter of the pump; it was adjusted within the bored pipe without any seating; and it formed a piston without any packing. Its form being that of an oblique section of a solid cylinder, whose diameter was equal to the interior of the working barrel, and the line of its suspension being beyond the diameter, the areas of the two portions of its surface were unequal; consequently, there was more pressure on one side of the line of suspension, than on the other. By this extra amount of pressure, the disc was turned on its axis, allowing a free passage for the water, parallel with the sides of the pump. The closing of the lower valve on the return stroke was, for this reason, without noise or concussion. It was evident also, that as packing was not necessary for the disc piston, and as the rubbing surface of its periphery was very small, the friction must be greatly diminished. Messrs. Bramah and Robinson, made an experiment for comparing a pump, with a packed bucket and butterfly valves, with one having a disc piston; the diameter of both pumps was 10 inches, with a stroke of 8 inches, a lever of six to one, and a lift of water of 5 feet; it was found that the former required a force equal to 460 lbs., and the latter 196 lbs to complete a stroke. As regarded their duration; a disc pump 7 inches diameter, with a stroke of 8 inches, and a lift of 40 feet, drawing its water through 600 feet of suction pipe, rising in that length 28 feet vertically, and worked by a steam engine 26 strokes per minute, had been found, after working nearly night and day, at the Equitable Gas Works, during fifteen months, without repair, to exhibit but little appearance of wear in the piston, and both it, and the clack valve, were perfectly tight. As the subject appeared to interest the Institution, he promised to present, on a future occasion, a more detailed account of some similar pumps, with the actual results obtained.

Mr. Lowe corroborated the statement, of the efficiency and duration of the valve, used at the Equitable Gas Works; its friction was necessarily very

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13 The plunger was used by Sir S. Morland in 1683, for the force-pumps at the Machine de Marly.

14 The annexed engraving of a treble ring valve, fig. 13, is a section of Mr. Simpson's valve described by Mr. Homersham, in his paper of last session before referred to. It is a conical valve formed of rings, shutting down upon separate seatings, allowing a passage for the water both inside and outside the rings. Valves of this construction have been introduced at the Lambeth and Chelsea water works. The valve at the Lambeth works is 30 inches diameter, the perpendicular rise or lift when fully open does not exceed 1¾ inches. The clear uninterrupted area through which the water passes is more than two thirds of the whole area of the valve, the internal diameter of the seating being 27 inches. The valve at the Chelsea works is 43½ inches diameter, and the greatest height to which the rings of the valve rise, does exceed 2¼ inches.

15 A valve of a very similar construction is described in Belidor's "Architecture Hydralique," vol. iii., p. 221, as having been introduced by him in 1737, for the improvement of the water-works at the Pont Notre Dâme, Paris. The situation of the pivot of the valve, is described to be, at one-twelfth part beyond the line of the geometrical diameter of the pump-barrel.

small, for as it formed at the same time both piston and valve, and in the return stroke, from its nearly vertical position in the working barrel, the parts in contact, were reduced to the area of the points of the minor axis of the disc, the friction was in proportion to that area. As a seat valve, he thought it less liable to become defective, than any other, as it was scarcely possible for any sand, or other foreign matter to lodge upon it, and the valves which he had seen at work did not show any symptoms of being so affected.

Mr. Farey said, that it was an axiom relative to steam engines, that their action became more perfect as their size increased, but that this could not apply correctly to pump valves; for as their size had augmented, the difficulties in their construction had been more fully developed. With small valves it had been considered, that the vertical height of the lift of a clack, should be one-fourth of the diameter of the barrel, but it was evident that rule could not be adhered to with large valves. Other forms, allowing a free passage for the water, had therefore been resorted to, and with great success, but there was still room for improvement. He had a high opinion of the valve, which had been used originally by Messrs. Boulton and Watt, and which was called, from its form, the 'Bishop's cap,' It consisted of four triangular flaps of leather, hinged on the periphery of the valve and meeting in the centre; the number of these flaps had been, he believed, increased to six and eight for very large sizes, and they afforded a very free passage for the water. Much yet remained to be done, in improving the valves of the air pumps of steam engines, especially in adapting them to the speed of the engine, so as to avoid the loss of power, consequent on drawing, or forcing the water through contracted passages.

Mr. Jordan was happy to find his opinion of the disc valve corroborated. He had viewed it almost entirely as a clack valve, on which the whole weight of the column of water would rest, and for that purpose he thought it particularly suited. He could not agree in the opinion that chips of wood or other substances, would be liable to accumulate near the axis, and render it leaky. He thought, on the contrary, that it would clear itself very easily, and as the faces or seats were vertical, it was not possible for anything to rest upon them. It had been urged that these valves were difficult of construction, and would scarcely be found tight, under a very heavy column. He conceived however, that with modern machinery, there could not be any trouble in making them perfectly accurate, and that the simple addition of a beard of leather, fixed on the upper side of the longer portion of the valve, and to the seating at the shorter part, would render the valves quite tight.

Mr. Homersham observed, that any particular form and proportion of a valve, which enabled it to answer well, in one situation, was no criterion of its doing the same, under other circumstances; for instance, the suction and delivery valves, of the pump of a Cornish mine engine, required to be differently proportioned; as in order to follow the speed of the plunger, the water was obliged to move through the former, more rapidly than through the latter; for the velocity of the down stroke of the steam piston of a Cornish engine, was chiefly regulated by the portion of the stroke at which the steam was cut off, whereas its velocity in going out, was most usually adjusted by varying the period of the pause at the end of the stroke; although it was also somewhat governed by the number of strokes per minute, which were required to be made. Therefore, as the plunger always moved quicker in the former, than in the latter case, the velocity of the passage of the water through the suction valve (unless its area was increased), was greater than through the delivery valve, and the moving part of the valve, against which the water impinged, required to be heavier in the former than in the latter, to insure its closing, before the return stroke of the engine commenced. This had been pointed out in his paper on valves, which was read in the last session, and a rule was given[16] for their relative weights, which should always be in proportion to the velocity of the water passing through them; if this were not attended to, and they were both made of the same weight, the delivery valve would not open freely, and thus more weight would be required to carry the engine 'outside,' and the duty would be diminished. He was therefore of opinion, that every valve required to be adjusted expressly for the situation in which it was placed, and the duty it was required to perform.

Mr. Galloway drew the attention of the meeting, to a pump which was introduced by Mr. Jacob Perkins in 1820,[17] and was rewarded by the Society of Arts. The barrel consisted of four boards, nailed together, so that its horizontal section formed a square. The bucket-rod was enlarged to a broad end, intersecting the square diagonally; to this, two valves were affixed by leathern hinges. Their form was that of an isosceles triangle, the base of each being united to the rod, and the other sides resting, in an inclined position, against the inner sides of the barrel, filling the entire area. In the down stroke of the bucket, this form offered little opposition to the water, and was sufficiently tight for common purposes, with but little friction. Mr. Galloway subsequently constructed a pump with a wooden barrel, in which the valve was in one piece; the preponderating action, like that of the oval disc pump, was effected, by giving the barrel the form of a trapezium, the valve being suspended by an axis, which crossed it at the bases of the two unequal parts. Neither the trapezium valve, nor that of Jacob Perkins, were, he conceived, generally applicable; their utility would not extend beyond domestic purposes, or those countries, where the means of boring cylindrical barrels were not attainable. Mr. Galloway was of opinion, that the principal objections to the elliptical disc valve were, first, that as the axis of the valve, did not coincide with the minor axis of the ellipse, the spindle would either benp, on the valve being raised to a vertical position, or it would not fit the cylinder when it was shut; secondly, that there was no compensation for abrasion, across the minor axis, so that when the valve was worn, either by the friction of sand or from other causes, it would become leaky. Mr. Galloway then exhibited a form of valve, by which he submitted these objections would be obviated. If an ellipse was intersected diagonally, at an angle of 45° with the major and minor axes, and one portion was turned over, so as to produce a heart-shaped figure, when joined to the other portion by a hinge; it was obvious that these two leaves, when placed in a cylinder, would fill the cavity as the original ellipse had done; both the minor and major axes being at different angles. These leaves being supported from beneath by rods with ball and socket joints, the wear in any direction, would be compensated by the extension of the leaves, as their constant tendency was to become horizontal. The rocking rods, acting at points on the leaves, where the preponderance of surface was in one direction, enabled the water to open and close them, with that easy motion which was so much desired in heavy lifts.

Mr. Jordan wished it particularly to be understood, that he had directed attention to the disc valve, hoping that from its simplicity of action, it might be tried and found serviceable, for the clacks of deep mine pumps, of large diameter, and working under a column of from 10 to 50 fathoms in height. There was little doubt of the valve being tight under ordinary circumstances, and with short lifts, but when a heavy column of water, was allowed to rest upon a valve, the slightest inaccuracy was detected.

Mr. Homersham differed in opinion with Mr. Jordan, as to the applicability of the disc valves to deep mine-pumps. He conceived there would be a certain amount of difficulty, in constructing them so as to be perfectly tight, under a heavy column of water, and the spindle or pivot of the valve, would require to be of large diameter, to insure its being strong enough to bear the pressure. It was also necessary, for the perfect action of the valve of a pumping engine, that it should be closed, by the time the piston of the pump arrived at the top, or the bottom of its stroke; this could only be accomplished, by the weight of the valve, balancing the maximum velocity of the water put in motion through it, so that it should begin to close, as the flow of water diminished, and be quite closed, when the motion of the piston ceased; this, he conceived, would be difficult to accomplish, with the valve then under consideration.

Mr. Palmer remarked, with reference to these objections, that the opinions given, were clearly in opposition to facts, deduced from fifteen months operation of this pump, raising water under a vertical column of 40 feet, during which period, the slip or loss of water, approached nearer to the calculated result, than any pump duty that had come under his observation. In reference to the second objection, it was quite clear the valve-spindle must be of adequate strength, to support the column of water the pump had to lift: he believed that no greater evil (considered in an abstract sense) could result from the use of a large spindle, than an increased friction at its bearings, and a corresponding loss of velocity in the fall of the valve. These evils were, however, neutralized by increasing the excentricity of the spindle, and thereby enlarging the valve's area above the spindle, which increased area would always be considered, in reference to the altitude of the column of water above the valve, in order to insure the least loss of water, and at the same time to avoid the percussive action, so detrimental in other pumps. As regarded the third objection, namely, that there would be great difficulty in keeping the disc-valve perfectly tight; he would remark, that in the pump referred to, the minor axis of the piston was not sensibly worn, while the major axis was shortened $\frac{3}{20}$ths of an inch, but still preserving the true elliptic form, and fitting the pump as accurately as when first put into action, although the piston had made upwards of 16,800,000 double strokes, and had travelled over a rubbing surface exceeding 2,100 miles, during the upward or effective stroke. The wear of the clack-valve at the major axis was less than $\frac{1}{30}$th part of an inch, while at the minor axis it had undergone no change, although the number of beats it had made equalled the number of strokes of the pump. The modifications of the elliptic disc piston and valve into the trapezium form, as proposed by Mr. Galloway, appeared to him to be attended, not only with a considerable increase of cost in the manufacture and the fitting of the trapezium valve, and the working-barrel, but also increasing the amount of rubbing surface, with a corresponding amount of wear and tear, as compared with a pump having the elliptic valve performing the like amount of duty. The two semi-elliptic valves proposed by Mr. Galloway, were ingenious, but they were contrived with the view of remedying an evil that did not really exist in the disc-elliptic piston valve, namely, wear and tear of the minor axis, and leakage at the parts supposed to be worn; nor would the action of the two elliptic leaves, he conceived, be as efficient as the simple elliptic disc piston valve.

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16 The following is the rule refered to by Mr. Homersham. "The mean velocity of the water in feet per second through the valve being ascertained, one half more is added, and considered as the maximum velocity of the water through the valve, and the height of the head of water being found that would produce the velocity, every $1\frac{3}{4}$ inches of such height is then considered as equal to an ounce weight avoirdupoise acting upon every square inch contained in the area of the valve, against which the water impinged in its passage to the pump barrel, allowance being made for the difference of the weight of the ring when immersed in water, compared with its weight in the air."

17 Vide "Transactions of the Society of Arts," 1820, vol. xxxviii., p. 106.

AGRICULTURAL CHEMISTRY.

By Professor Brande, F.R.S., &c.

Lecture VIII.—*Delivered at the Royal Institution, March* 10, 1844.

(Specially reported for this Journal.)

Quitting now the consideration of the ultimate elements of plants, attention will be directed to the substances elaborated from them by the plant, into which, by its vital functions, it converts the carbon, hydrogen, oxygen and nitrogen, by grouping them together in various proportions. This operation, which is the peculiar province of the plant, and which the animal is completely unable to perform, is an operation almost as yet beyond the skill of the chemist, who can in some cases, change one of these elaborated substances into another, but cannot, except in some small isolated cases, construct them from their elements. It has been shown that plants do not feed on carbon, hydrogen, oxygen, or nitrogen in their crude state, nor until they have combined into forms which may be considered as intermediate between organic and inorganic matter, viz., water, ammonia, and carbonic acid, and decomposing and recombining their ultimate elements, produce these secondary products, which are termed the proximate elements of plants, and are known by the names of gum, starch, sugar, gluten, fibrin, albumen, lignin, resin, oil, &c. These are of the greatest importance to the agriculturist, because it is on these that animals live, and therefore on their relative proportion depends the value of a crop. The proportion in which two of these proximate elements are present in some of the commonest crops, is shown by the following list:

	Starch.	Gluten.
Wheat flour, from	39 to 77	8 to 35 per cent.
Rye . .	50 ,, 61	9 ,, 13 ,,
Barley . .	67 ,, 70	3 ,, 6 ,,
Oat . .	70 ,, 80	2 ,, 5 ,,
Rice . .	84 ,, 85	
Buck wheat .	50 ,, 60	
Peas and Beans .	40 ,, 50	
Potatoe . .	10 ,, 15	

The proportion varies according to mode of growth, soil, climate, &c. The manner in which the plant takes up the carbonic acid, the water and the ammonia, by the roots and leaves, regulated by light and heat, will be considered at the next meeting. The proximate elements thus produced, having contributed to the support of one generation of animals, by decomposition become the substances suitable for the food of plants, which are again devoured by the animal, and in this manner the chain of creation is kept up.

In the ultimate analysis of the organic constituents of plants, we arrive but at one result, the oft-told tale of carbon, oxygen, hydrogen and nitrogen; but in the proximate analysis we arrive at an infinite variety of substances, in which the fecundity of nature, in producing from four elements so great a diversity of distinct bodies, is powerfully shown. By burning and other destructive means the ultimate elements are separated; but to procure the proximate elements, much milder processes are adopted. As an illustration of the ordinary methods adopted, the examination of the composition of wheat flour may be taken. If this be put in a muslin bag, and agitated in water, it will be seen that a white powder, which is the starch, will separate from it and fall to the bottom of the water, whilst a peculiar adhesive fibrous substance will be left in the bag, resembling birdlime. This, which is termed gluten and on the relative quantity of which in flour its value as food depends, instead of being a simple substance, is a very compound one; for hot alcoho digested on it, takes up some substances and leaves fibrin, as it cools it deposits caseum, and if evaporated, will leave glutine. Ether digested on this, dissolves from it some fat. The water in which the flour was washed holds gum and sugar in solution, and after filtration from the starch, on boiling, a substance is separated analogous to white of egg, termed albumen. In this manner can be separated, from an apparently homogeneous substance, the following proximate elements;—gluten, fibrin, caseum, glutine, fat, starch sugar, gum, and albumen. In this manner are the processes condncted for separating organic substances into their several proximate parts. These may be grouped under four heads, according to their ultimate elements.

Class I. Where the carbon has hydrogen and oxygen in the exact proportion for forming water.

Class II. Where the oxygen is in excess over this proportion.

Class III. Where the hydrogen is in excess.

Class IV. Where, in addition to the carbon, hydrogen, and oxygen, nitrogen forms a part.

The first class, which may be considered as composed of carbon and water, contains gum, sugar, starch, wood, and other neutral bodies.

The second class, in which there is excess of hydrogen, contains the resinous bodies, such as resin, wax, oil, fat, &c.

The third class, with excess of oxygen, contains the vegetable acids.

The fourth class, characterized by the presence of nitrogen, contains the alcaloids, gluten, albumen, gelatine, &c.

The peculiarities of each group must be next considered. The first group can be converted the one into the other slightly by art, but readily by nature. And when the similarity of their chemical composition is considered, their easy convertibility is not surprising, though their physical properties appear so essentially different. Their composition is given below:—

	Pe cent		Or, taking their carbon as a fixed quantity.	
	Carbon.	Water.	Carbon.	Water.
Cane sugar. . . .	—	—	12	11
Grape sugar . . .	40	60	12	12
Starch	41	59	12	10
Gum	42	58	(12, bracketed with Starch)	(10, bracketed with Starch)
Acetic acid . . .	47	55	12	9
Wood	50	50	12	8

Sugar is characterized by its solubility in water and alcohol, by its sweet taste, by being soluble in alkalies, and by its crystallizing readily. There are several varieties of sugar, but the two principal are cane and grape sugars, the latter being that which gives the sweetness to fruits, as to grapes, plums, pears, apples, figs, &c. Although the difference between cane and grape sugar in composition is merely that the latter contains one atom more water, yet the former possesses sweetening properties in a much more eminent degree. Unfortunately for domestic economy the sweeter sugar can be artificially converted into the one less sweet, but not vice versa. These sugars can be distinguished from each other by the action of acids and alkalies. Sulphuric acid completely decomposes cane sugar, leaving nothing but a carbonaceous mass, whilst it but slightly colours grape sugar. Honey, which consists principally of grape sugar, is merely rendered into a fluid like treacle, whilst a solution of sugar candy is acted on very strongly, little else but a mass of charcoal being left. Alkalies have a contrary effect, acting strongly upon grape sugar, and but slightly on cane. There are several other means of distinguishing between various sugars, and amongst the best is their action on sulphate of copper.

Gum, which belongs to this group, is soluble in water and insoluble in alcohol, and hence comes a ready method of separating sugar and gum when dissolved in water; it is only necessary to add alcohol, and the gum is precipitated. This method is frequently resorted to in analysing substances for food. There are several modifications of gum, differing from each other in some of their properties, and as types of three kinds may be taken, gum tragacanth, the gum which exudes from the cherry and plum trees, and gum arabic. Some of these gums can be converted into other kinds with great facility. Immersed in boiling water, gum tragacanth swells considerably; boiled for a long time, it passes, through cherry-tree gum, into gum arabic.

Woody fibre is insoluble in nearly all menstrua. When a piece of wood has been subjected to the action of water, dilute acids and alkalies, everything soluble is dissolved out, and a fine white powder is left, which is the woody fibre or lignin, and is that part of the vegetable which is worked up into paper. There are several varieties or modifications of this, forming both elder pith and the hardest wood.

Starch, unlike the other proximate elements of plants, has an organized structure. When examined by a microscope before removal from the plant it is seen in the cells of the wood growing like a fruit or berry, having a spot on the granule supposed to be a point of attachment. It is composed of concentric layers, with a fluid in the interior soluble in cold water, but which is protected by the exterior, which is not soluble till immersed in hot water, when, bursting, the whole forms the well known gelatinous mass. A beautiful and delicate test is used for starch, viz, a solution of iodine. Several varieties of starch are known, amongst which the best known are potatoe starch and wheat starch. One lately introduced, called tous les mois, consists of very large grains. Starch is very abundant in most vegetable substances used for food, and is essential for nutrition. To ascertain the presence of starch, pour on the substance a solution of iodine in water, and a beautiful blue iodide of starch is formed if it is present. A cut potatoe or a slice of bread shows this exceedingly well.

The transmutation of this class of substances takes place very readily. Starch or wood are easily converted into gum or sugar. Cotton or sawdust, stirred up with a little sulphuric acid, is reduced to a gummy mass; this, boiled for 24 hours, is converted into sugar, which may be separated from the acid by the addition of chalk, and filtering the sweet liquid from the sulphate of lime thus formed. It may then be crystallized. But the sugar thus obtained is grape sugar, which has but little sweetening power. Cane sugar boiled with acid is in a similar manner converted into grape sugar. Starch is very easily transmuted. If it be carefully heated to a point short of charring, it is converted into a kind of gum, known as dextrine. It has then lost the property of forming a blue with iodine, and is readily soluble in cold water. It is manufactured largely in France, and is used there to stiffen ribbons. It is also the principal ingredient in the cement at the back of the postage stamps, as it is very adhesive.

The second group, having excess of hydrogen, consists of resins, oils, fat, &c. They are present in nearly all our food. The greater number of them are found to consist of two substances, termed by chemists, elaine and stearine, the latter being the solid principle. In the solid fats these may be separated by pressure, as in the manufacture of linseed, cocoa nut, olive, and other oils. There is a dispute at present in the scientific world, whether animals have or have not the power of forming fat in their system from food which does not contain it, but all agree that when present in the food the animal can treasure it up in certain parts of the body.

The third group, containing oxygen in excess, embraces, with one exception, the whole of the acids in vegetables which have no nitrogen; this exception, which is acetic acid or the acid of vinegar, is never obtained except by decomposition. These acids are abundantly secreted in some plants, and are also said to be excreted by the roots of most plants. Wood is converted partly into acetic acid when it is distilled at a strong heat, and in this manner most of the vinegar used at table is obtained. Sugar is also converted into vinegar very readily; a little vinegar added to a large quantity of sugar and water, causes the whole of the sugar to disappear, and acetic acid is found in its stead. Tartaric is one of the commonest vegetable acids, being present in nearly all sour-leaved plants. It obtains its name from being the acid in the tartar of wine. When tartaric acid is neutralized by potash, it forms a very soluble substance, but when the acid is in excess, the compound is very insoluble, and is precipitated as cream of tartar, or bitartrate of potash. It is from this deposit taking place more largely in the juice of the grape which renders it so fit to make the best wine; other juices, retaining this acid in solution, produce consequently sour wines. In forming these acids, the plant is absorbing oxygen from the air instead of yielding it, and in the growth of such fruits as lemons, the amount absorbed must be considerable.

Lecture IX.

The fourth section of proximate principles, or those containing nitrogen, are considered as being the most essential to animal life, they going to form new flesh in the animal, whilst all the other principles are supposed to be consumed during respiration, principally in order to maintain the heat of the body. When the gum, starch and sugar were washed out from wheat flour, an adhesive fibrous substance was left called gluten. This contains all the nitrogenous substances in the flour, not being a simple principle, but a mixture of three or four; one is like cheese, one like white of egg, but all contain nitrogen. They are characterised by their action towards various solvents, but as they are very similar in composition, they are not worth separating, when considered as food for animals. It has been lately shown by Mulder, that when deprived of extraneous salts, and of a little sulphur and phosphorus, they exactly resemble the nitrogenous principles of animals, that, in fact, they have exactly the same composition, whether derived from animal or vegetable, and are only modifications of one principle, to which he has given the name of proteine. They may therefore be represented as follows:—

Albumine, Fibrine, Caseine, Glutine } Carbon 84 + Hydrogen 36 + Nitrogen 6 + Oxygen 15.

It is essential that an exact mode of ascertaining the quantity of nitrogen present in a substance should be known; and there has lately been proposed by Will and Varrentrap, a very delicate method of effecting this. When an organic substance is mixed with caustic potash or soda, and lime, and then heated, the whole of the nitrogen present is driven off as ammonia, which may be ascertained by its smell, by its action on moistened litmus paper, and by the fumes formed by holding a rod dipped in muriatic acid over it. If this is collected by being passed into muriatic acid, sal-ammoniac, or chloride of ammonium is formed; when to this is added a solution of platinum, a copious brown precipitate is formed, consisting of the ammonio-bichloride of platinum. This dried and weighed, will indicate the quantity of ammonia or nitrogen evolved from the heated organic substance, 225 grains of it containing 17 of ammonia, or 14 of nitrogen. Or, it may be decomposed by a red heat, and 14 grains of nitrogen reckoned for every 99 grains of platinum that is left, as its following composition will prove:—

Ammonio-bichloride of platinum,

Platinum	99	171 Bi-chloride of platinum.
2 Chlorine	72	
Hydrogen	1	37 Hydrochloric acid.
Chlorine	36	
3 Hydrogen	3	17 Ammonia.
Nitrogen	14	

The value of various substances as food for animals being considered to be according to the quantity of nitrogen they contain, lists have been drawn up to show their comparative richness in nitrogen. In the following list, the numbers attached show the quantity of the various substances that is necessary to yield an equal amount of nitrogen:—

Hay	10	Pea straw	6	Peas and beans	8
Clover hay	8	New potatoes	28	Wheat and oats	5
Vetch hay	4	Old potatoes	40	Barley	6
Wheat straw	52	Turnips	60	Maize	6
Barley straw	52	Carrots	35	Oil cake	2
Oat straw	55	Cabbage	30		

It follows, as a necessary consequence, that when animals are fed on substances poor in nitrogen, they must eat more of such food than would be requisite were they fed on richer food. Thus vegetable feeders eat a greater quantity than do animal feeders; men fed on fish, potatoes, or rice, require to eat more in proportion. But neutral substances, also, such as gum, sugar, &c., are required for the sustenance of life, and consequently we find in milk, the liquid prepared by nature for the food of the young animal, a proper admixture of all these requisites. In 1000 parts of milk are found, according to analysis,

Caseine	45	to	90
Sugar	36	„	50
Butter	27	„	35
Phosphate of lime and other salts	9	„	10
Water	883	„	815
	1000		1000

The various processes of decay, such as fermentation, putrefaction, and eremacausis, (the latter term being the one now fashionable to describe the slow decay of woody substances) may all be considered as the return of complex substances to those more simple in composition. The fibrin, &c., consist of high numbers, but in putrefaction they are reduced to substances with low numbers, passing off as carbonic acid, water, and abundance of ammonia. In the vinous fermentation, the alcohol is a tertiary compound, carbonic acid a binary one. In eremacausis, all the compounds are given off as carbonic acid, water, and a little ammonia. Thus they all pass into air.

To ascertain how the proximate elements are produced and changed in plants, the germination of the seed must be watched. Although there is an infinite variety in the appearance of seeds, and consequently they might be supposed to differ a great deal, yet all agree in containing but two essential parts, the germ, and food for it to consume before it has put forth roots to gather it for itself. In the cocoa nut, these are covered by a outer fibrous coat, then a hard woody one, then the food or albumen of the seed, as it is termed, buried in which, at the soft end of the husk, is the embryo. It is similar to this in the smallest seed. In the chesnut, when the husk is removed, a mealy matter is seen, in the small end of which is the germ. When the germ grows, great changes take place in the seed, for which water, air, and a certain temperature are requisite, but no light, it being detrimental to a growing seed. If one of these conditions is absent, the seed will not grow. If they are present, provided the seed has not lost its vitality, it is sure to grow. Seeds differ very much in their power of retaining vitality, some remaining dormant in the soil for years, not germinating until the soil should by chance be turned up, they either wanting air or heat. Clayey soils, by enveloping the seed, prevent the air from getting to it. For want of moisture seeds lie dormant but still not dead, as is proved by a crop now growing from seed taken from Egyptian tombs. With the requisite circumstances, seeds swell, soften, and burst their membranes, the germ puts forth its radicle, which pierces the earth and sends out rootlets, after which the stem shoots up, and forms branches. At first the seed, feeding on the carbonaceous matter stored up, abstracts oxygen from the air, and evolves carbonic acid, but its province afterwards, when it has formed roots and leaves, is to decompose the carbonic acid of the air and to liberate oxygen. The roots of plants are said to throw out acetic acid; when they have been grown in powdered marble, acetate of lime has been found. Liebig and others insist much on this point, considering that it is by this means that plants render insoluble substances soluble. During germination, a portion of the gum and starch in the seed is converted into sugar, which is called the process of saccharification. In growing plants a substance called diastase is formed, which has the remarkable property of being able to convert many times its weight of starch or gum into sugar, and it is in this manner that seeds whilst growing become so sweet. This is seen beautifully in the process of malting, which consists in allowing the barley to grow until its maximum of sugar is formed, which is just when the plumule begins to show, and then stopping it by drying. If the diastase had been previously washed out with water it would have been spoilt for malt, as saccharification would not have taken place. For beer making, the malt is bruised in hot water, and the action of the diastase goes on, the mucilage and starch is converted into sugar, and this again is decomposed into alcohol and carbonic acid.

When the young plant has exhausted the storehouse nature has provided it with, it is strong enough to derive its food by its roots and leaves, until which time no true wood is formed. The stem of a plant may be seen to consist of several parts, the centre portion, or pith, becoming obliterated as the plant grows; the wood is of two kinds, the old or heart wood, and the new wood or alburnum; in like manner the bark is of two kinds, the newer being termed the liber. The bark is connected with the pith by layers running from it, called the medullary rays, forming in timber the silver grain. The branches are but extensions of the stem, the smallest fibre resembling the wood of the stem. So, also, are the roots; but as they taper off the pith disappears, and at length the wood and bark, only cellular matter being at the extreme points; these are the spongioles, and in these the power of absorption resides; it is on account of the injury inevitably done to these that transplanting is so dangerous an operation. These absorb the water in the soil holding saline substances and carbonic acid in solution. The question has been raised, can the roots of plants select their food? and although there have been many experimenters, the evidence is very contradictory. Dr. Daubeny made some experiments on barley and peas with a solution of strontia, and found that they would not take it up. Saussure obtained similar results with acetate of lime and common salt. But their selective power is at all events limited, as they have been made to absorb solutions of arsenic, corrosive sublimate, opium, and tobacco, and their effects are said somewhat to resemble those on animals. The excretory function of the root was once supposed to be the reason of the necessity of a rotation of crops, as a plant was said to throw out substances which were poisonous to plants of the same kind. Now, however, it is explained by saying that each plant requires particular inorganic food, and if one crop has removed all of that kind from the soil, of course a similar crop could not thrive. Thus turnips will grow after wheat, because, as they require different constituents, the wheat has not removed those which the turnip requires.

The power of the root to absorb liquids from the soil is generally attributed to two actions, endosmose and capillary attraction. Endosmose, or the property of thin fluids to pass through porous bodies if thicker fluids are on the other side, is well illustrated by immersing the ends of three tubes tied round with membrane into water, having previously poured into them solutions of gum, sugar, and some alcohol. The water passing through will cause the level of the thicker fluids to be considerably raised. The capillary action of porous bodies is seen when the end of a cane is dipped into spirits of turpentine; it rises up through the length and may be lighted at the other end. The sap in a plant decidedly circulates, and its course has been distinctly traced. It ascends from the root by the outer layer of wood to the leaves, there, being spread over a large surface gives up a great quantity of water, is acted on by light, and flowing down the inner bark, much thickened, deposits new wood in its course. Thus each year a ring of new wood and new bark is formed, and by counting the rings of wood in the section of a tree, its age may be ascertained.

Lecture X. and last.

The direction of circulation of the sap when it forms new wood, may be rendered evident by ringing the bark of a tree; it will be found that the new wood will always be deposited from the upper part of the cut, showing that in the bark it is travelling downwards. The force with which the sap rises is very great, and experiments have been made by cutting a branch in the spring time, and so confining it in a tube with mercury that the force with which it rises can be measured. An application of this has been recently made to the preserving timber by means of impregnating it with various saline fluids. The fresh cut stem is immersed in the fluid, with the leaves and branches still attached; evaporation going on at the surface of the leaf, the fluid is drawn into every part much more thoroughly than can be done by other means. The circulation is never stopped in a tree, for though it is much less in winter, it still goes on. A thermometer placed in the interior of a tree shows it to be a little warmer than the air; this is easily accounted for; the earth being warmer than the air, the sap drawn from it must necessarily be so also. This is exceedingly useful, as it prevents it from freezing, and cracking its delicate vessels.

The leaf, which is a flat expansion of the wood and bark, contains vessels which bring the sap in, and others which carry it out and down into the inner bark. Few have an idea of the enormous transpiration continually taking place from the surface of leaves. Dr. Hales found that a sunflower exhaled from 20 to 30 oz. of water in a warm day, and 5 oz. at night. In dewy or damp weather it did not exhale any. By this means the sap, which enters it watery and insipid, goes out from it much thicker and sapid. This also is the reason why leaves yield so much more ash than any other part. The organs of the leaves are very delicate, and few can bear the soots, ashes, acids, &c., which load the air of London. Some, however, can, and a list of them has been published by Mr. M'Cullock. Green-house plants are delicate, and sometimes fall victims to injurious vapours diffused through the house. At Godsden, some pipes had been covered with a paint containing coal tar; almost every plant was injured or killed. This proves that plants can absorb vapours by their leaves, as they show the effects before it has time to get to the roots. The mischief that cold easterly winds cause to the leaves is as great as though they were placed before a fire.

These are merely the mechanical powers of the leaf; the chemical are powerful and astonishing. They can be explained, but difficultly imitated. The chemist, for instance, can readily make carbon into carbonic acid, but he can scarcely get the carbon out again: this the plant is always doing, evolving the oxygen. This is the general result, though at times it is slightly different, when, for instance, the sap is to be acid, the oxygen must be retained. When it is to be resinous, as in fir trees, excess of hydrogen is wanted; deriving this principally from water, oxygen must be liberated from this source, as well as during the formation of wood. The rapidity with which the leaves of a tree deprive the air of its carbonic acid is no chemical fiction, as there are abundance of experiments on record to prove it. Boussingault brought the limb of a vine into a jar, and found that it deprived the air of carbonic acid and evolved oxygen as fast as he carried a tolerably rapid current through it. For this it requires a bright sun, and that is why plants grow so quickly in a tropical climate. Decandolle immersed aquatic plants in water impregnated with carbonic acid, and found that they deprived the water of the gas, replacing it with oxygen. Thus they perform for fishes what land plants do for land animals. Dr. Gilly made a mixture of gases having a great excess of carbonic acid, and immersed a turf of grass therein; after four hours' exposure to sunshine, he got the following result:—

	Before	After
Nitrogen . .	105	105
Carbonic Acid .	57	4
Oxygen . .	28	78
	190	187

With the exception of a little loss of oxygen, the whole of the carbonic acid absorbed was replaced by that gas. Saussure obtained the same result from Lythrum salicaria, and Vinca minor. Priestley, long ago, placed sprigs of mint, whilst growing, in air which had been destroyed by a mouse or a candle, and found that it restored it to a proper state. It was then supposed to be due to the mint sending out an agreeable odour; but he proved that plants with a disagreeable odour would do the same. In his correspondence with Franklin, given in the Philosophical Magazine, he says that he hopes the knowledge of this will prevent persons from cutting trees growing near houses. Other remarkable changes can be proved to be effected by plants. The little water cress, as well as many other plants, has the power of decomposing sulphuric acid, retaining the sulphur, and liberating the oxygen; other plants, in like manner, decompose phosphoric acid.

Dumas has drawn up a very ingenious contrast between animals and vegetables.

Vegetables.		Animals.	
Produce	Azotised principles. Starch, sugar, oils, &c.	Consume	Azotised principles. Starch, sugar, oils, &c.
Decompose	Carbonic acid Water Ammonia	Produce	Carbonic acid Water Ammonia
Evolve	Oxygen	Absorb	Oxygen
Absorb	Heat	Evolve	Heat
Are an apparatus of de-oxidizement.		Are an apparatus of oxidizement.	
Are stationary.		Are locomotive.	

These are not true of the petals, &c., of blossoms, which act like animals, sometimes evolving ammonia, always absorbing oxygen, and occasionally producing very great heat.

When the bark of a plant is green, it acts like the leaf, therefore in herbaceous plants the whole surface acts alike. In the cactus there are no true leaves, the stem supplying its place. The bark of the root, in some cases, secretes a substance not found elsewhere. Phloridzin is thus found beneath the bark of the root of apple and pear trees.

The circumstances which influence and modify the growth of plants, are chemical and mechanical. At the head of the chemical must be placed light. By analysing rays of light it has been found that the violet or chemical rays are those in which the power of light on plants resides. Mr. E. Solly, of the Horticultural Gardens, has made experiments on the action of various coloured glasses on the light for plants, and he has obtained very excellent results by the use of violet glass, that is, by cutting off all the rays of light but the violet. The influence of mineral manures has been shown to be twofold, by passing into the roots, and also by yielding parts of themselves, as in the case of the nitrates. Phosphorus is indispensable for wheat, silica for grass. Lime acts on crops by inducing changes in the organic matter, by neutralizing acids, by decomposing inorganic salts, and by liberating ammonia from its combinations, as, for instance, from rain water. In tracing the growth of vegetables, their power of absorbing, changing, and recombining, the materials obtained from the soil and the air, has been seen, as also their influence when they are returned to the soil, acting as manure, loosening the soil, and returning to it its inorganic salts. The parts of the plant thus used for manure has great influence; thus the leaves are much better than sawdust. There are also advantages attending ploughing it in in a green state; this is frequently done by agriculturists, as, after fermenting, it yields a rich mould. For this reason it is judicious to gather together the hedge-row weeds, and bury them in the soil. Vineyards can be manured by their own cuttings, and for a length of years will scarcely require any other manure. This method has been revived of late, but it was a practice resorted to by the Romans. The same principle will apply to most crops, as by green crop ploughing both the organic and inorganic constituents are returned.

The action of manures is principally chemical, but the soil requires also mechanical assistance, one of the principal of which is a good system of drainage. This has met with a powerful advocate in Mr. Smith, of Deanston. Draining carries off all superfluous water, which would otherwise keep the soil cold, dilute the food of the plant, and give rise to noxious emanations. On the other hand, when it is removed, the air penetrates to the roots, increases the fermentation in the soil, and renders stiff clay tractable. But its benefits are not confined to stiff lands, being sometimes advisable in sandy soils, particularly where springs exist. The old plan consists of digging a deep trench and filling it with large stones. Lately a system has been prevalent of laying down earthenware tiles of various shapes; this has been carried out largely in the neighbourhood of Tunbridge and Penshurst. Very good tiles may be obtained at from 20s. to 24s. per 1000. Ploughing is a well-acknowledged means of improving the soil; it acts by breaking it up, admitting air, and so assisting the decomposition of organic and inorganic matters; nitrates are very abundantly formed in new ploughed land. It also acts by mixing the soil and subsoil, especially if one be clay and the other sand. Sometimes, however, this is said to be injurious. Johnston states that the farmers in Durham are afraid to turn up one foot of subsoil, partly on account of the injurious effects of the iron which has come from the plough. This bad effect, however, lasts but a short time, as it soon becomes peroxidized, and is then inert.

Diametrically opposite to draining, but at times equally beneficial, is irrigation. It is of advantage in dry soils, or in those which are thoroughly drained. It acts by bringing finely divided matter and salts to the plant. Paring and burning are frequently resorted to with advantage, returning the ashes to the land. Clay, when burnt, and converted into brick, acts like sand, and where sand cannot be obtained, it is a good substitute.

The alternation of crops is always looked upon as beneficial, and the four course system is the one usually adopted. But when it is considered, that turnips flourish best in a sandy soil, whilst wheat likes a clayey one, it is evident that to grow these on the same land cannot be the perfection of agriculture. It is now supposed that by attention to agricultural chemistry, the same crop may be grown continuously on the same land, by the careful supply of proper manures. But to obtain this result, chemistry must go hand-in-hand with agriculture, and the man of experience must not be ashamed of calling in the assistance of the man of science. Without going the length that some enthusiasts have gone, all must acknowledge that chemistry and agriculture have come into close contact, that already the former has been of service to the latter, and promises far more than it has yet done. Great success has undoubtedly been obtained by the application of these principles, and if failure has sometimes occurred, it is because all the circumstances that must be taken into consideration are not yet fully understood. Many experimenters, however, have met with very satisfactory results, and have published accounts of their experiments, amongst the most recent of whom is Mr. Biggs, of Overton, who has just issued a pamphlet detailing his conclusions. When the deductions of science first begin to be applied to the arts, they invariably meet with many obstacles; sometimes arising from the obstinacy of those who are devoted to the old methods, sometimes from the unwarrantable confidence of those who adopt the new. But the farmer who will carefully weigh and consider the light that science throws on his path, and who will subject the investigations of the philosopher to a well-arranged practical test, is the one who will reap the golden harvest of success.

THE EXPERIMENTAL BRIG SQUADRON.

The whole of the new class 12-gun brigs are now off the stocks, and are being brought forward for commission with all possible despatch. The following table shows the exact dimensions of each brig:—

	Daring.	Osprey.	Flying Fish	Mutine.	Espiegle
	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.
Length between perpendiculars	104 0	101 0	103 1	101 11½	104 8
Length of keel for tonnage	83 1¾	80 6¼	81 8	81 2	83 7¾
Breadth, extreme	31 4	31 10	33 4½	31 11	31 9½
Breadth for tonnage	31 0	31 6	31 0½	31 6	31 6½
Breadth moulded	30 6	31 0	31 6	31 0	31 0½
Depth in hold	15 2	13 6	14 3	13 7	13 1¼
Burden in tons	425 3/94 0	424 91/94 0	444 76/94 0	428 36/94 0	422 57/94 0

The object in building the above five brigs is to produce a class of vessels superior to the old 10-gun brig, and at the same time to illustrate the comparative merits of the different principles which their respective constructors hold in the science of naval architecture.

Whitehaven.—In consequence of the contemplated extension of the Carlisle and Workington Railway to Whitehaven, the old established steam company of the latter town have given orders for a first-rate iron steam vessel, to be built under the direction of Mr. Grantham, by which it is contemplated that the journey by sea will be accomplished in little more than six hours, and by railway to Carlisle in two hours more. Such increased facilities of communication with these extensive mining and agricultural districts, must prove of the utmost advantage to the population. Means of easy access will thus be afforded to the western portion of the lake district. Messrs. Fawcett, Preston, & Co., are to construct the engines of the new vessel, and they are to be made on the direct acting principle, now generally adopted in the most improved vessels.

REGISTER OF NEW PATENTS.

(Under this head we propose to give abstracts of the specifications of all the most important patents as they are enrolled. If any additional information be required as to any patent, the same may be obtained by applying to Mr. LAXTON at the Office of this JOURNAL.)

IMPROVEMENTS IN PROPELLING.

John Keddle, of Glasgow, Gentleman, for "*certain Improvements in propelling.*"—Granted November 2, 1843; Enrolled May 2, 1844.

This invention consists in the peculiar mode of driving an endless chain or band, in cases where two wheels, fixed on each side of the boat, are employed for the purpose of propelling. It is well known that an endless chain passing over two wheels fixed on each side of the boat with floats or paddle boards attached has before been employed, but in such cases the periphery of the wheels has been provided with teeth or projections, which teeth are made to pass between the links of the chain for the purpose of taking hold and driving such chains; this plan of giving motion to endless chains appears from the specification to be objectionable and impracticable. The object of this invention is therefore to drive the endless chain by means of the friction of contact of the two surfaces; that is, by the friction of the surface or periphery of the driving wheel and the surface of the chain, for this purpose there is on the axis of the main or crank shaft, firmly keyed, a wheel, and at some distance from this wheel there is another of equal diameter fixed by its axis to a sliding frame attached to the side of the boat; round these wheels is passed the endless chain, which consists of a series of plates or bars of iron forming the links which are combined together by means of bolts passing through holes formed in the ends thereof, these bolts also pass through holes formed in the end of a diagonal frame, to which are bolted the paddle boards or floats. The chains being passed round the periphery of the wheels, can be distended to any required extent by means of the sliding frame, and in order to prevent the chains from running off the wheels, the same are provided with flanges. The second part of the invention consists in the application of a metallic band or belt formed of a plate or plates of metal, to which are to be attached by any convenient means the floats or paddle boards.

The inventor claims the mode of driving endless chains to which the floats or paddle boards are attached by means of surface driving of wheels, (that is to say, by means of the friction of contact), instead of using toothed wheels; also the mode of giving motion to endless bands composed of metallic plates.

PURIFYING METALS.

Joseph Dukinse Stagg, of Middleton, in Teesdale, Durham, Manager of Smelting Works, for "*A new and improved plan of collecting, condensing and purifying the fumes of lead, copper, and other ores, and metals, and also the particles of such ores, and metals arising or produced from the roasting or manufacture thereof, and also the noxious smoke, gases, salts and acids, soluble and absorbable in water, generated in treating and working such ores and metals.*"—Granted December 2, 1843; Enrolled May 2, 1844.

This invention consists in causing the fumes of lead, copper, and other ores, and also the particles of such ores, &c., to pass through water contained in an air-tight vessel, which vessel above the surface of water is divested of air and kept constantly exhausted by means of an air-pump or other mechanical contrivance. For this purpose the inventor causes the fumes and vapours to pass through a flue or chimney, to which is attached a pipe bent down at the end at right angles, and made to dip a few inches below the surface of the water contained in the cistern, which may be of any required depth. This cistern, which may be constructed of wood sufficiently strong to withstand the atmospheric pressure, is divided by means of partitions into compartments, each alternate partition commencing at the top of the cistern and descending to within a few inches of the bottom, the intermediate ones commencing at the bottom of the cistern and ascending near to the top. The pipe through which the fumes or vapours pass from the chimney, enters the cistern at one end, and at the opposite end there is a pipe leading to an exhausting apparatus, which consists of a double acting air pump worked by a small steam engine.

The action of this apparatus is as follows: motion being imparted to the air pump, the cistern will be exhausted of air and will have the effect of creating a draft in the chimney sufficient for clearing the manufactory of the fumes generated, which fumes or vapours are caused to pass over and under the several partitions, and through the water contained in the cistern, which water will be greatly agitated, and have the effect of purifying, and condensing or detaining such portions of other vapours as are soluble and absorbable in water. Such portions as are not absorbable, passing off through the air pump into the atmosphere in a comparitively pure state, those portions left in the cistern can afterwards be resmelted, and whatever valuable salts or acids are held in solution in the water can be separated by the process of distillation.

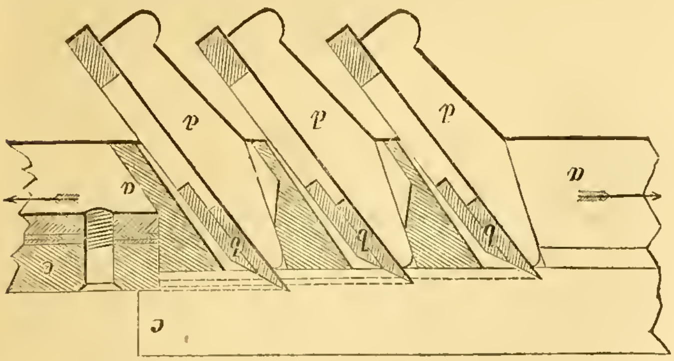
REVOLVING ENGINE.

Philip Walther, of Angel Court, Throgmorton Street, London, for "*certain Improvements in the construction of steam engines.*"—Granted October 12, 1843; Enrolled April 12, 1844.

The class of engines to which these improvements relate, are those which act by means of steam issuing into the air, so as to cause a rotary motion. The basis of this revolving engine consists of two hollow arms of equal length fixed upon a horizontal axis (which is also hollow), and caused to revolve in a vertical plane, the whole being supported by suitable bearings. At the outer end of each of these arms there is a square or oblong box, denominated a steam receiver, into each of which steam is alternately admitted and discharged in successive jets instead of in a continuous stream as has been the practice with other reacting steam engines. To one of the arms there is fixed a small steam engine, the object of which is to open and close the passages by which the steam is admitted into and discharged from the receiver. The piston rod of this engine is elongated so as to pass through both ends of the cylinder, and also through stuffing boxes, and into the square boxes or receivers, and to each end of the piston rod is attached a slide valve which opens and shuts the apertures in the following manner. Steam being admitted through the hollow axle passes into the arms, then presuming one of the valves which are worked by the *small steam engine* to be open with the square box or receiver attached to the ends of the arms, steam will pass through the same and fill the receiver, the *small steam engine* being set to work, moves the valve contained in the receiver, so as to close that aperture through which steam was admitted into the receiver, and open an aperture for the escape of steam into the atmosphere; the reaction of which causes the whole apparatus to rotate, the action upon the other valve being precisely the same, so that steam is alternately admitted into the receivers and discharged therefrom into the atmosphere.

MACHINE FOR CUTTING LEAVES OF WOOD.

Benjamin Parsons, of York Road, Lambeth, Surrey, Engineer, and Edward Esdaile, of City Saw Mills, City Road, Middlesex, Sawyer, for "*An improved machine for cutting leaves of wood, such as those commonly called scale boards.*"—Granted November 9, 1843; Enrolled May 8, 1844.



This improvement consists in the multiplication of the knife or cutter of the machine, and also in supplying the place of the additional quantity of wood removed from the block by the application of an adjusting bar. The machine for cutting scale boards or leaves of wood consists of a frame supporting a horizontal table, which is caused by certain mechanical arrangements to move backward and forward from one end of the frame to the other; o this frame there is attached a cutter, which at every stroke of the machine, removes or cuts from a block of wood supported above the table, a scale board or leaf of wood. The improvement is an application of two or more cutters, which may be so regulated as to cut any thickness of scale board, and also in the application of an adjusting or support bar, which may be understood by referring to the annexed drawing, where *a*, *a*, shows a portion of the table or bed plate, which is caused by certain mechanical arrangements to move backwards and forwards in the direction indicated by the arrows; *b*, *b*, *b*, are three knives or cutters, which may be set at any height from the bed plate, depending upon the thickness of boards to be cut from the block of wood; *c*, *c*, that is to say, the first knife if required may be set at $\frac{1}{16}$ of an inch, above the table, the second $\frac{2}{16}$, and the third $\frac{3}{16}$ of an inch, the knives being secured at their ends by means of wedges *d*, *d*, *d*; *e*, shows a portion of an adjusting bar which can be raised or lowered by means of adjusting screws according to the thickness of scale board intended to be cut. There are three of these bars extending in a direction of the length of the table, the object of which is to support the end of the block of wood as the wood is removed therefrom, and also to prevent the other end of the block from rising up.

The patentee claims the multiplication of knives or cutters, and the application of an adjusting or support bar or bars as described.

IMPROVEMENTS IN THE MANUFACTURE OF IRON.

Arthur Wall, of Bistern Place, Poplar, Middlesex, Surgeon, for "*certain Improvements in the manufacture of iron.*"—Granted November 18, 1843; Enrolled May 18, 1844.

This invention may be divided into two classes, the first is the addition of certain mixtures or substances to the iron when in a state of fusion; and secondly, in submiting the iron to the action or influence of electricity. With regard to the first part of the invention, the compositions which are of two kinds, consist first of a mixture of steel or wrought iron in a comminuted state, such as filings, &c, and resin, which are to be mixed together in the proportion of about 2 lb. of iron or steel filings to about 5 lb. of rosin, this mixture is made into balls of about 5 lb. weight each, which balls are to be thrown upon the surface of the iron when in a state of fusion, in the cupola or other furnace, one ball being used to about every 5 cwt. of iron.

The second composition consists of a mixture of common salt, resin and charcoal, or other carbonaceous matter. Although the inventor prefers the above, other fluxes may be used, such as borax, nitre, &c. in place of common salt; the above being made into balls are to be used when the metal is in a state of fusion, and after the first mixture has been added in the proportion of 1 lb. to about every 100 lb. of iron.

The second part of these improvements consists in subjecting the iron to the action or influence of electricity. In carrying out this part of the invention, Mr. Wall causes a current of electric fluid to pass through the iron in every possible direction, by stretching or extending copper wires across the mould in which the casting is to be made, and by means of a galvanic or voltaic battery, causes the electric current to pass through the metal whilst in a fluid state, and also whilst approaching and when in a solid state, more especially when casting ordnance, in which case the patentee recommends that the electric current should be passed through the piece after it has become solidified, care being taken not to continue it so long as to entirely decarburate the iron, and bring it into a malleable state. The inventor also proposes to pass the electric current through the iron when in the furnace or cupola, by inserting a piece of iron into the top hole so as to touch the smelted metal, and another piece of iron or other conductor into one of the tuyre holes, which piece may be moved about on the surface of the metal, so as to pass the electric current through the same in every possible direction.

SELF-ACTING AEROMETER OR DRY GAS METER.

Stephen Hutchison, of the London Gas Works, Vauxhall, Engineer, for "*Improvements in gas meters.*"—Granted October 12, 1843; Enrolled April 12, 1844.

The necessity which has long existed for an instrument of the description now introduced, and recommended to the notice of the public, and by which an accurate and intelligible mode of registration of the gas consumed could be obtained, has long occupied the attention of scientific men. The inconveniences that result from the peculiar construction of the wet meter, as well as the unsatisfactory manner in which it registers the consumption of gas, both called for the introduction and adoption of some superior plan by which consumers might be supplied with more uniformity, and that they might also comprehend the registration of the quantity which has passed through the meter, and with which they became chargeable.

Mr. Hutchison's improvements in gas meters is an apparatus which he has named "An Aerometer," it consists of a cast iron plate and box with passages leading into 4 compartments, and thence into the upper part cast in the same, and fitted with 4 lower cup valves, which are sealed with quicksilver; 4 tin-plate compartments fixed into the cast-iron pipes; four flexible leather bags saturated with tar, naptha, and oil, are attached to the compartments with heads, rods, beams, connecting rods, cranks, carriages, &c., to communicate motion to the valves and shaft, which revolving communicates with the index. An index with dial five inches square is inclosed in a box and external casing with brass unions for the inlet and outlet pipes; the hands of the index revolve similar to those of a clock, the short or hour hand denoting thousands of cubic feet, and the long or minute hand indicating tens of cubic feet. The possibility of escape of one atom of gas without it being duly registered by the index, the inventor states is entirely obviated by the quicksilver in the cups. Attached to the shaft is a catch to prevent its revolving the reverse way.

The Aeromoter not only works without the slightest resistance to the flow of gas, but assists its current to the burners; it requires the least possible pressure in the mains to work it, and affords a steady uniform light without any interference, and the construction is of so simple a nature that its derangement by ordinary means is an impossibility. The valves and the other mechanical contrivances are made of a metallic compound, which resists the action of sulphuretted hydrogen or ammoniacal gases, its duration may therefore be considered to be secured for a very long period. There are likewise not any stuffing boxes to get corroded.

The inventor considers that his new meter or Aerometer has the following advantages over the old meter:—That the heat or cold cannot possibly interfere with, nor disorganize the mechanical arrangements connected with the action, that the wear and tear will be found to be inconsiderable, that the lower part is not liable to decay, it being made of cast iron, and that the index will enable the consumer to ascertain with ease and certainty the quantity of gas that has actually passed through the meter, the correct registration of which is insured by the absence of any liquid which in wet meters not only often prevents it, but causes a very considerably loss to the companies supplying the gas, equal to one-sixth the quantity manufactured.

PAPIER MACHEE.

JOHN COPE HODDAN, of No. 29, Liverpool-street, King's Cross, Middlesex, Civil Engineer, for "*Improvements in the mode of manufacturing papier machée, and other articles made of vegetable pulp.*"—Granted Nov. 21, 1843; Enrolled May 21, 1844.

This invention consists in a mode of combining successive layers of wet pulp, by causing the same to be wound round a cylinder until it has acquired a thickness sufficient for the purpose it is intended, after which it is to be cut from the cylinder with any convenient instrument. The machine first described consists of a vat or back containing a quantity of pulp, which the inventor prefers to be made from fine coloured rags; on the edge of this back there are two plummer blocks or steps supporting a cylinder covered with wire gauze, which cylinder is partly immersed in the pulp contained in the back; above this cylinder, and a little to one side thereof, there is another cylinder of wood or other suitable material supported by two levers, moving upon an axis at their lower ends; this latter cylinder is brought into close but light contact with the gauze cylinder, by means of cords and weights being attached to the levers. Motion being given to the two cylinders, the pulp will be raised from the "back" by the gauze cylinder, and will be allowed to pass between the two cylinders and round the wood cylinder in successive layers, until it has become of a thickness required for the purpose intended, after which it is cut across, or from end to end of the cylinder, and the substance opened out and pressed slightly so as to flatten it. The material may afterwards be immersed in linseed oil, as the manufacturer may think fit, and pressed in dies suitable for the article intended to be made. The second machine consists of an iron frame supporting a wood cylinder, and also a small roller, which is below the cylinder and so arranged, by means of levers as to be raised and pressed against the cylinder. Between the cylinder and roller an endless felt passes, which felt receives the pulp from an ordinary paper machine, and the same passes with the felt between the roller and cylinder, and is wound round the wood cylinder in successive layers whilst in a wet state, and for the purpose before described. The inventor claims the mode of combining successive layers of wet pulp together by winding the same round a cylinder and afterwards cutting it off with any convenient instrument.

IMPROVEMENTS IN THE MANUFACTURE OF GLASS.

JOHN WITHERS, of Smithwick, Staffordshire, Manufacturing Manager, for "*An improvement or improvements in the manufacture of glass.*"—Granted Nov. 16, 1843; Enrolled May 16, 1844.

These improvements relate to the cooling or annealing process, and have reference to a patent granted in 1842, to James Timmins Chance, part of whose improvements consisted in the construction of a long gallery, and in the application of a carriage running within the gallery upon a railway; at each end of this gallery was built the flattening and annealing kilns, a communication being formed with the flattening kiln and the gallery by an opening sufficiently large to allow the workmen to remove the plates of glass from the flattening stones, and place them upon an open carriage which were afterwards removed from the flatting kiln through the long gallery to the annealing kiln. Now the object of Mr. Wither's invention is to dispense with the long gallery or arch, which he does by constructing carriages of sheet iron or other suitable material, closed on all sides with the exception of one, which is constructed with an air-tight door, or at least sufficiently so for practical purposes, the object being to prevent the admission of atmospheric air as much as possible. By the application of carriages of this description, the working of the flatting kiln need not be interrupted, for so soon as one carriage is filled with plates or sheets of glass, it can be removed and another brought in its place. The carriages after being filled with plates of glass, the door of the carriage is closed, and the same can then be removed to the annealing arch (the temperature of which can be regulated at pleasure), without the least risk of being exposed to the action of cold air.

ROTARY ENGINE AND ROTARY PUMP.

MATTHEW LEACH, of Manchester, Mechanic, for "*Improvements in rotary steam engines, which improvements are applicable to pumps for lifting and forcing water.*"—Granted November 2, 1843; Enrolled May 2, 1844.

Fig. 1.

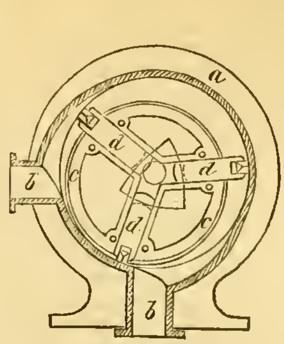
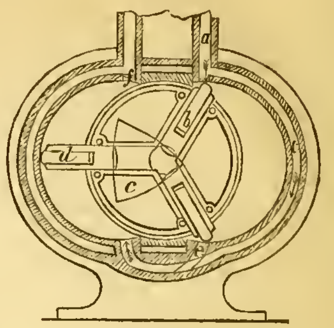
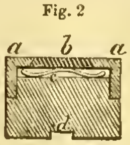


Fig. 3.



The principal novelty in this engine consists in the application of a triangular tappet or cam placed between the sliding pistons, by means of which the outer edge of each of the sliding pistons is simultaneously kept in contact with the surface of the inside of the cylinder. Fig. 1, shows an elevation of this rotary engine, with one side removed; *a, a*, is the external case or cylinder provided with two openings *b, b*; *c, c*, is the inner cylinder placed eccentric with the case, and mounted upon an axis which passes through stuffing boxes in the ordinary manner, this cylinder is provided with three sliding pistons *d, d, d*, one end of each of the sliding pistons resting against the one edge of the triangular cam or tappet *e*, whilst the other bears against the interior surface of the external cylinder or case, and forms a steam-tight junction therewith, which is effected by means of a metallic packing, the peculiar construction of which will be seen on reference being had to fig. 2, which shows a longitudinal section of one of the pistons. In this figure *a, a*, and *b*, are three pieces of brass, and *c*, a steel spring, the force of this spring acting against the piece of metal *b*, which is of a dovetail or wedge-like form, drives the two side pieces *a, a*, against the interior side of the cylindrical case, and so forms a steam-tight junction, or at least sufficiently so for practical purposes; this view shows a portion of the lower edge of the piston removed as at *d*, which is intended to receive the edge of the triangular cam or tappet

Fig. 2



By this arrangement it will be seen that the spring *e*, besides forcing out the pieces of metal *a, a*, and *b*, against the inside of the cylinder or case, presses the end of the piston against the triangular cam, which pressure is transmitted to the other pistons, so that there is a reaction of pressure which is equally distributed throughout the three pistons.

It will be evident that this apparatus may be used either as a rotary engine or a rotary pump, and that the ports *b, b*, may be used either as induction or eduction ports. Fig. 3, shows another modification of this engine, in which the steam or water entering the engine is divided into two parts or streams, which impinge upon two separate pistons at the same time. Suppose the steam to be passing through the passage in the direction shown by the arrows one portion of such steam would be admitted through the opening *a*, and would act upon the piston *b*, the other portion after passing along the passage *c*, would impinge on the piston *d*; that portion of steam which acted on the piston *b*, escaping through the eduction port shown in dotted lines at *e*, and that portion which acted on the piston *d*, would escape through the eduction port *f*.

AXLES FOR WHEELS.

WILLIAM ROWAN, of the firm of John Rowan and Sons, Dough Foundry, Antrim, Engineer, for "*certain Improvements in axles.*"—Granted November 7, 1843; Enrolled May 7, 1844.

Fig. 1.

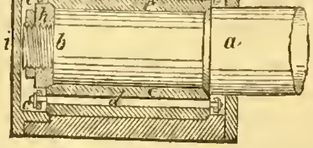
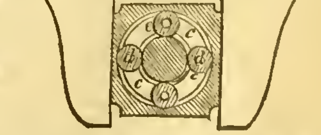


Fig. 2.



The object of this invention is to reduce as much as possible the friction caused by the journal or neck of the shaft, and its bearing, by the introduction of anti-friction rollers, the mode of applying which will be seen by the accompanying engravings, which show a longitudinal and transverse section of a box for supporting the ends of the axle; fig. 1, is the longitudinal section of the apparatus, and fig. 2, a transverse section drawn on a smaller scale; in fig. 1 *a*, is a portion of a railway axle, that part from *a* to *b*, being reduced in thickness; *c*, *c*, are two circular rings or carriers, which are made to slip over the axle *a*, *b*, and fit loosely thereon, these rings or carriers are connected together by means of four pins *d*, *d*, which form axles to the rollers *c*, *e*; these rollers are bevelled off at each end and made to fit against corresponding bevelled parts as will be clearly seen, thereby preventing the axle *a*, *b*, moving endways. The carrier *c*, *c*, and rollers *e*, *c*, being put together are in the first place slipped into the box *g*, *g*, the rollers together with the box are then slipped over or upon the axle *a*, *b*, and secured by the nuts *h*, and end plate *i*. The axle being put in motion. the rollers *c*, *c*, besides having a rotary motion will be carried, together with the carrier plates *c*, *c*, round the main axes *a*, *b*.

The inventor claims the application of friction rollers or wheels to axles, such rollers having rounded or bevelled ends, and mounted or supported by carrier plates, which fit loosely upon the axle and revolve round the axle as well as the rollers, some being kept together by means of caps, screws, or other contrivance.

IMPROVEMENTS IN THE MANUFACTURE OF ZINC.

James Graham, of Wapping, Middlesex, for "*Improvements in the construction of pots and vessels, and furnaces used in the manufacture of zinc, and in other manufactures, and also improvements in the treatment of the ores of zinc, in the process of manufacturing zinc.*"—Granted October 18, 1843; Enrolled April 18, 1844, reported in the Mechanics' Magazine.

1. The improvement in the construction of pots and vessels. The mould for the external surface is composed of a number of staves bound together with hoops, which, instead of being rivetted together at the two ends are joined by screws, whereby they are readily slackened to allow the staves to e withdrawn when the vessel has been formed inside. This mould is dropped upon a core placed in an upright position, which regulates the internal form and thickness of the pot or other vessel; the core being secured at the base by means of stays, leaving an open space all round, into which the composition for the formation of the pot is rammed by a tool made for the purpose. In the top of the pop, as thus moulded, but which subsequently becomes the bottom, there is an aperture left which serves to receive a pipe to convey off the metal into the receivers in the manner next described.

2. The improvements in furnaces. Each furnace consists of an arched oven, in which a number of the pots or crucibles before described are set; the flues being so arranged, that the action of the fire may come into play all round their external surfaces. Every pot has a pipe perforated throughout its whole length with small holes, inserted into the hole in the bottom of the same, and standing up on the inside to nearly the same height with the sides, through these small holes the vapour of the metal, as it is driven off by the heat, escapes, and is conveyed downwards by means of another pipe attached to the bottom of the pot on the outside, into receivers placed in a chamber formed below the furnace, where it is collected as condensed. The vapour cannot ascend as the pots are furnished with lids, which are securely luted on after the charge has been put in.

3. The improvements in the treatment of the ores in zinc. The products arising from the distillation of the ores of zinc are retained by another set of pipes leading from the bottom of the pots. When blende is distilled, the sulphuric acid is collected in chambers, such as are commonly used in the manufacture of that acid; and when calamine is being reduced, the carbonic-acid gas may be collected for any of the purposes to which it is applied.

ELECTRO-MAGNETIC MOTIVE POWER.

Lectures on Electricity. By Henry M. Noad. London: George Knight & Sons, 1844.

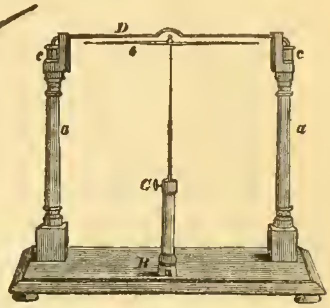
(Second Notice.)

On the previous occasion, in adverting to this useful work, we availed ourselves of some of its more general features, we shall now refer to that part which is particularly interesting to our readers, the application of the electro-magnetic sciences to mechanical purposes. The connection of electricity and magnetism, on the phenomena of which the practical applications are based, had been long suspected; the German philosophers in particular, devoted their attention to this subject, though in the last century great diversity of opinion prevailed. In a memorable discussion, promoted by the offering of a prize on the part of the Electoral Academy of Bavaria, it was maintained by Professor Van Swinden that the resemblance between the operations of electricity and magnetism was apparent only, and had no real basis. He consequently considered the power of each was distinct in its nature. Professors Steigelehner and Hübner took the opposite side, and contended for the doctrine now received, that both sets of phenomena are derived from the same cause. It was not, however, until 1819 that this question was set at rest by Professor Oersted, of Copenhagen, to whose important discovery we have since been so much indebted.

"The fact observed by Oersted was, that when a magnetic needle was brought near the connecting medium, (whether a metallic wire, or charcoal, or even saline fluids, of a closed voltaic circle,) it was immediately deflected from its natural position, and took up a new one, depending on the relative positions of the needle and wire. If the connecting medium was placed horizontally *over* the needle, that pole of the latter which was nearest to the *negative* end of the battery, always moved *westward*; if it was placed *under*, the same pole moved to the *east*. If the connecting wire was placed parallel with the needle, that is, brought into the same horizontal plane in which the needle was moving, then no motion of the needle in that plane took place, but a tendency was exhibited in it, to move in a vertical circle, the pole nearest the *negative* side of the battery being depressed when the wire was to the *west* of it, and elevated when it was placed on the *eastern* side. Fig. 2 represents

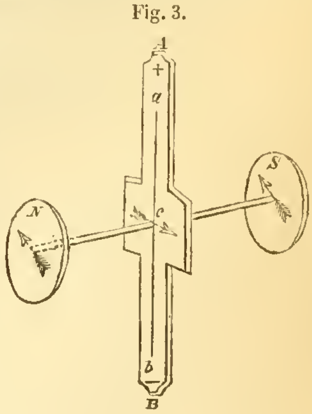
Fig. 1.

Fig. 2.



a convenient arrangement for exhibiting the action of a wire conducting a current of Electricity on the magnetic needle. *a a*, two turned wooden pillars screwed into a base board B, and surmounted by two mercury cups *c c*. *D*, a copper wire, the ends of which dip into the mercury, as do also the wires connected with the opposite extremities of a simple voltaic battery. A current of Electricity can thus be made to pass either way along the wire D: *e* is the magnetic needle nicely poised on a wire, which by the screw G may be elevated or depressed. and the needle thus set either above or below the wire D, or it may be removed and replaced by the dipping needle *b* fig. 1. As in all electro-magnetic researches, it is necessary to bear in mind these affections of the needle and electrified wire; several contrivances have been made to assist the memory respecting the details. Fig. 3, represents the plan of Dr. Roget. *A B* is a slip of card, on each side of which, a line *a b* is drawn along the middle of its length, the end *a* being marked +, the end *b* —, and the centre *c* being crossed by an arrow, at right angles to it, directed as in the figure. Through the centre, and at right angles to the plane of the slip of card, there is made to pass, a slender stem of wood, at the two ends of which, are fixed in planes, parallel to the slip of card *A B*, the circular discs of card marked respectively with the letters *N* and *S*, and with arrows parallel to, but pointing in a contrary direction to the one at *c*. The same marks must be put on the reverse of each of the three pieces of card, so that when held in different situations they may be seen without turning the instrument.

Fig. 3.



"If the line *a b*, be supposed to represent the connecting wire. (the direction of the current of Electricity being denoted by the signs + and — at the ends of the line) the arrow at the centre will point out the direction in which it tends to move, when under the influence of the north pole of a magnet, situated at *N*; or of a south pole situated on the other side, as at *S*; and vice versâ the arrows *N* and *S*, will indicate the directions in which the north and south pole respectively tend to revolve round the connecting wire in its vicinity, with relation to the direction of the current of Electricity, that is pas ing through it. It must be observed that the poles *N*, *S*, are not conside d as in connection with each other, or as forming parts of one magnet; th r operations are exhibited singly and quite independently of each other. T e advantage of the instrument consists in its being capable of being held in any situation, and thus easily adapted to the circumstances of any fact or periment of which we may wish to examine the theory."

It was Ampère who first succeeded in effecting the rotation of a magnet round its own axis. He effected this by placing a magnet without support in a vessel of mercury, but kept in a vertical position by a weight of platinum, attached to its lower end. The object in this experiment was to make the electrical current pass through one half of the magnet, and then, having diverted or broken it from its course, to make it pass away in such a direction as not to affect the other half. The reason assigned for this is that supposing a positive current is made to descend a magnet placed vertically, with its north pole uppermost, it would tend to urge that pole round from right to left, but it would have the reverse influence on the south pole, for it would urge it round from left to right. Taking another supposition, that there are two electrical currents, corresponding to the vitrious and resinous electricities, still the tendencies would be the same. In the experiment just alluded to of Ampère, the electric current after passing through the upper portion of the magnet, then goes into the mercury, through which it is diffused, and in no sensible respect affects the lower portion, nor interferes with the rotation produced by its means on the upper pole. A better mode is, however, now employed for effecting this object by carrying off the current in a different channel, which is effected by means of an apparatus constructed by Mr. Watkins. A flat bar magnet is supported in a vertical position by an upright metal wire, fixed in the base of the apparatus, and having a hole in the centre, containing an agate cup, to receive the lower pointed end of the magnet; its upper end turns in another hole, made in a vertical screw with the milled head to turn it by. This is passed through a screwhole made in an arched piece of wire screwed to the upper part of the platform or base. Around the vertical wire first described a cistern is placed to hold mercury, and another cistern is provided having a hole in its centre, to allow the magnet to pass through, and revolve within it near the middle of the magnet. The cisterns have metal wires projecting into them, through their sides and supports, cups of mercury, for the purpose of completing the communication by connecting wires with the voltaic battery. Two small curved and pointed wires are fixed to the magnet, and the ends of the wires dip into the mercury in the cistern. The voltaic circuit having been completed the magnet begins to revolve within the electricity, which it conducts itself, forming indeed a part of the circuit. In these experiments, the rapidity of the rotations of the magnet depends upon the delicacy of the point of suspension, as much as on the strength of the magnet itself, or the power of the voltaic battery combined. To act upon a large magnet, a cup, to contain mercury, must be provided and fixed to the vertical screw, by means of which and another battery an electric current can be passed from the top of the magnet to its equator, and an opposite current from its lower end to the equator, so that an additional force is obtained.

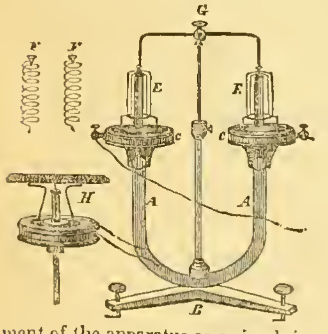
The vibratory tendency of electrified wire is a step beyond this. Mr. Marsh employs a slender wire, suspended from a loop and capable of free motion. Its lower end is amalgamated, and dips into a cistern of mercury. A cup at the top of the wire, and another below it are also filled with mercury, and through them the electric current is passed down the loose wire, but no motion is perceptible until a horse-shoe magnet is placed in a horizontal position on the platform, with its poles enclosing the wire, when the wire is instantly moved backwards and forwards, according to the position of the poles and the direction of the current. The wire thus thrown out of the mercury the circuit is broken, and the effect ceases until the wire falls back by its own weight, when the operation is resumed, and soon produces a succession of vibrations.

By employing a spur wheel, with a similar apparatus, this motion can be converted into one of rotation, though after all the division of the wheel into rays is not absolutely necessary, for a circular disc of metal will do quite as well. This is a very interesting and a very pretty experiment, when tried on a considerable scale, as the wheel revolves with immense velocity, and streams of coloured sparks burst from it.

The rotation of coils, wires, helices, &c., is well illustrated by an apparatus of Messrs. Knight, of Foster Lane. In the usual plans, mercury is employed, but Messrs. Knight dispense with it, and produce a useful modification of Ritchie's rotating magnet.

"In Fig. 4 a horse-shoe magnet is represented supported on a tripod stand with levelling screws. *A A* is the magnet; *B* the tripod stand, *C C* two circular wooden cisterns for holding mercury and capable of being adjusted at any required height by binding screws, *E E* are two light wire frames, *F F* two helices, *H* a Ritchie's rotating magnet; on the tops of the wire frames and helices are small cups to contain a drop of mercury, *G* is a piece of brass wire bent twice at right angles and terminated at each end by a fine point to dip into the globules of mercury: it can be raised or depressed without disturbing the general arrangement of the apparatus as a simple inspection of the figure will show.

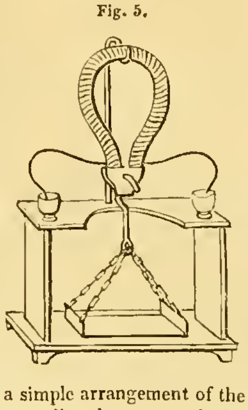
Fig. 4.



"When the rotating magnet is set in action in this apparatus a loud hum ming noise and sometimes a loud musical sound is excited by the rapid vibratory motion assumed by the fixed magnet during the rapid revolution of the electro-magnet. This musical sound is best observed when the levelling screws of the tripod are placed on a mahogany table in the middle of a large room. For the electro-magnet *H* a simple coil of wire may be substituted, the rotation of which will be exceedingly rapid, its faces becoming alternately attracted and repelled by the poles of the magnet."

The power of the electro-magnet is a great consideration, and in order to produce the greatest effect of electro-magnetic induction on soft iron, the current must be made to encircle it by passing through a considerable length of insulated copper wire wound round the iron. A great length of wire is, however, found to weaken the effect of the current, and it is considered better that the total length of the wire intended to be used should be cut into several portions, each of which, covered with silk or cotton thread to prevent lateral communication, is to be coiled separately on the wire. The ends of all the wires, Mr. Noad directs, must then be collected into two separate parcels and made to communicate with the same voltaic battery, taking, however, precautions that the current shall pass along each wire in the same direction. The accompanying engraving shews a simple arrangement of the electro-magnet, mounted on a wooden stand with a small scale pan attached to the bit or keeper of the magnet. So intense is the magnetic power thus induced on the iron that weights of upwards of half a ton can be sustained. Mr. Noad's large magnet, weighing one hundredweight, will sustain, when excited by an energetic compound battery, from 10 to 14 cwt.; but Mr. Richard Robert's magnet, weighing 35 lbs., with an armature 23 lbs. in weight, when excited by a battery of eight pair of Sturgeon's cast iron jars, is reported to have sustained a weight of 2950 lbs., or upwards of 26 cwt. Mr. Noad's magnet supported a weight of 14 to 1, but Mr. Robert's of 84 to 1 without the armature, or 50 to 1 reckoning the gross weight. We should like to see such a magnet under the operation of Armstrong's hydro-electric battery at the Polytechnic Institution. At any rate there are indications the sustaining weight is very great. Mr. Radford's magnet, weighing 18¼ lbs. and with an armature of 14¼ lbs., excited by a battery of twelve of Sturgeon's cast iron jars, sustained a weight of 2500 lbs., or 22 cwt. The results are as follows:—

Fig. 5.



	Weight of Magnet.	Weight of Armature.	Total Weight.	Weight sustained.	Proportion to Net Weight of Magnet.	Proportion to Gross Weight of Magnet.
	lb.	lb.	lb.	lb.	lb.	lb.
Noad's magnet	—	—	112	1568	—	14
Roberts's . . .	35	23	58	2950	84	50
Radford's . . .	18¼	14¼	32½	2500	137	76
Joule's	—	—	11½	2710	—	236

The intensity of a magnet of the weight of Mr. Noad's, constructed on the same principle as Mr. Radford's, and excited by an adequate power, would sustain at least twelve tons weight, if the power do not increase, indeed, in a much greater proportion. It is singular, however, that in these experiments the power should be inversely as the weight. Mr. Noad thus describes Mr. Joule's magnet.

"The third electro-magnet alluded to, is that of Mr. J. P Joule, and is shown in Fig 6. *B B*, are two rings of brass, each 12 inches in exterior diameter, two inches in breadth and one inch in thickness; to each of these pieces of iron are affixed, by means of the bolt headed screws, *s s*, &c.: 24 of these are *grooved*, and fastened to the upper ring; 24 are plain and affixed to the lower ring. A bundle, *W W*, consisting of sixteen copper wires, each of which was sixteen feet long, and one-twentieth of an inch thick), covered with a double fold of thick cotton tape, was bent in a zig-zag direction about the grooved pieces. Fig. 7 represents the method adopted for giving the electro-magnetic ring a firm and equable suspension: *a*, *a*, are hoops of wrought iron, to each of which four bars of the same metal are riveted and welded together at the other end into a very strong hook. The hoops are bound down to the brass rings by means of copper wires. The weight of the pieces of grooved iron was 7·025 lbs., and that of the plain pieces 4·55 lbs.; and when excited by 16 pairs of the cast iron battery, arranged into a series of four, a weight of 2,710 lbs. was suspended from the armature, without separating it from the electro-magnet; and Mr. Joule thinks, that by the use of some precautions, which have occurred to him since making his first experiments, the actual power will be very considerably augmented."

Fig. 6.

Fig. 7.

The application of electro-magnetic power to a practical purpose has occupied the attention of many able and ingenious men, and it has been carried to such an extent that its ultimate success may be foreseen, although, at the present moment, economical difficulties stand in the way. The number of these inventions is very great, so that we may anticipate, from the amount of time and talent devoted to the subject, a practical solution of the problem is not far distant. To give anything like a connected history of this subject would take up far more time than it is in our power to afford, neither is it necessary to do more than allude to some of the more prominent plans, which exhibit the principles on which the inventors have proceeded. In 1837, Mr. Davenport, of Vermont, U. S., took out a patent for a rotary engine, thus constructed: the moving part is composed of two iron bars, placed horizontally, and crossing each other at right angles, these are covered with insulated copper wire, and sustained by a vertical axis, and having proper connection with the voltaic battery in the usual mode. Two semicircles of strongly magnetized steel form an entire circle, interrupted at the two opposite poles only, and within this circle, which is placed horizontally, the galvanized iron cross moves in such a manner that its iron segments revolve parallel, and very near, to the magnetic circle and in the same plane. The axis of the cross at its upper end is fitted by a horizontal cog wheel to another larger vertical wheel to the horizontal axis of which the weight is attached, and raised by the winding of a rope. By the galvanic connection these crosses and their connected segments are magnetized, acquiring north and south polarity at their opposite ends; and being thus subjected to the attracting and repelling force of the circular fixed-magnet a rapid horizontal movement is produced, at the rate of six hundred revolutions in a minute, when a large calorimotor is employed. The movement is stopped in an instant by breaking the contact with the battery, and then reversed by simply interchanging the connexion of the wires of the battery with those of the machine, when it becomes equally rapid in the opposite direction.

We should remark for the benefit of our readers that Mr. Noad's eighth lecture contains much useful information as to electro-magnetic motive power, and electro-magnetic locomotion, from which lecture we select the following list of some electro-magnetic machines, with the references to the periodicals in which descriptions are contained.

"Sturgeon's Electro-magnetic Engine for turning Machinery. 'Annals of Electricity.' Vol. i. p. 75.

"Jacobi's valuable paper on the application of Electro-magnetism to the moving of machines, with a description of an Electro-magnetic Engine. 'Annals of Electricity.' Vol. i. p. 408-419.

Mr. Joule's Electro-magnetic Engine. 'Annals of Electricity.' Vol. ii. p. 122.

"Mr. Davenport's Electro-magnetic Engine. 'Annals of Electricity.' Vol. ii. p. 257.

"The Rev. F. Lockey's Electro-magnetic Engine. 'Annals of Electricity. Vol. iii. p. 14.

"Dr. Page on Electro-magnetism as a moving power. 'Annals of Electricity.' Vol. iii. p. 554.

"Mr. Joule's second Engine. 'Annals of Electricity.' Vol. iv. p. 203.

"Mr. Uriah Clarke's Engine. 'Annals of Electricity.' Vol. v. p. 33.

"Mr. Thomas Wright's Engine. 'Annals of Electricity.' Vol. v. p. 108.

"Mr. U. Clarke's Electro-magnetic Locomotive Carriage. 'Annals of Electricity.' Vol. v. p. 304.

"Jacobi on the 'Principles of Electro-magnetical Machines.' Report of the Meeting of the British Association in Glasgow in September, 1840. 'Annals of Electricity.' Vol. vi. p. 152. (This is a most valuable paper, and is well deserving of attentive study.)

"Mr. Robert Davidson's Electro-magnetic Locomotive. 'Engineers' Magazine,' &c. Part 15, p. 48.

"Mr. Taylor's Engine. 'Mechanics' Magazine.' Vol. xxxii. p. 694.

"Mr. Watkin's Electro-motive Machine. 'Phil. Mag.' Vol. xii. p. 190.

"An Inquiry into the possibility and advantage of the application of Electro-magnetism as a moving power, by the Rev. James William M'Gauley.

"Report of the Proceedings of the British Association for the Advancement of Science at the Dublin Meeting, August, 1835."

In 1838, as it will be remembered, Capt. Taylor's electro-magnetic engine was exhibited. It is thus described:—"Mr. Taylor employs as his prime movers, a series of electro-magnets, which are alternately and almost instantaneously magnetized and de-magnetized, without any change of polarity whatever taking place, and in bringing certain other masses of iron or electro-magnets successively under the influence of the said prime movers when in a magnetized state, and in de-magnetizing the said prime movers as soon, (or nearly so.) and as often as their attractive power ceases to operate with advantage; or in other, and perhaps plainer words, his invention consists in letting on or cutting off a stream of the electric fluid in such alternate, quick, and regular succession, to and from a series of electro-magnets, that they act always attractively or positively only, or with such a preponderance of positive attraction, as to exercise an uniform moving force upon any number of masses of iron or magnets placed so as to be conveniently acted upon. Mr. Henley constructed a very large electro-magnetic engine, on Captain Taylor's plan, at the time that that gentleman took out his patent. The wheel was 7 feet in diameter, and weighed 4 cwt. This machine did some work, but at an enormous expense, 6 cwt. of sulphate of copper having been consumed in one week, in experiments alone. The battery employed contained 13 cwt. of metal."

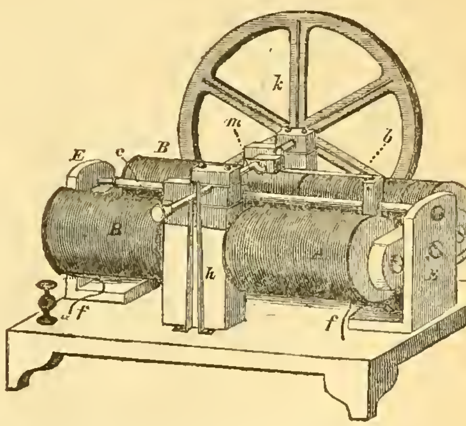
In 1837, Mr. Davidson had also applied himself to the subject. His machine differs little in construction or principle from that of Capt. Taylor. In 1842, Mr. Davidson constructed a large electro-magnetic locomotive, and tried it on the Edinburgh and Glasgow Railway. "The carriage is sixteen feet long and six feet broad and weighs above five tons, including batteries, magnets, &c. The electro-magnets are not one solid piece of iron; nor are they rounded behind. Each of the side parts or arms is constructed of four plates of soft iron put together, so to form as it were a box for the sake of lightness. The arms are twenty-five inches long and joined together behind by plates of iron. Their rectangular poles measure eight by five inches, and at their nearest points are only about four inches asunder. The coils with which they are surrounded do not consist of a single copper wire, but of bundles of wire wrapped round with cloth to insure insulation. According to Mr. Davidson's first arrangement these magnets were placed so that their poles were nearly in contact with the revolving masses of iron in their transit: but so prodigious was the mutual attraction, that the means taken to retain the magnets and iron in their assigned position were insufficient."

This machine only realized four miles an hour, being less than that of a single man, who could on a level railway move a carriage of the same weight with equal velocity.

Professor Jacobi, of St. Petersburgh, tried in 1838, at the expense of the Russian government, the experiment of propelling a boat by electro-magnetism. The vessel went at the rate of four miles an hour with the stream and three miles against it, which as Mr, Noad remarks, is more than was realized at first with the steam-boat.

The accompanying engraving represents a small working model of an electro-magneto-motive engine, constructed by Mr. Bain and improved by Messrs, Knight and Son.

Fig. 8.



"On to a stout mahogany board are fixed the brass uprights $E\ E$; to these are attached the electro-magnets $A\ B$, covered with stout wire; through the upper part of these uprights, and above the magnets, the two ends of the steel spindle c work; this spindle carries about its centre an iron bit, which is alternately attracted by the two magnets A and B, but prevented from absolute contact by pieces of paper; another spindle m, at right angles with c, and supported by the uprights $h\ h$, carrying at one end the fly wheel k, and on the other a small pully, is cranked in the centre and connected with c by the spring and hook b. At h are seen two brass springs bearing lightly on the spindle, which is divided in the middle by a small piece of ivory, so that one only is in contact at the same time. The connections are formed thus:—one termination of the electro-magnet A is connected to one of the upright springs bearing on the spindle, and the other termination to the binding screws seen at the end of the board. The one termination of the electro-magnet B is connected with the other spring, and the other extremity to the same binding screw to which one end of A was attached, the remaining binding screw being in connection by means of a wire with the brass box in which m works. The working of this machine is greatly assisted by two spiral springs fixed underneath the board attached to the moving bit. The whole arrangement performs extremely well, and no doubt if made on a large scale would be very powerful.

NEW LINES OF RAILWAY.

We have in the last number made some general remarks on the state of the railway interest, and here it is our intention to give some account of the new lines, which are now before the public. In undertaking such a task many difficulties beset us, for some have only been paper plans and have already disappeared from the scene, and some have sustained defeat in the House of Commons. The number of projects, moreover, is so great as almost to defy complete enumeration, and to prevent any concise view being taken of their general bearings. We must, therefore, do the best we can with them, beginning with the north.

The Dundee and Perth Railway is to have a capital of £250,000, and is chiefly supported by the local interests. It is to be connected with the chain of railways at Dundee, including the Dundee and Arbroath, and Dundee and Newtyle, and Arbroath and Forfar, and is to run to Perth, a distance of 20 miles. The estimate is £250,000.

At Perth, the line is taken up by the Scotch Central Railway, which runs by Stirling to the Edinburgh and Glasgow Railway at Falkirk. The capital is £700,000; the line a light line 40 miles long, and the estimate £15,000 per mile. The local aristocracy and authorities strongly support it. A circuitous line is thus formed between Dundee and Edinburgh, and a direct line between Dundee and Glasgow, which is of great importance, for Dundee is engaged in the Eastland and linen trade as Glasgow is in the Western and cotton trade. Communication is in fact opened up with the North Eastern Scotch counties to the rest of the country. A line is also talked of from Arbroath to Aberdeen, but many deep rivers have to be passed, though at the same time it must be admitted the coast is thickly covered with flourishing seaports.

A bill is in the house for a short line called the Glasgow, Garnkirk, and Coatbridge Railway; and a line is re-agitated to proceed from Glasgow to Dumbarton and Loch Lomond, being 20 miles, and requiring a capital of £300,000.

A more interesting arena is, however, the country to the south of Edinburgh and Glasgow, where many lines compete for the communication with England. As Yorkshire and Lancashire on one side, and Glasgow and Edinburgh on the other, require lines on their own sides it is quite futile to think of a single line to serve all. In fact, the Gordian knot is cut by the introduction into the House of Commons of a bill for a railway, from Edinburgh along the coast to Berwick, called the North British. As this is a line required for local wants it can scarcely be objected to, and will be highly valuable to the Edinburgh and Glasgow Railway proprietors as a continuation of their East and West line. From Berwick the associated Southern English lines are prepared to carry a line to Newcastle, thus providing for the communication between Yorkshire and Edinburgh, but giving no adequate accommodation to Lancashire and Glasgow, much busier localities. A line is therefore in the field, following much the same route as the one surveyed by Mr. Hyde Clarke in 1836, which goes from Glasgow by the existing railways to Paisley and Kilmarnock, and thence by Cumnock, Sanquhar, Dumfries and Annan to Carlisle, a distance of 92 miles, costing £13,000 per mile. The capital proposed is £1,300,000.

One of the competitors to this latter plan is called the Caledonian Railway, and follows Mr. Locke's line, and that adopted by the Government Commissioners, from Carlisle, by Lockerby, Symington, and Lanark. Here the line would diverge on the right to Edinburgh, and on the left to Glasgow. The capital proposed is £1,800,000. This would be a short line for the Lancashire people to Edinburgh and Glasgow. This line is promoted by the Grand Junction and Associated Lancashire Railways.

The Scotch or Central Union Railway is to favour the views of the Newcastle and Carlisle Railway people, starting from Gilsland on that line and proceeding through the inland districts, with branches to Glasgow and Edinburgh. This line is scarcely likely to be a favourite, being supported by no strong interest, and promising benefit only to one party.

From Carlisle a line is to be carried direct to Lancaster. This is supported by the Associated Lancashire lines, and the bill is before the House of Commons. Of the Cumberland West Coast line a further portion is proposed to be effected by the Whitehaven and Maryport line, which is connected with the railway system by the Maryport and Carlisle Railway. This Whitehaven Extension unites the coal ports of Cumberland, and is certain of completion. In Furness, another joint of the West Coast or Morecambe Bay line is proposed to be effected, by means of the Furness Railway, which is also before the house. With regard to the plan for the embankments of this line nothing at present is being done.

In Lancashire, a line from Blackburn to Preston is before the legislature. The length of line is 9½ miles, the capital proposed £120,000. This will have a beneficial influence on the Preston lines. To Bury two lines are proposed, one called the Rossendale, another from the Manchester and Leeds. To join the Rossendale project a line is proposed called the Blackburn, Burnley, and Accrington, capital £400,000, which would advantageously open up the North-West district of Lancashire. These are the principal Lancashire lines, but many others interest the district. We must not, however, omit to notice a report that Lord Francis Egerton is about to turn the Bridgewater Canal into a Railway.

Here, too, we may pause to mention that the Manchester direct line is about to be revived. This line would be 185 miles long, leave London at Battle Bridge, and proceed by Barnet, Luton, Bedford, Kettering, Harborough, to the Midland Counties Railway near Leicester. Following the railway to Derby, from Derby a direct line would be taken to Manchester.

Looking at the West Midland Counties, heretofore a neglected district, we find the Chester and Holyhead line, with a capital of £2,100,000, supported by the London and Birmingham Railway Company, and deserted by the Grand Junction Railway Company. A part of this plan is to buy up the Chester and Birkenhead Railway.

The communication to Shrewsbury, providing for a very great line of traffic, has at last been taken up, and some dispute is going on as to the course to be pursued. The Grand Junction want a line to Stafford, which although a good line for Manchester would clearly be a bad line to the South. Others promote a line from Shrewsbury to Wolverhampton. Such a line would of course take the North Wales traffic. It is also proposed to form a direct communication between Shrewsbury and Birmingham by Wolverhampton and Dudley, which would certainly entirely avoid the Grand Junction line: and if another contemplated line be carried forward from Shrewsbury through the mining districts, Oswestry, Ellesmere, and Wrexham, to Chester, (the part between Wrexham and Chester, 11 miles long, is before Parliament,) which is, we understand, supported by the London and Birmingham Railway Company, a direct communication will be made between London and Birmingham, with the Holyhead and Chester line, without running on any part of the Grand Junction Railway, or the Chester and Crewe line; and also by the branch from Chester to Birkenhead, already agreed to be bought up, a direct communication will also be formed with Liverpool, without running on either the Grand Junction or the Liverpool and Manchester lines, consequently there will be two most formidable competing lines of railway between Birmingham and Liverpool.

A line is talked of from Wolverhampton by Dudley, Stourbridge, Kidderminster, Worcester, Evesham, and Banbury, to Oxford. From Oxford and Banbury a line is also proposed to Rugby, by the London and Birmingham Railway, as likewise one from Banbury to Warwick, and so by Leamington to Coventry.

A plan called the Trent Valley line is well supported, and is to have a capital of £900,000. This line is under the auspices of the Manchester and Birmingham Railway, and is to start from Stafford, proceeding by Rugeley, Lichfield, Tamworth, Atherstone, and Nuneaton, to Rugby. It will be seen this line cuts off a great corner between Rugby and Stafford, saving a considerable distance, and of course competing with the London and Birmingham and Grand Junction, yet it is strongly reported to be favoured by the latter Railway.

The danger which has always threatened the Birmingham line, from its being a Birmingham line and nothing else, is now imminent. Passing through a thinly-peopled, inactive district, it has, perhaps, less local traffic, in proportion, than any part of the country, and is always liable to be turned on the right and the left, depriving it of its lateral feeding traffic, and the traffic beyond its Birmingham terminus. The Birmingham, however, has long been a favourite line—it was the best in the country—it was the head of the railway interest—it could do wrong and receive none—such seemed to be the popular feeling, but those more distrustful have always looked forward to the day when the London and Birmingham line would have to fight for its traffic inch by inch. The immediate quarter from which that danger was most imminent, the eastern side, is for the moment apparently secure, Mr. George Hudson, the railway dictator of the north, having for the time being entered into league and alliance with the Birmingham directors. That this will not last for ever any one who considers the position of the parties, and the great ability of Mr. Hudson, must feel convinced; nothing would astonish us less than to find Mr. Hudson next year abandoning the Birmingham, securing himself, and promoting a new line to London, for a line to the east must be carried. Does it, indeed, stand to common sense that a district 150 miles long and from 50 to 100 miles broad, containing 10,000 square miles and 2,000,000 of people is to be neglected, or that its population will be contented to go 50 miles out of their way to fill the pockets of the Great Midland and London and Birmingham Directors? It does not—the local interest and the public interest are both opposed to such a state of things. We, therefore, place no confidence in the safety of the Yorkshire traffic of the Birmingham, and we think the present truce a hollow one.

If, however, we consider the Yorkshire alliance a hollow truce what shall we think of the warfare with the Grand Junction. The London and Birmingham, it is true, is not so much bound up with the Grand Junction, but the Grand Junction cannot do without the London and Birmingham, while after all neither of them has got anything to gain by hostility. If the London and Birmingham, by the Trent Valley line, make a shorter route to Stafford and Manchester, the Grand Junction may give a Manchester direct line a shorter route between London and Liverpool than by the Birmingham, and also a more convenient line to the north. The Grand Junction have now not got the Manchester traffic to lose, and a slight modification of the Trent Valley line, carrying it by Leicester, Kettering, Bedford, Hertford and the North Eastern to London, would leave the London and Birmingham but little to boast of, while it would please all other parties much better. The London and Birmingham, of all parties, are the least able to engage in offensive warfare, for they have nothing to gain and have much to lose. Indeed, the best thing for them would be an amalgamation with the Grand Junction, although we are aware there is a difficulty in settling the claims of London and Liverpool to the seat of management. If, however, this be not done, it is by no means beyond probability that the Grand Junction may amalgamate themselves with a line to London, such as we have mentioned, to be worked right through, and which would have many attractive features.

The Great Western have again countenanced the Forest of Dean line, which starts from Stonehouse, on the Cheltenham and Great Western, and Bristol and Gloster, crosses the Severn, proceeds near Monmouth, crosses the Wye, and then extends into South Wales, communicating with the numerous collier lines which extend up the vallies of South Wales; undoubtedly the traffic on this line from that seat of wealth, the iron district, to London, Birmingham, and Manchester, would be considerable, the advantage to the ironmasters of communication with the manufacturing and commercial districts being self evident. At the same time this project will provide for a rapid communication from Milford and Fishguard with the South of Ireland and Dublin. It seems well conceived and likely to add much to the traffic of the Great Western Railway, though it may pare off a little of the Bristol traffic to the South of Ireland. The capital is to be £2,500,000.

We shall now proceed further south, still keeping westerly. Here the line from Exeter to Plymouth is the main ground of contest, one line proceeding inland and the other by the coast. Funds have, however, been promoted by the associated Western railways to make a communication between the two towns. The continuation to Cornwall is in agitation but is not adequately supported. The Great Western support an extensive plan for a line into Wiltshire. This line, starting near Corsham on the Great Western, this side of Bath, proceeds by the populous and active towns of Troubridge, Westbury, and Warminster, to Salisbury, having a branch from Melksham to Devizes, and another from Westbury to Frome. The length of line is reckoned at 52 miles, and the estimate is £10,000 per mile. It has been suggested by the *Railway Record* that this is done out of spite against the South Western, but we do not see how it is to affect the legitimate traffic of the South Western, while we believe it would be a most remunerative line, as providing for the traffic of the North Wilts towns with London, and for the traffic of the whole district with Bristol, its natural port. There is now before Parliament a line from Salisbury to the Bishopstoke Station on the South Western line at the junction of the two lines, Southampton and Portsmouth, which will tend materially to promote the interests of Southampton, for we are convinced that an extensive system of railway communication is essential to its commercial prosperity. In North Wilts considerable manufactures are carried on, and access to this district would enable the merchants of Southampton to extend their trade. The line proposed would also give them the benefit of a supply of coal from the Bristol field, a supply which they much want. Altogether we consider the Salisbury and Great Western a valuable line.

The Bristol and Exeter have proposed a branch to Crediton. This is a short line, but seems likely to be profitable and useful.

Agitation is going on for lines from the South Western to Poole, Dorchester and Weymouth; and we hope the demands of the local interests will be complied with, for we are sure the realization of these plans will be for the benefit of all parties.

The South Western branch from Basingstoke to Newbury has been approved by the House of Commons, while, most unaccountably, the Great Western branch to the same place has been rejected. By the Newbury branch, and the proposed London and Birmingham line from Rugby to Oxford, it may, however, be considered that the communication from Southampton to the north is provided for, an object of great importance to the port of Southampton, consequently essential for the developement of the local traffic on the South Western Railway, and giving that company a stronger hold on the mail traffic.

A bill is before the House of Commons for a railway, on Prosser's wooden principle, from Guildford to the Woking Station on the South Western Railway. This must be considered an experimental line, and one of much interest. It will most likely hereafter be extended to Godalming.

A line which is started by the South Eastern and Croydon Railway Companies is called the London and Chatham and Chatham and Portsmouth Junction Railway. The line is formed by the Kingston and Epsom, Epsom and Croydon branches, and thence by Bromley to Chatham, with a branch to Gravesend. This line does not seem to be a favourite.

The Brighton and Chichester line, under the auspices of the Brighton Railway Company, is to have a capital of £300,000. It proceeds from Shoreham, through Worthing and Arundel, to Chichester. On the other side of Brighton the same company propose a line by Lewes to Hastings, with a capital of £475,000. These two lines together will form a long extended line along the coast. From Hastings the South Eastern Company support a line by Hastings, Rye, and Tenterden to their line. We should, however, provide for a coast line differently. Let the Brighton proceed with their lines from Brighton to Hastings, and from Shoreham to Chichester, thus forming a continuous line of 70 miles along the coast; let the South Eastern abandon their branch from Headcorn to Hastings, and instead form a continuation of the Brighton and Hastings line, through Winchester and Rye to Ashford, by these means there will be a direct communication with Hythe, Folkestone and Dover, and also through the proposed branch from Ashford, to Canterbury, Ramsgate, Margate, and Whitstable. Let the South Western form a line, from the Portsmouth branch through Fareham and Havant to Chichester, and unite with the Brighton branch; also, let the Southampton proceed with the line projected to Dorchester, along the coast; then let the Great Western and Exeter run a line along the coast through or near Sidmouth, Lyme Regis, and Bridport, to join the South Western extension at Dorchester; also, let the Exeter proceed with the line to Plymouth and Falmouth, then we shall have the whole Southern coast of England accommodated, and we may say protected, by a continuous line of railways—now become imperatively necessary since steam power will enable the French to invade our Southern coast suddenly at any point.

Branches to Maidstone, and from Ashford to Canterbury, Ramsgate, and Margate, are taken up by the South Eastern Railway Company.

With regard to metropolitan lines, the projected lines to Manchester and York are the chief features. The Bricklayers's Arms branch of the South Eastern and Croydon line is now finished; the West London Extension has been rejected by the House of Commons. The Middlesex and Surrey Grand Junction Railway does not appear to make any way. Its proposed capital is £600,000, and it is projected to run from Harrow on the Birmingham Railway, to Merstham on the Brighton and Dover lines, crossing the Great Western at Southall, and the South Western, and consequently the Thames, at Kingston.

The Richmond and Staines Railway is being revived. It starts from the West London Railway to Stainse, throwing off a branch to Richmond. This would be rather an expensive affair; but we believe a Richmond line, if properly managed, would pay well, for the traffic is very great and could be much increased.

The Blackwall have brought forward a railway to Gravesend. It is to begin on the Kentish shore, opposite to the Blackwall terminus, and thence be carried along the north shore of Kent, through a populous and trafficking district to Gravesend, having a branch of about a mile long to Dartford.

The squabbling of the South Eastern lines is lulled for a time, but is ever ready to break out again. Experience and the force of circumstances have now produced a strong bias against short lines; and the necessity of amalgamating these four lines, for the purpose on the one hand of staying the mischievous bickering which has prevailed, and on the other augmenting the general income by consolidation, has become more and more apparent. The ill-feeling of a few narrow-minded and litigious individuals may for a moment stand in the way, the ambition or interest of directors and officials may induce them to withstand any measure which will shear them of emolument, but common sense and common arithmetic must prevail in the end. The cessation of competition, the abolition of a plurality of offices, the energy devoted to a general development of traffic, the economical conduct of one grand operation instead of four small ones, must inevitably and undoubtedly tend to a diminished expenditure, an enlarged receipt, and a divisible profit much more considerable. This requires no lengthened argument to prove it, facts have established it, no one doubts it, and he who runs may read its import. We therefore urge on the shareholders of the South Eastern, Brighton, Croydon, and Greenwich Railways the question of amalgamation, feeling convinced, that the sooner they can carry it into effect, the sooner they will reap the benefits of it. We are aware that at present there is a difficulty in ascertaining the real value of each line, and settling the final quota of each party, but even a provisional amalgamation would be no bar to the eventual interests of any party.

The Eastern Counties Company are engaged in a number of new lines. They have revived the Stratford branch, the estimate of which is £45,000. They propose a Harwich branch, cost £320,000, for which they have a competitor, and the Brandon and Peterborough line, 72 miles long, the estimated cost of which is about a million. They have also to provide for the extension of the Northern and Eastern line to Cambridge and the north, and of the Brandon and Peterborough to Norwich. The old Thames Haven has been revived, with a branch from the Eastern Counties Railway to Tilbury.

About the Harwich competition we need say nothing, between the two parties we suppose the branch will be made, though both bills have been refused this Session. The Eastern Union scheme is one for an extension of the Eastern Counties Railway to Ipswich, but its fate is uncertain.

The line from Yarmouth, by Norwich and Brandon, to Peterborough gives a long lead, but the communication by Peterborough and Northampton is too circuitous not to foster a better communication with Derbyshire and Leicestershire. A line must subsequently be taken either from Peterborough to Leicester, or by the Manchester direct route, from the Northampton and Peterborough near Kettering, to Leicester. At present, Mr. George Hudson, the railway dictator of the North, is in close league with the London and Birmingham, but such an alliance cannot last for ever.

The East and West Suffolk, in which some of the Eastern Counties' officials are concerned is a circuitous line from Colchester to Ipswich, Bury St. Edmund's, and Cambridge, the proposed capital of which is £450,000, and the benefit of which we do not very well see except as a local Suffolk line for promoting the interests of the port of Ipswich, and providing for the traffic of Bury St. Edmund's.

The Lynn and Ely, capital £200,000, is a very promising branch line, Lynn holding a very high rank among the secondary ports, and the outlet for a very rich and extensive district. If this plan provided for a convenient communication with Norwich, Lynn might prove a competitor for the Norwich traffic with Yarmouth.

We have now to allude to another great and important field for competition, the communication between London and York. Several parties have started distinct lines, of which one is the Cambridge, Lincoln and York, capital £2,500,000. This proposes to carry out the original Northern and Eastern line between Cambridge and York, but with a distinct line from Cambridge to London. The Great Northern is to go by Hitchin, Biggleswade, St. Neots, Huntingdon, Stamford, Grantham, Newark, Gainsborough, and Doncaster to South Milford on the York and North Midland Railway, and having a junction with the Sheffield and Manchester Railway. Another route, the Direct York line, follows much the same route, but a little more to the west in its Southern parts. A coast line is also promoted. A fierce opposition to any line in this direction is to be expected from the London and Birmingham and Great Midland interest, and strong support from the local parties, who are not disposed any longer to be deprived of the benefits of direct railway communication.

The East Midland district is very extensively traversed with projected lines. One line, and an excellent one, taken up by the Midland Counties, is Mr. Laxton's old line from Nottingham to Newark and Lincoln. This opens a communication for Lincolnshire with Leicester, Derby, Birmingham, and the West and South of England. The capital proposed is £350,000, and the length of line 33 miles. From Lincoln a line is projected to Boston, its southern shipping port, and to Gainsborough, on the Trent, its northern port, and now carrying on a thriving and extending trade. A line from Lincoln, Gainsborough, and Doncaster to Wakefield, is the subject of much controversy. The capital proposed is £750,000, the length of line 54 miles. From Lincoln to the South shore of the Humber, opposite Hull, a line is also contemplated, and which would form an easier communication with that port from most parts of the country.

The Sheffield and Chesterfield Railway was projected as a direct route from Sheffield to the South, and as a competitor with the North Midland, and under an enlightened system of legislation will be authorised as a great benefit to the public. The Barnsley and Peniston Junction was proposed also by the Sheffield and Manchester Railway Company as a shorter route from Manchester to Barnsley, Leeds and York, and must in the end be carried.

The Huddersfield and Manchester Railway and Canal is one of the plans for making use of existing lines of canal, and would prove a serious competitor with the Manchester and Leeds Railway. The capital proposed is £600,000, and arrangements have been made with the Canal proprietors.

The Leeds, Bradford and Halifax line has been proposed as affording a shorter route between Manchester and Leeds than is at present afforded, and will, we hope, ultimately be carried into effect. The length is nine miles; the capital proposed £300,000. We should observe, however, there are two competitors for this line.

The Leeds and Thirsk line is proposed as a means of saving a considerable distance between Leeds and the North, and is vehemently opposed by the York and North Midland parties.

Several lines are projected from the up country to Goole; and something of the kind is essential to allow this rising port effectually to compete with Hull. The interests however of the Don Navigation are in the way.

The Harrogate and Knaresborough line is a short branch from the York and North Midland. The capital proposed is £140,000, and the length of line 16 miles.

The York and Scarborough line, joining the Whitby and Pickering, is one of the favourite plans of Mr. George Hudson, on which he has guaranteed 10 per cent. It proceeds from York to Pickering and Scarborough, and will undoubtedly prove a valuable line.

With regard to Ireland a good movement is going on there. The completion of the railway communication between Dublin and Belfast by way of Drogheda, may be considered as secure. A branch from Drogheda to Kells is proposed, and a line from Dublin to the North West through Kells. The Great Leinster and Munster, from Dublin to Kilkenny, is being revived, and a line called the Dublin and Cashel seems likely to be pushed on. A line from Dublin to Mullingar, one from Portadown to Monaghan, and another from Carlow to Wexford, are also projected.

REVIEWS.

Architectural Biography:—Neues Allgemeines Kunstler Lexicon, von Dr. G. K. Nagler, 1—XIV. Band. München 1835—44.

At first sight, this work appears to be one of great labour and industry, and is certainly very far more comprehensive in plan than any other we are acquainted with, inasmuch as it gives the artists of all ages and all countries, living ones included. When, however, we come to put it to the test by examining and consulting it, we very soon discover that performance by no means keeps pace with promise, and that it is little better than a mere *omnium-gatherum*, very slovenly executed, without any sort of judgment, discrimination or diligence; wearisomely diffuse and prolix where compression would have been desirable, the very same information having been given over and over again in other works; and provokingly unsatisfactory and meagre where information is most of all desirable.

As we can best estimate this extensive Biographical Dictionary by its architectural articles, and as those are likely to have most interest for our readers, we shall chiefly touch upon that department of the work. In every department there are a number of exceedingly obscure names—such as will hardly ever be searched for by any one, or if they should be, will, when found, be discovered to be mere names, it being in many instances honestly confessed that nothing whatever is known of the individuals themselves; or else we are told that they are "said to have been," or are "supposed to have been," so and so. Surely then that would have been an all-sufficient reason for not encumbering with them a publication which has swelled out so enormously beyond the limits at first assigned to it, that instead of being completed as was promised in *six* volumes, the first Lieferung of the *fourteenth* does not reach to the end of the letter R.!

Yet although, it would seem, omission was on no account to be thought of, although—provided it could be got at all—no name, however utterly insignificant and null, was to be passed over, omissions there have been after all, and many of them—for they are not a few—are most startling and incomprehensible ones. It does seem quite incredible that while Dr. Nagler has literally opened the door of his Temple of Fame to so many of the οι πολλοι, hoi polloi—the ragtail and bobtail among the followers of art, he should have slammed it to, in the face of one whose name would be a passport into more select company than he would here have found, for as we have already, hinted, it does not consist entirely of the worthies of art. Nevertheless, so it is:—Charles Barry has been passed over altogether!—sort of omission to be matched only by that of Byron and Canova—two names with which—they being recently dead—all Europe was then ringing—in Crabb's Historical Dictionary, notwithstanding that the work is crammed with hundreds of names now fallen into utter oblivion! If, however, Charles Barry's fame had not reached Dr. Nagler, that of another English architect has, and has travelled post-haste to him, without stopping anywhere by the way. Until apprized of the fact by Dr. Nagler, we were not aware that Mr. Leitch Ritchie was an architect; for we never heard of him but as an Editor of, and writer for Annuals. The pains-taking accuracy which leads him to dub Leitch Ritchie an architect, leads him also to describe Professor Hosking as an engraver! than which blunder he could have committed no graver and more grievous one in that gentleman's opinion.

Out of the two Pugin's, the Doctor has contrived to make one, hashing up the father and son together in the most whimsical manner, and serving up to his readers what is a mere tissue of blunders from beginning to end. The blunders seem sometimes to be very malicious ones, as for instance, when he calls *Gwilt, Guilt*, he is thereby himself guilty of a most awkward mistake:—no wonder, therefore, that Gwilt should bear the Germans a grudge.—Britton is described both as an architect and as one of the most learned writers on the subject of architecture—in evidence of which last, perhaps, his unlucky "Dictionary" is mentioned as one of his literary achievements. We do not, however, mean to say that he might very well have been omitted—certainly not; for in a work of the kind, not only artists alone, but also those who have written and published upon art ought to find a place, and their productions should be recorded. Had, therefore, consistency of plan been observed, we should have had Bentham, Dallaway, Thomas Hope—if only as the author of the "History of Architecture;" Sir James Hall, on account of his very fanciful but ingenious treatise on Gothic architecture; and the late J. C. London. The last-mentioned was certainly entitled to notice if only on account of the extensive influence some of his publications have had in popularizing the study of architecture. The author of the valuable work on the Picturesque, Sir Uvedale Price, is another who was fairly entitled to notice as a writer on æsthetics. John Burnet, again, is mentioned merely as an engraver, without a syllable to apprize us of his excellent treatises on "Composition," &c. These, however, are but a very few of the omissions of the kind that might be instanced—neither are such omissions confined to English writers of the class; on the contrary, we have detected so many in regard to foreign ones of different countries, that we are warranted in describing this department of the work—which, if executed with decent care, might have been rendered an eminently serviceable one—as grossly defective. Besides this, and besides being more or less defective in regard to architectural biography generally, the articles belonging to it are for the greater part exceedingly meagre and unsatisfactory—in fact, treated as if of little or no interest to any one. Now, although in planning the work, it might have been a question whether architectural biography should be admitted or excluded—once admitted, it ought to have been quite as carefully and diligently executed as the rest; or rather a great deal more carefully than any part of the work now appears to be. Even when we cannot complain, as we so frequently have to do, of positive omission, we sometimes obtain a bare name, without even so much as determined dates. Will it be believed that only two lines and a half are allotted to Ventura Rodriguez, the Spanish architect *par excellence* of the last century, the mere list of whose works forms a catalogue of several pages in Llaguno, and of whom there is a very extensive memoir or "Elojio," by no less a writer than Jovellanos? Had all the rest been in the same proportion, the whole work would not have exceeded a single volume; whereas at present no sort of proportion at all has been observed, for there are some articles of most extravagant and outrageous length. By way of contrast to the instance just quoted, and the very scanty and imperfect information to be derived from the architectural articles in general, we refer to those on Rembrandt and Rubens, both of whom have been so amply spoken of in innumerable biographical works of every description, that condensation rather than extension in regard to them, would have been a merit. Nevertheless, to the former of these no fewer than *one hundred and thirty six* pages are assigned; and to the other *ninety one*, or together 227 pages: thus more space is given to those two artists than to upwards of ONE THOUSAND! and so far from being exaggerated this number might be even doubled, there being a prodigious quantity of names which do not average in length above one-tenth of a page.

After all, those two special articles consist chiefly of descriptive catalogues or lists of the etchings of the one, and of the numerous engravings from the works of the other—useful no doubt to print-collectors, but altogether misplaced in a work of this kind. Consistency, indeed, there is in respect to lists of engravings, for they are given most liberally in every case, nothing being easier than to extract them ready prepared from Bartsch and other works of that kind, and so fill up page after page by mere "scissors-and-paste" industry. But while print-collectors are likely to be already provided with the information thus diligently collected for them, others, who are not particularly interested in it, have good reason for complaining that it occupies a very undue space, and that while this Kunstler-Lexicon is rendered greatly more voluminous and expensive than there is any occasion for, by the insertion of such lists of engravings, it frequently does not afford them at all the information they seek. At all events the work does not fairly answer to its title; greatly exceeding in one particular the promise made by it, but falling very far short of it in all the rest—in the architectural department more especially; where the only additions of any interest, to that species of biography and history, are the articles on some of the living architects of Germany.

By aiming at *universality*, this "Lexicon of Artists" has been rendered far less complete than it might have been, by contracting the plan of it. The quantity of names is so enormous that in very many places it looks like a mere catalogue; and of the rest there is a good deal that seems mere dry indiscriminate compilation—and frequently very slovenly performed, into the bargain—to say nothing of egregious blunders. In regard to these last, we do not know whether there are any more such flagrant ones as those above pointed out, but they are sufficient to destroy all confidence in the work as an authority: all that we do not know to be correct, or cannot verify for ourselves, lies under the suspicion of being wrong. The whole is a sort of chance-medley, done according to no other principle than that of taking without inquiry—without either selection or rejection, whatever was most come-at-able. Being done, however, this Kunstler Lexicon will now for a long while stand in the way of another undertaking of the kind, at least in Germany; and as for expecting anything of the kind in this country, it is almost entirely out of the question: else we should recommend for it a division into separate publications of special biography. A dictionary of architects only, or of both architects and sculptors, is a desideratum, and likely to remain so, because it would be most unpromising as a bookselling speculation. If to be done at all—at least so as to be done satisfactorily, such a Biographical Dictionary ought to be brought out by some "Society." There is, indeed, one body from whom an undertaking of the kind might be looked for—the Royal Institute of British Architects, were it not so un-ambitious and so modest that it seeks no other fame than that which it now derives from its *Royalty*.

Original Geometrical Diaper Designs, by D. R. HAY, Decorative Painter to the Queen, Edinburgh. London: Bogue.

We have now a second part of Mr. Hay's designs before us, with a continuation of his essay on ornamental design. With the practical remarks in this on carpet ornament we concur, but page 5 abounds with rank heresy, partly arising from looseness of expression, but calculated to impress very incorrect doctrines on taste. It is to be inferred from what Mr. Hay says, that ornament is something used to conceal defects. "Wherever, therefore, we observe an ornament, we may suspect a defect." His divarication of ornamental design is rather trenchant. "There are two distinct classes of ornamental design. The one belongs exclusively to architecture, and the other conjointly to architecture and manufactures." What will be thought of this by the archæologists and polychromists—"all merely architectural ornaments are sculptured." We could accumulate notes of this kind, and make a long comment on them, but we shall reserve our remarks until the work is more advanced.

Ancient and Modern Architecture. Edited by M. JULES GAILHABAUD. Series the Second. Parts 18, 19, and 20. London: Didot.

Part 18 is more interesting from the associations connected with the buildings, than from their architectural merits. The cathedral of Bale, in Switzerland, cannot be regarded as a fine composition, nor the Palazzo Foscari at Venice. The latter is very meagre in its proportions. Part 19 contains the Temple of Arveris at Edfu, and that of Jupiter Olympus at Selinus. The plate of the latter contains a good many details, but the subject is interesting enough to admit of more copious illustration. Part 20 is by far the most pleasing of the three, it contains plates of two buildings at Venice, the Procuratie Nuove and the Library of St. Mark, the latter the work of Sansovino. These are undoubtedly designs of great merit, and though having many technical defects, undoubtedly showing much taste, and had they ten times as many faults we should prefer them to the insipid and mindless copies of our modern architects.

It has struck us in looking at this valuable work that as M. Didot has given English letter-press and English titles to the plates, it would increase their value much if a scale of English feet were inscribed in addition to the one of French metres.

STAINED GLASS EXHIBITION.

Sir,—The Stained Glass Exhibition as a national exhibition is certainly disgraceful—but still it is what any person acquainted with the circumstances attending the art of painting on glass might expect, for it is the only branch connected with the arts which has not a fair chance of advancement. In the first place, the orders which are given are generally given to shopkeepers, who will only employ men who will work *cheap*, for they expect to get four and five hundred per cent. profit on the works, consequently they must be badly executed to enable the artist to exist at all; and what is very strange, the architects encourage the ancient style of glass painting; not the best examples, but the worst absurdities of the ancients, abounding in nondescript heads and animals in the bad drawing of the 12th and 14th century; as for instance, in the Temple and Savoy Churches: if men in those remote periods could have drawn better they certainly would have done so. If you attempt to do better in the way of drawing, &c., many of the architects say it is too good for glass, which I think is very ridiculous for it forces the artist to make his figures cripples to please them—they speak of the colours used by Willement and others who know nothing of the practical part of the business. Mr. Willement has at present two glass painters at work, who are reputed to be the worst workmen in the trade, while the work of those two men employs twelve glaziers to work up. So much for the artist's part of the work; with respect to the colours, upon which they pride themselves, if you will take the trouble to walk round the Exhibition, you will find that all the glass painters have the same colours in common;—the colours are an article manufactured by the glass maker, and sold at a certain price per foot to the trade; therefore, no merit is due to the glass painter, as he does not produce them himself, but merely paints on the surface with brown and passes it through the fire to fix that colour, which is the ancient principle. The modern style is to produce all the colours on one piece of glass, without the assistance of lead, which requires great experience in the glass painter to attain, and is the only way in which a perfect representation of Nature can be obtained; by having the real light shining through your picture, you may obtain effects which no other style canaccomplish. But to return to the Exhibition—I certainly do not think it right that tradespeople should be allowed to send in specimens of painted glass, as if they were the artists; if so, the Commission is rendered useless—for instance, Cobbet & Son are glaziers, Chance & Co. glass manufacturers, Crace & Co. paper hangers, and, Mr. Wailes a grocer at Newcastle-on-Tyne, who has turned glass painter, and is filling our churches with his ancient rubbish wholesale, introducing plenty of bright colours and figures with yellow faces as if they had the jaundice, as may be seen in the figure of the Pilgrim on the staircase at the Exhibition.

I am, Sir, your obedient servant,

W. N.

May, 1844.

NEW PROCESS OF SILVERING GLASS.

At a recent meeting of the Chemical Society, Mr. Warington, the secretary, gave a description of Mr. Drayton's patent process of silvering glass, and exhibited a beautiful specimen. The method employed is, to add to a solution of nitrate of silver, sufficient ammonia to precipitate a little oxide of silver to the solution thus formed, to add some oil of cassia mixed with spirits of wine; this forms the silver solution, which must be poured over the surface of the glass to be silvered, and which must be previously well cleaned, a fillet of putty having been laid round the edge to retain the liquid; on to the surface of this must now be dropped a small quantity of the reducing solution, which consists of oil of cloves dissolved in spirits of wine, when the reduction of the silver will take place, it being deposited on the glass, the surface next to the glass assuming a splendidly brilliant face, more resembling a polished speculum than an ordinary mirror.

In the course of the interesting conversation which ensued, it was considered as probable that the reducing agent in this process is aldehyde, formed from the alcohol by the agency of the oils employed. It has been previously noticed that aldehyde will reduce silver from its solutions, and indeed a solution of this metal has been proposed by Liebig as the most delicate test for the presence of aldehyde in a liquid. This explanation we believe to be correct; for if we examine the composition of oil of cloves, as given by Dumas, it seems very probable that it would reduce the ether of the alcohol to the state of aldehyde; for one proportion of oil of cloves and one of ether, are exactly equal to six proportions of aldehyde minus water: thus

$$\begin{array}{lll} \text{Oil of cloves} & = & C^{20}\ H^{13}\ O^{5} \\ \text{Ether} & = & \underline{C^{4}\ H^{5}\ O} \\ & 6\,) & \overline{C^{24}\ H^{18}\ O^{6}} \\ & & \overline{C^{4}\ H^{3}\ O} \end{array}$$

which, with one of water, forms aldehyde, or, when oxide of silver is present, reduces it by abstracting its oxygen, the aldehyde being converted into aldehydic acid combines with another portion of the silver present.

It might be imagined that silver being the metal used, instead of, as at present, the cheaper alloy of mercury and tin, the expense of this process would prevent its extensive use; but when it is known that 12 grains of silver are sufficient to cover thoroughly a square foot of glass (as stated by Mr. Warington), that there is no pressure employed, and therefore no risk of breakage, that the operation can be carried on any where, no expensive level tables being needed, that it is performed very quickly, half an hour being sufficient to complete it, and that when done, there is no chance of its running, or crystallizing, which is frequently the case with the present method, besides its far superior brilliancy, we think there can be no doubt of its general adoption.

BEALE'S ROTARY ENGINE.

Mr. Editor—Some time ago you gave a drawing of Beale's Patent Engine and Boiler, now I shall feel greatly obliged if you could give or procure a candid reply to my questions, *i. e.*, is the boiler a good or bad one—are the tubes (above the water line) dangerous and liable to burn out or crack, and does not the boiler prime very much? The engine (though simple) of course is bad, like all other rotaries, as it wears itself more at the periphery than at the centre on the sides. I am exceeding pleased with the information about boilers, for it is a subject very much neglected, and is in my opinion of as much consequence as the engine. Mr. Buck's article on tubes is good, but nothing is said about the length, and therefore it is incomplete; he would find 3 in. tubes in a locomotive of the present construction very extravagant of fuel, which is the main point in all boilers. You say plenty about marine engines, but nothing about boats, which is worse than engines without boilers; could you not give the lines of some of the fastest river boats with full particulars, commencing with the boat, then the boilers, then engines, paddles and speed. Such information would be very acceptable.

Your's, respectfully,

Patience.

Birmingham, April 11, 1844.

[We gave a drawing and description of Mr. Beale's engine and boiler in the *Journal*, vol. 5, pp. 181 and 182, and if our correspondent will refer thereto, he will perceive that we then noted the exposure of the upper ends of the tubes to the fire as a great objection, as so much surface was lost. In practice the water is kept nearly up to the top cock. Although we had a somewhat lengthy trial with the boat and engines, we did not experience any inconvenience from "priming;" this description of engine would not be effected thereby in the same manner as a common reciprocating one. We believe Beale's engine to be the best of all the rotaries; at any rate, the best that has come practically under our notice. Its power is very great and constant—the generality of rotaries are mere toys, incapable of heavy work.]—Editor.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

April 29.—Mr. C. H. Smith *on the Magnesian limestone.*—This paper was a continuation of those formerly read treating on the sandstones and oolites: on the present occasion Mr. Smith proceeded with the subject by describing the great beds of magnesian limestone, which lie, with little intervals, from Nottingham and Tynemouth, and more especially those between Mansfield to Knaresborough, an extent of about seventy miles. In this district stone is found combining the carbonate of lime and magnesia from the lowest amount of the latter to proportions comprising pure dolomite—of course they vary greatly, both in appearance and quality, and that even in cases where the substances are, chemically speaking, the same;—among the best of these stones, as building materials, are the Bolsover, Roche Abbey, Barnham Moor, and Huddlestone. The first-named has been tested in the Norman Church at Southwell, which remains in a state of high preservation;

but much, as Mr. Smith particularly insisted upon, depends upon the situation of the beds from which the stone is raised: the remains of Roche Abbey, for example, and the church at Tukhill, both built with the stone which Sir C. Wren distinguished as second only to Portland, are in a perfect state with all the sharpness of the mouldings preserved, whereas buildings in the neighbourhood erected with the same material during the present century, but without due regard to the choice of the beds, are already in a state of decay; so also with regard to the Barnham Moor stone, many Roman remains at York are in a far better condition than the works of the middle ages in that city, not excepting the cathedral, and others at Hull, Beverly, and Tadcaster, built with the same stone. The Cadeby stone is found to decompose rapidly; a specimen used in London, perished in about fourteen years, and yet this stone is found within a short distance of Conigsburgh Castle, which was built with a similar stone from an adjoining hill, and remains the most perfect specimen of masonry of its age existing in this climate. The characteristics of durable magnesian limestone are its compactness and high crystallization; those which appear earthy, and powdery, and leave white on the fingers, on being handled, are not to be trusted. The Anston quarries, which supply the stone for the Parliament Houses, were left to be the subject of a final communication.

At the annual general meeting held May 6, Earl De Grey was re-elected President—Vice Presidents, Messrs. Papworth, Kendall, and G. Smith. Honorary Secretaries, A. Poynter and G. Bailey.—Honorary Secretary for Foreign Correspondence, T. L. Donaldson.

ROYAL INSTITUTION.

April 27.—"*On the Recent Researches in Electrical Decomposition.*"—By Dr. Miller, of King's College.

The lecturer, after showing by experiments that liquids when conveying the current are capable of extricating heat and inducing magnetism, and in these respects resembled solid conductors, proceeded to state that they differ from solids in the motion which their particles visibly exhibit; he asserted that most liquid bodies capable of transmitting the current consist of two or more chemical elements in combination, and that when subjected to the influence of a voltaic battery they are decomposed; one portion of the elements accumulating at one pole of the battery, whilst the other portion collects at the opposite pole. Water, he remarked, had always been considered one of the substances most easily thus decomposed: yet he showed that a spark may be obtained under water from two charcoal points forming the poles of a battery, of nearly as great brilliancy as that produced by bringing them in contact in air, which is admitted to be an extremely bad conductor; he also interposed at one point of the circuit a small quantity of distilled water, and showed that no electricity passed; on adding a solution of sulphate of soda to the distilled water, immediate decomposition ensued, and abundance of gas was extricated, an experiment from which he inferred that the presence of a little saline matter confers conducting power upon the water. After recalling attention to the discovery of Dr. Faraday, that the power measured at any one point of a voltaic circuit is a measure of its force at any other point, so that the proportion of a substance decomposed at one point is a measure of the quantity capable of being decomposed at any other point in the same circuit, he stated, that when saline solutions were electrolyzed, an apparent exception to this law was observed, and the current appeared in this case to have twice the power; so that a proportion of the salt was decomposed, and at the same time gases from the decomposition of an equivalent quantity of water were set free, whilst a voltameter included in the circuit only indicated sufficient electricity to decompose either the salt or the water, not both. This apparent paradox he explained by stating that the salt alone is in any case decomposed, and that the decomposition of the water is an accidental circumstance. All salts, he said, might be considered as composed of a metal, or something tantamount to a metal, in combination with a substance or group of substances possessed of equal but opposite electric power (in contradistinction to the common notion that they consist of an acid and a base in chemical union). When subjected to the decomposing action of the battery, the metal, he said, appeared at one pole, while the whole remaining elements were transferred to the opposite pole; when the metal, like potassium, was capable of decomposing water at ordinary temperatures, gas was given off, consisting of pure hydrogen, an oxide of the metal was formed, while at the other pole oxygen was given off from its separation from the bodies in combination with which it was transferred under the influence of the current, at the same time, an equivalent of acid was set free; when, on the contrary, the metal, like lead or copper, was not capable of decomposing water, no hydrogen was extricated, but the metal itself was deposited in the solid form. Experiments were shown in proof of this assertion, the salts being in some cases dissolved in water, in others melted by heat alone; when melted nitrate of silver, for instance, was thus treated, the metallic silver was obtained in beautiful crystals. After adverting to the value of the voltaic battery as a powerful means of investigating the molecular grouping of compound bodies, and aiding in the examination of disputed points in theoretical chemistry, the lecturer concluded by describing some curious results obtained relative to the transfer of the bodies disengaged under the influence of the current, and by stating that, contrary to the usually received opinion, such transfer did not take place in equivalent proportions in opposite directions; but that some substances, on the contrary did not appear capable of transfer at all; among this number was copper, and he referred to this cause the impoverishment of the solution around the electrotype plate where the process is long continued.

May 3.—"*On the application of the Microscope to Geological Research.*" By Dr. Carpenter, F.R.S.

Dr. Carpenter pointed out how much the progress of science depends upon the perfection of the instruments employed in the observation of its phenomena; and that even to geology, whose facts are for the most part obvious to the unassisted senses, the achromatic microscope has afforded, of late years, the most efficient aid. He noticed the researches of Messrs. Witham, Nicol, and others, on the structure of fossil woods, and the light which these had thrown on the origin of coal. The investigations of Prof. Owen on the structure of teeth were next glanced at, and illustrations of their application to the determination of fossils were given. The identification of the Labyrinthodon as the gigantic Batrachian, whose footsteps are preserved to us in the sandstone of the Stourton quarries, was noticed as one of the most interesting results of this kind of investigation; and a sketch was given of the train of reasoning by which Prof. Owen has established the true character and habits of the Megatheroid quadrupeds. Dr. Carpenter then gave a summary of the researches, on which he has been himself engaged, on the structure of the shells of the Mollusca, Crustacea, and Echinodermata. With the aid of highly-magnified delineations, he explained the *cellular* organization of the shells of Pinna, and other allied genera belonging to the family Margaritaceæ, by which the fossil forms of that group are at once distinguished (even by the examination of the minutest fragment) from all others;—the very curious *plicated membranous* structre, which is characteristic of Terebratula and its allies, and distinguishes them from all others;—the true character of the lines upon *nacre*, to which its iridescence is due;—and the *tubular* structure, analogous to the dentine or ivory of teeth, which is found in certain other genera, and is distinctive of them. After describing the peculiar *cancellated* structure of the shells of the Rudistes, and stating that, by his microscopic test, the perplexing *Cardium hibernicum* should be referred to that group, he briefly explained the structure of the shells of the Crustacea, the inner portion of which is tubular, and strongly resembles dentine, whilst its surface (beneath the horny structureless epidermis) is covered with a layer of cells, in which the colouring-matter is deposited; and gave a brief account of the structure of the shells, spines, &c. of the Echinodermata, pointing out the difference in pattern between the stems of different species of Pentacrinus, which rendered the microscope a very easy means of distinguishing them. The lecture concluded with a notice of the researches of Ehrenberg on Fossil Animalcules; of which the *silicious* remains form a large proportion of the chalk-marls of Southern Europe, besides abounding in other deposits; whilst the *calcareous* species make up a great portion of the chalk itself in many localities. Of these species, whose minuteness is almost inconceivable, many of those now living appear to be identical with those which existed at the early part of the tertiary epoch.

May 10.—Lord Prudhoe, President in the Chair.

"*On the Chemical and Mechanical processes, and the social influences of the Penny Post.*" By Rev. John Barlow, Sec. R. I.

Mr. Barlow said that he took this subject because it exhibited one of those instances where immense mental labour, ingenuity, and applied science were required to produce the most familiar articles of common use. The notion of separating, by a system of stamps, the financial department of the Post-office from the transmission and delivery of letters, originated with Mr. C. Whiting, fourteen years since. This gentleman has been rewarded by the government for the taste and mechanical skill exhibited in the method in which he proposed to adjust his plan to the penny-rate adopted at the recommendation of Mr. Rowland Hill. With this notice of the history of letter-stamps, Mr. Barlow entered on the manufacture of the adhesive label. These are executed by Messrs. Perkins, Bacon, and Petch, on Mr. Perkins's principle of steel engraving by transfer. The process depends on the property of iron to become hard or soft as it receives or loses a small quantity of carbon. This was demonstrated by experiment; and the description of the process was illustrated by the exhibition of hard and soft steel rollers, plates, and impressions furnished by Messrs. Perkins & Co. Mr. Barlow laid great stress on the absolute identity of every engraving, however numerous, produced by this method. He then observed, that the engine-work on the adhesive labels is of so close a pattern that it cannot be taken off by lithography or any similar contrivance, while on the other hand, the eye is so accustomed to notice slight differences between one face and another, that the most skilful imitators of a minute engraving of a human countenance (as that of the Sovereign on the label) could not possibly avoid such a deviation from what he was copying as would ensure the detection of a forgery. Mr. Barlow next adverted to the qualities of the coloured inks with which the labels are printed. Though sufficiently permanent to withstand the effects of sun-light, rain, &c., they would be discharged by any fraudulent attempt made to remove the obliterating stamp, for the purpose of issuing the label a second time. The gum used for fixing these labels to letters, Mr. Barlow described as being probably derived from potato-starch, and therefore perfectly innoxious. The manufacture of the postage envelope is effected by many powerful, yet accurate machines. The paper is pervaded by coloured threads as a security against fraud. When sent from the manufactory of Messrs. Dickinson, it is delivered to the firm of Messrs. De la Rue. It is there cut into lozenges by the engine of Mr. Wilson. One of these was exhibited, and its power contrasted with that of the old bookbinder's plough.

Thirteen thousand five hundred lozenges for folding were cut in a few seconds. To exhibit the precision of this engine, 1000 strips of paper, each $\frac{1}{80}$th of an inch in width, were cut in the same short time. Previously to being stamped, each lozenge has a notch cut in each side, for the convenience of folding: this is done by an angular chisel. The envelopes are then stamped at Somerset House. The machine used for this purpose, combines the operations of printing and embossing, and was invented by the late Sir W. Congreve. Mr. C. Whiting enabled Mr. Barlow to exhibit the whole process, by sending one of these machines, which executed several stamps, slightly differing in device from that on the postage envelope. One of Mr. De la Rue's folders also attended, and showed the rapidity with which the envelopes are folded and gummed after they are stamped. The government envelopes employ at Messrs. De la Rue's thirty-nine folders on an average, and a quick hand can fold 3,500 in a day. Mr. Barlow then noticed some statistical conclusions. One engraving on Mr. Perkins hard steel roller will afford 1,680 transfers to soft steel plates: these again will, when hardened, admit of 60,000 impressions being pulled from each, so that one original will afford 100,800,000 impressions of labels, enough to paper one thousand apartments of 24 feet by 15, and 12 feet high, making allowance for door, two windows, chimney, pier glass, and dado. Twelve years ago, common envelopes were sold at 1s. the dozen: now, the postage envolope, with its medallion, may be bought wholesale at half a farthing (exclusive of the stamp), and yet though the manufacture is peculiarly costly, it returns a small profit to the government. More than two hundred and twenty millions of chargeable letters were posted in 1843. Now, taking a common sized letter as an unit, this quantity would pave a road 25 yards wide (the average width of Oxford Street, pavement included) from the General Post Office in London, to the entrance of Oxford. Or, supposing all the letter-boxes in the United Kingdom to be open, and to communicate with one large spout, the letters would keep flowing through it at the mean rate of 14 in a second. Mr. Barlow then briefly noticed some of the social advantages of the penny post. He touched on the strength and permanence it afforded to the influences of home—on the motives for self-education which it supplied—on the aid it ministered to the inquirer after truth. He stated, that at present about five millions sterling are forwarded through the Post Office by money orders, and noticed the advantage of this arrangement to all, but especially the humbler ranks. He asserted that nothing is too valuable or too fragile to be trusted to this cheap conveyance: birds' eggs and diamonds, living insects, and watches, pills, plaisters, and bills of exchange, are committed to it with equal confidence. Mr. Bagster sends each sheet of his Polyglot edition of the Holy Scriptures ten times through the Post Office, some of these transmissions being to learned men residing at a distance from London, so that under the old system the postage on each volume of this work would have amounted to £165. Mr. Barlow concluded by a short but expressive quotation from an anonymous writer, declaratory of the manifold benefits of the Penny Post, and of the obligations which the country owes to the originator of the system.

NEW IRON LIGHTHOUSE.

Triumph of modern Engineers in the construction of Lighthouses,—The first lighthouse that we read of, was erected on the island of Pharos, near Alexandria, which was looked upon as one of the seven wonders of the world. This tower was built by Ptolemy Philadelphus, in the hundred and twenty fourth Olympiad, under the direction of the famous engineer, Sostratus of Cnidus, in Asia Minor, at the expense of eight hundred talents. The architect was held in such esteem with Ptolemy and other monarchs, that by Strabo he was called the friend of Kings. He was allowed by Ptolemy to inscribe his name on the tower.

What would the contemporaries of the Egyptian Monarch have said, had they seen the modern masterly constructions for the useful purpose, as the lighthouses at the Maplin in the estuary of the Thames, and at the Point of Air, in the county of Flint, both upon sand banks? The latter stands at the mouth of the Dee on quaggy sand, within an hundred yards of the channel, where the tide rises about twenty feet. This most necessary Pharos will annually save a multitude of lives and much property; and was built by the Honourable Corporation of the Trinity House, (always attentive to the safety and welfare of seafaring men), from the design of Messrs. Walker and Burges, engineers, London, who are widely known over every part of the kingdom. It rises upon nine strong iron pillars, most firmly secured in their naturally unstable foundation, and promises to resist the rage of the windy storm and mighty tempest.

It has every possible convenience for the light-keeper, and exhibits a most brilliant white light, fifty-five feet above the ordinary level of the sea, up the Dee towards Chester, and to the west, as far Point Elianus in Anglesea; and a red light towards Hoyle Bank, thus furnishing an unerring guide to the vessels traversing those intricate waters, where so many valuable lives have been lost, and so many riches buried in the ocean.

The building is entirely constructed of iron: the principal framing and pillars are of cast iron; the inclosure of the sides forming the habitable part of the building of wrought iron, corrogated plates. The lantern framing is cast from one of the brass guns recovered from the wreck of the Royal George at Spithead. The entire weight of metal employed in the onstruction of the lighthouse and lantern exceed 120 tons. The interior of the building above the reach of the waves affords ample accommodation for two light-keepers, and also for such stores as are in immediate demand. The light was first exhibited from this building on the evening of the 11th of February last. —*Chester Chronicle.*

TRAFALGAR SQUARE.

We may say of this "Public Improvement,"—"Better late than never;" for at last—after we know not how many years—the hoarding has been removed, and the area thrown open; but we cannot exactly say in regard to it, "All's Well that End's Well," since we must confess to being disappointed. Even in what he has done, Mr. Barry has fallen short of our expectations: it is, indeed, comparatively good, yet does not come up to what we looked for from him. As it seems to us, he has fallen into strange delinquency of taste, in carrying the parapet walls on the East and West sides of the area, not horizontally and parallel to the pavement of the area, and to the horizontal lines of the buildings on those sides, but inclined and following the slope of the ground on the outside of the level area. This occasions a very disagreeable and even paltry effect as far as the area itself is concerned,—which it may be presumed was the point chiefly to be studied. Could it have been done, we should like to have seen those sides of the area enclosed by screen walls of such height as would have shut out the buildings to the East and West, for they are a very sad drawback on the architectural ensemble of this *Place*. At present it is too much of a jumble; and has, besides, the look of being *manqué*, by being quite out of symmetry, where symmetry has been intended. The regular architectural arrangement of the "Area" itself called for a corresponding degree of uniformity in the whole Square or *Place*. As to the two basins we do not greatly admire them at present, thinking it would have been better had they been *sunk*, so that the surface of the water would have been on the same level as the pavement. What the Fountains will be, we know not, but hope they will prove something vastly superior to the mere *squirts* we have hitherto had.

In speaking of Trafalgar Square, we cannot forbear reprobating the barbarous taste which has disfigured the portico of the National Gallery, by inserting most vulgar looking iron fences—or offences—daubed over with vile green paint, between the columns; and that, too, just at a time when so much is said about decorative design in all its branches. Such a fragrant instance of vile taste in the entrance to a temple of Art, and a Royal Academy, is truly shocking, and even dispiriting, since it shows that we do not make any systematic advance in taste, but take a step forward one day, to go back another, or perhaps even two, on the following day. Besides which the stingy paltriness manifested in this instance is perfectly scandalous and disgraceful. While no bounds are set to extravagance in any thing connected with the Palace of Westminster,—which after all is not exactly the most suitable place for the exhibition of works of art,—any thing seems to be considered quite good enough for National Galleries and British Museums.

ATMOSPHERIC RAILWAY.

Report on the Atmospheric Railway. Addressed to the directors of the Chester and Holyhead Railway, by Robert Stephenson, C.E. Weale, High Holborn.

This report which has been anxiously expected for some time past was received by us shortly before we went to press, we are therefore precluded from making any observations or any systematic selection. We shall now confine ourselves with a selection of what we consider the practical part of the report, founded upon the numerous experiments made under Mr. Stephenson's directions, by his valuable assistants Mr. G. Berkley and Mr. W. P. Marshall, at the Dublin and Kingstown Railway.

The first practical application of the Atmospheric Railway was in June 1840, at Wormbolt Scrubs, the particulars of which will be found in our *Journal* for July 1840, Vol. III. p. 253, and likewise a drawing of the apparatus, in the following number, p. 259, Vol. III.

The first part of the report enters very minutely into the loss of power occasioned by the leakage in the air pump, the vacuum tube, and the connecting pipe, under a variety of circumstances, the result shows that the average amount of leakage at the density of the external air is 219 cubic feet per minute, for the air pump and connecting pipe 478 yards long and 15 in. diameter, and 252 cubic feet per minute, for the vacuum tube 2490 yards in length and 15 inches diameter, or 471 cubic feet together, but if a vacuum be formed equal to 15 inches in height of the barometer, or the air twice rarefied, the effect of the leakage will be doubled.

Mr. Stephenson has given five tables; one of them is 3 ft. 6 in. long, full of details of observations made to ascertain the amount of leakage, &c., and also to show the actual velocity of the train compared with theory. He has also given another table, which we here insert, showing the weight drawn by the trains, the resistance due to friction and gravity, the velocity, &c.

LOSS OF POWER WITH DIFFERENT WEIGHTS OF TRAIN.—TABLE VI.

No. of Train.	Train. Weight. Tons.	Train. Friction and gravity. lb.	Train. Maximum uniform velocity. Miles per hour.	Vacuum Tube. Height of bar. Inches.	Vacuum Tube. Pressure of vacuum. lb. per sq. inch.	Vacuum Tube. Total power of working air pump. H.P.	Power indicated by air pump during motion of Train. H.P.	Power absorbed in attaining the vacuum. H.P.	Power absorbed in attaining the vacuum. Per centage of total.	Power indicated by maximum uniform velocity of Train. H.P.	Loss of power indicated by maximum uniform velocity of Train. H.P.	Loss of power indicated by maximum uniform velocity of Train. Per centage of total.	Power indicated by friction and gravity of Train. H.P.	Loss by resistance of atmosphere and friction of piston and valve. H.P.	Loss by resistance of atmosphere and friction of piston and valve. Per centage of total.
4	26·5	781	34·7	18·5	9·2	322	176	146	45	150	172	53	72	78	24
5	30·8	907	32·0	19·0	9·5	336	181	155	46	143	193	57	77	66	20
7	34·7	1023	29·0	20·0	10·0	454	184	270	59	137	317	69	79	58	13
8	36·8	1084	28·3	20·7	10·4	350	186	164	47	139	211	60	82	57	16
9	38·3	1129	28·3	21·0	10·5	381	186	195	51	140	241	63	85	55	14
10	42·5	1253	25·7	22·1	11·0	389	184	205	53	133	256	66	86	47	12
11	43·8	1292	25·3	22·5	11·2	386	181	205	53	133	253	65	87	46	12
12	45·5	1341	25·2	22·7	14·3	427	181	246	58	134	293	69	90	44	10
14	51·0	1503	22·7	23·3	11·6	396	173	223	56	124	272	68	91	33	9
15	53·5	1576	21·7	24·0	12·0	460	170	290	63	123	337	73	91	32	7
17	58·0	1709	20·4	23·8	11·9	506	170	336	66	114	392	77	93	21	4
18	59·8	1763	18·0	23·6	11·8	390	170	220	56	100	290	74	85	15	4
20	64·7	1907	16·7	24·4	12·2	415	162	253	61	96	319	77	85	11	3

In this table those trains are selected from the experiments detailed in the large table, (3,) which present the most uniform and valuable results.

We now come to what we consider the practical part of the report; Mr. Stephenson proceeds—

Having now, I trust, clearly explained the object and results of the experiments instituted upon the Kingstown and Dalkey Railway, I will proceed to draw a comparison between the working of the atmospheric system, and of other descriptions of motive power which have long been in use, with the view of showing their relative advantages or disadvantages. For this purpose I have selected the stationary engines at Camden Town, because they present a case which is similar to that at Kingstown; or, at all events, the disparities are not such as will materially interfere with the comparison. Table No. VII. represents the gradients and length of the Euston incline, with the weight of the rope there used, the dimensions of the engines, and a description of the various trains that are most commonly drawn up the incline; the total power given out by the stationary engines is then given, and divided into the power absorbed by the resistance of the engines, rope, train, and atmosphere, separately, from which are deduced the proportion of loss arising from this application of the rope as a means of communicating motive power.

TABLE No. VII.

The constant upon which this table is founded, an average gradient $\frac{1}{100}$; length worked by rope 0·91 mile; weight of rope 7 tons; area of both cylinders of engine, 2904 square inches, and velocity of pistons 224 feet per minute.

Train. Weight. Tons.	Train. Friction. lb.	Train. Gravity. lb.	Train. Velocity. Miles per Hour	Friction of Engine. H. P.	Friction and Gravity of Rope. H. P.	Friction and Gravity of Rope. lb. per ton of train.	Friction and Gravity of Train. H. P.	Friction and Gravity of Train. lb. per ton of train.	Resistance of Atmosphere. H. P.	Resistance of Atmosphere. lb. per ton of train.	Train excluding Engine and Rope. H. P.	Total excluding Engine. H. P.	Power lost by Rope. Per cent. of total.
35	350	740	20	13	45	24·1	58	31·1	13	7·0	71	116	39
40	400	845	20	13	45	21·1	67	31·1	15	7·0	82	127	36
45	450	951	20	13	45	18·7	75	31·1	17	7·0	92	137	33
50	500	1057	20	13	45	16·8	83	31·1	19	7·0	102	147	30
70	700	1479	20	13	45	12·0	116	31·1	24	6·5	140	185	25
90	900	1902	20	13	45	9·3	149	31·1	29	6·0	178	223	20
110	1100	2324	20	13	45	7·7	183	31·1	32	5·5	215	260	17

Stationary Engines and Ropes.

Before I proceed to institute any comparison between the results presented in this Table, and those obtained by the experiments on the Atmospheric Railway, I am anxious fully to explain the data upon which the former are based, and the more so, as all the results are calculated, with the exception of the power absorbed by the friction of the engines, and of the rope. An indicator was applied to the Camden Town engines, to ascertain this amount, and from these results we arrive at the fact that about 58 h. p. is required for working the engines and drawing the rope alone, at a velocity of 20 miles per hour. From experiments upon the friction of the engines and machinery on the Blackwall Railway, where there is the opportunity of disconnecting the rope and drums, and taking the proportions of the power on the two railways, I have considered 13 h. p. of this to be due to the friction of the engines and machinery, which leaves 45 h. p. for the friction of the rope.

The friction of the several trains taken at 10 lb. per ton, added to the gravity due to the average gradient, is multiplied into the velocity previously mentioned of 20 miles per hour, and expressed in horses' power in the Table. The power absorbed by the resistance of the atmosphere is calculated from the experiments of Lardner, previously referred to. The total power given out by the engines is thus obtained, from which is deducted the power required to overcome the friction of the engines and machinery, for the purpose of making a more correct comparison with the power expended on the Atmospheric Railway at Kingstown, as in that case the power required for this purpose is also omitted. The power required to work the rope in the cases specified amounts to a loss varying from 39 to 17 per cent. of the total, decreasing as the weight of the train is augmented.

In proceeding to compare with these the results of the experiments on the Atmospheric Railway, it is my object to select a case in each, which shall present the closest analogy in the amount of their resistance and velocity. The 4th train in Table No. VII., and the 18th in Table No. VI. correspond very closely in these particulars, the total resistance of the former, including the friction, gravity, and resistance of atmosphere, being equal to 102 h. p., and of the latter 100 h. p., and the respective velocities being 20 and 18 miles per hour. The loss of power from the working of the rope in the former case is equal to 30 per cent. of the total, while the loss in the latter, arising from raising the vacuum, leakage, and imperfections of the apparatus, amounts to 74 per cent. of the total power. In order, however, to institute a correct comparison between these two cases, the total power in the former must be increased in the proportion of the mean to the maximum velocity, which in this instance is ascertained, from experiments made, to add 37 h. p. to the total, and the comparison stands thus: the loss of power on the Euston incline amounts to 45 per cent., while that on the Kingstown and Dalkey Railway is 74 per cent. This result is obtained with a train which represents the average working of the Euston incline; it is therefore evident that in this particular instance the rope is very considerably more economical than the atmospheric system. If we assume other weights of train, we shall perceive, that as they become lighter the proportion of loss by the atmospheric apparatus will be diminished on account of the reduction in the effect of leakage accompanying the reduction in pressure, but the proportion of loss by the rope will be increased as the power required to work the rope itself is the same with a light as with a heavy train; while on the other hand, with heavier trains the proportion of loss by the rope will be diminished, and that by the atmospheric system greatly augmented, from the increased effect of the leakage, and the additional power required to raise the vacuum to a greater height.

This comparison may be carried further by examining the quantity of fuel consumed per day on these two lines; and this I am enabled to accomplish from the observation of a fortnight's working of the Euston incline, and from an experiment on the Kingstown and Dalkey Railway, in which the number of trains, the exact weight of each, and the consumption of fuel, was ascertained during an entire day. The result of the former was, that 13 trains averaging 44 tons each, the mean resistance of which amounted to 1590 lb., were drawn up the incline of 0·91 mile length, at a mean velocity of about 17 miles per hour, in one day of 15 hours, with a consumption of 30 cwt. of coal; and the result of the latter was that ten trains averaging 44 tons each, the mean resistance of which amounted to 1295 lb., were drawn up the incline of 1·22 mile length, at a mean velocity of about 14 miles per hour, in one day of eight hours, with a consumption of 29 cwt. of coal. The consumption of coal per mile of the trains in these two cases amounts to 284 lb. on the Euston incline, and 266 lb. at Kingstown; and dividing these by their respective amounts of friction and gravity, we obtain the comparative consumption per lb. of tractive force as ·18 lb. in the former case, and ·21 lb. in the latter.

The result of this comparison corresponds very closely with the previous comparison of h. p. and the slight inconsistency is accounted for by the circumstance that I have not taken into consideration the times the fires were alight, the different construction of the engines, &c. But these I have purposely omitted, as it was not my object to enter into a comparison of details, but only to illustrate generally the main features of the working of the two systems; and this cannot fail to be interesting, inasmuch as it is an instance which allows of a fair parallel being drawn between the two systems of motive power, the amount of work performed in the two cases being nearly alike, and the trains in each being drawn only in one direction, descending in the other direction by the force of gravity. If, however, we take some of the trains which are drawn up the Euston incline, amounting to fully 100 tons weight, we shall find that the total resistance exceeds the capacity of the tube which is employed at Kingstown namely, 15 inches diameter; for supposing the pressure to be equal to 22 inches height of the barometer, or 11 lbs. per square inch, the train just named upon the gradient of 1 in 75, which is near the upper end of the Euston incline, and continues for about one-third of its length, would offer a resistance, at a velocity of 17 miles per hour, of about 4500 lb., and would therefore require a tube of 23 inches diameter.

Such an increase of tube, it must be observed, immediately implied a great reduction of velocity with the atmospheric system, or an increased size of air pump, involving a corresponding increase of power, because the ratio between the areas of the air pump and vacuum tube is affected; and it has been clearly shown that, working at a high vacuum in a small tube, or increasing the size of the tube and lowering the vacuum, if the same amount of power be employed, involves equally the sacrifice of velocity. Here we perceive a decided proof, that what is termed good gradients is not a matter of indifference to the atmospheric system, and that we shall not be justified in attributing to it the power of economising the construction of railways to any considerable extent by avoiding the necessity of levelling the face of the country.

By the comparisons we have entered into, we see, that in the case of the Euston incline, a rope is considerably more economical as a means of conveying motive power than a vacuum tube; but if the incline were increased to a length of 3 or 4 miles, this would become very questionable, as the loss of power from the friction of the rope increases exactly in the proportion of the length; but in the atmospheric system the loss from the leakage does not increase so rapidly, as a large portion of it arises from the air pump and tube piston, and is the same with all lengths of tube. This it was my intention to have illustrated by referring to the circumstances of the Blackwall Railway, which is a case deemed by the inventors of the atmospheric system peculiarly advantageous for its application, especially in point of power, where they consider the economy resulting from its adoption would be found most conspicuous and decisive. But as the circumstances of this case are peculiar, and their introduction here would interrupt the natural course of investigation, I shall append to this Report a few observations on the subject, furnished at my request by Mr. G. P. Bidder, who has particularly devoted his attention to the application of the atmospheric system to that railway.

Locomotive Power.

I will now proceed to inquire whether the capacity of the locomotive engine and the loss of power by the locomotive system exceed or fall short of that indicated by the experiments upon which this Report is based. The 4th Train in Table No. III. being that in which the greatest velocity was attained, it is taken as the most advantageous to the new system under discussion: the load in this case was 26·5 tons, and the velocity 34·7 miles per hour was attained on a rise of 1 in 115, presenting a resistance of 1311 lb., including the friction, gravity, and resistance of the atmosphere. In overcoming this resistance, the experiment shows a loss by the atmospheric system of 53 per cent. Now a locomotive engine under these circumstances, in addition to the 1311 lb., must overcome the friction, gravity, and atmospheric resistance of the engine and tender, which is about 900 lb., together with a further resistance arising from the pressure of the atmosphere against the pistons, peculiar to the working of a locomotive, as it is a non-condensing engine: these will amount to 32 and 22 per cent. respectively, or together to 54 per cent. of the total power developed by the engine. In this comparison, I have neglected the friction of the working gear of the engine, as this is also omitted in the stationary engine, the indicator diagrams at Kingstown being taken from the air pump and not from the steam cylinder. I have also not noticed the loss that would arise from the slipping of the wheels, when a locomotive engine is worked upon so steep a gradient. The loss of power, therefore, by the use of the locomotive engine under such circumstances, appears somewhat to exceed that shown by the atmospheric system; this is, however, a most disadvantageous comparison for the locomotive engine, because the gradient far exceeds that upon which it can be worked economically.

When the load is augmented, the loss by the locomotive engine is slightly decreased, and the per centage lost of the total power is therefore diminished; while with the atmospheric system, the per centage of loss is considerably increased, amounting to 77 per cent. with a train of 64·7 tons. These considerations show that with small trains the expenditure of power by the atmospheric system is less than by locomotive engines on this gradient of 1 in 115; whilst on the other hand, whenever the resistance of the train is such that a high vacuum is required, the locomotive has the advantage over the atmospheric system.

The lightest trains taken upon the Kingstown and Dalkey incline at the velocities recorded probably exceed the capabilities of locomotive engines, and so far prove that the atmospheric system is capable of being applied to somewhat steeper gradients, and that on such gradients a greater speed may be maintained than with locomotive engines. It must be observed, however, that this advantage is not peculiar to the atmospheric system, but necessarily accompanies every system consisting of a series of stationary engines, in which the gravity of the moving power forms no part of the resistance to motion.

If we convert the loads moved in the experiments into equivalent loads on a level, we shall then find that in no case they exceed the duty which is being daily performed by locomotive engines. Thus, taking experiment No. 4, the load being 26·5 tons, the resistance per ton upon an incline of 1 in 115, at a velocity of 34.7 miles per hour, estimating the resistance of the atmosphere according to Lardner's experiments previously referred to, will stand thus:—

Gravity . . .	20 lb. per ton.
Friction . . .	10 ,,
Atmosphere . . .	20 ,,
Total resistance . .	50

And the resistance upon a level will be,

Friction . . .	10 lb. per ton.
Atmosphere . . .	20 ,,
Total resistance . .	30

Therefore, this train of 26·5 tons, on the incline of 1 in 115, will be equivalent to 44 tons upon a level, at the same speed of 34·7 miles per hour. This duty, which is indisputably the utmost given by the experiments at Kingstown, is much exceeded daily on many lines of railway in this country, and especially by the Great Western, and Northern and Eastern. Throughout the experiments, it will be seen that the duty performed by the Kingstown and Dalkey engine, when reduced to an equivalent level, falls short of the daily performance of locomotive engines on our principal lines of railway, both as regards speed and load.

When the comparison is made by applying the locomotive engine to the circumstances of the Kingstown and Dalkey incline, the atmospheric system becomes the more advantageous. Such a comparison, however, cannot be held as strictly correct, because the locomotive engine, as a motive power on steep gradients, is wasteful, expensive, and uncertain; therefore, on a long series of bad gradients, extending over several miles, where the kind of traffic is such that it is essential to avoid intermediate stoppages, the atmospheric system would be the more expedient. If, however, intermediate stoppages are not objectionable, as is the case in the conveyance of heavy goods and mineral trains on the railways in the neighbourhood of Newcastle-upon-Tyne, the application of the rope is preferable to the atmospheric system. This conclusion I conceive to be fully established by the comparison which has been made between the Kingstown and Euston inclines. Again, on lines of railway where moderate gradients are attainable at a reasonable expense, the locomotive engine is decidedly superior, both as regards power and speed, to any results developed or likely to be developed by the atmospheric system.

In considering these last, as well as all the preceding calculations and remarks, it must be borne in mind that they have reference solely to the question of power, and are entirely independent of the question of expense or convenience: the next step in the inquiry will therefore be, the expense of constructing lines on each system, and the probable cost of working.

In approaching this question, it is desirable first to ascertain how far it may be practicable to work with a single line of vacuum tube, which is certainly by some considered feasible even on great public railways. It does not, however, require much consideration to prove that a single line of tube would be quite inadequate to accommodate any ordinary traffic, such as exists on the principal lines in this country. It has therefore been urged by those who regard the capacity of the atmospheric system as almost unlimited, that a train may be dispatched every half hour, or even every quarter of an hour; but in making this observation, they entirely overlook the circumstance, that this very advantage, in respect of the number of trains, is fatal to the sufficiency of one line of tube for any considerable length of railway.

Suppose, for example, a line of railway for 112 miles length were divided into stages of 3½ miles each, as proposed by the inventors; if a train were dispatched from each end every half hour for 12 hours, and the speed of about 37 miles per hour, including the stoppages for traffic, could be attained, there would be a train at every 10 miles of line, and each train in its journey would meet 11 other trains with whose progress it would interfere; in short, each train would of necessity be stopped 11 times, and delayed until the train occupying the section of the tube had quitted it, and the tube had been again exhausted. Such a series of stoppages would, it is plain, give rise to so great an amount of delay, as would render the use of a double line of tube absolutely imperative. In the example just brought forward by way of illustration, the mean speed assumed is 37 miles per hour, the whole time of the journey would therefore be three hours; but the eleven stoppages occupying at least ten minutes each, which is very considerably below what practice would require, would, notwithstanding the great velocity assumed, extend the time to five hours. But let it be remembered that these stoppages cause additional meeting of trains, involving increased delay, and the time is consequently augmented to 7½ hours. Or if the mean velocity be reduced to 30 miles per hour, which is now the greatest mean rate on any railway, the total time of the journey will be thus increased to 10 hours

We must therefore assume a double line of pipe, and thus the principal difficulty just pointed out is certainly removed; but the addition of a double line involves another scarcely less formidable, when the expense of the system is the subject under discussion. The absolute stoppage of trains is avoided, but a most decided and large reduction of speed must still necessarily arise at the stations where the trains intersect, unless a separate series of stationary engines be erected for each line of tube; because the engine must be occupied in exhausting 7 miles of tube at once, which would detract very considerably from the velocity. Such a reduction is quite inadmissable if we are to view the system as applied to the great thoroughfares of this country; in which case I am confident that every perfection of which it is susceptible must be carried out.

The difficulty suggested as calling for duplicate series of stationary engines, may at first sight appear surmountable by confining the duplication to the points where the trains meet, and thereby avoiding a large addition to the original outlay in establishing the system upon a long line of railway: this, however, presupposes that the trains are not started so frequently as every half hour, since that would occasion the duplication of every engine. But this will not be found to be the case, because the intersections of the trains cannot possibly be made to take place always at the same points, even on the supposition that each railway is worked independently of every other with which it may be in connection. When we introduce in addition, the fact that several branch lines must necessarily flow into the main trunks, that no line can be worked independently, that the arrival of trains is, and must always be, subject to much irregularity, sometimes arising from their local arrangements, sometimes from weather, and at others, from contingencies inseparable from so complicated a machine as a railway,—it must be palpable that two independent series of stationary engines is as indispensable as two independent lines of vacuum tube, for the accomplishment of that certainty, regularity, and dispatch, which already characterise ordinary railway operations.

If what has been urged be thought inconclusive with reference to the duplicate series of stationary engines, the alternative of checking or stopping each train at the points where they meet must be admitted as inevitable, because two lengths or sections of tube must be under the process of exhaustion at one time by the same engine; we have, therefore, to inquire into the practicability of exhausting 7 miles of tube by the engine erected and calculated as only adequate to the efficient exhaustion of 3½ miles length. The calculations made in the previous part of this Report, on the subject of leakage, prove that any attempt to work a line in this manner, would involve such a diminution of velocity at each intersection of trains as could not fail to extend its influence, and produce great irregularity throughout the system, when confined even to one independent line of railway; and this would apply, in an exaggerated degree, to the numerous tributary streams of traffic which must flow sooner or later into all the main thoroughfares of railway communication, at points, and under conditions, which cannot at this moment be anticipated. Another very strong reason for these double engines being required, is, that in case of any failure to one of the engines, the whole traffic of an entire district of country would be stopped, and a duplicate engine at each station would be required to provide against this contingency, were it not also rendered necessary by the reasons already considered.

These facts in reference to the expense of construction (for I regard them in no other light than as facts, because they are the inevitable consequences which must attach themselves to this system wherever applied,) lead me to estimate the original cost much higher than any amount which has been calculated upon by those who have made their opinions public on this subject.

Comparative Estimates.

Mr. Samuda gave Sir Frederick Smith and Professor Barlow a calculation of cost, for average loads of 30 tons at the rate of 30 miles per hour, for a single line of atmospheric railway. Since Mr. Samuda furnished this calculation, experience at Kingstown has produced some modification in the proportions of the engines and vacuum tube: the following is now his estimate of cost for the apparatus as applicable to such lines of railway as the London and Birmingham.

Cost per Mile in Length.

Vacuum tube, 15 inches diameter . .		£1,632
Longitudinal valve, &c. . . .		770
Composition for lining and valve groove .		250
Planing, drilling, &c.		295
Laying, jointing, &c.		295
Station valves and piston apparatus . .		100
		3,342
Engine, 100 horse-power, with pump, &c.	£4,250	
Engine-house, chimney, &c. . .	450	
Total for 3½ miles . .	£4,700	
Cost per mile in length . . .		1,343
Total cost per mile . . .		£4,685

It will be observed that Mr. Samuda has only estimated for the a single line of vacuum tube and a single series of engines, under the impression that such an arrangement is adequate to meet every necessity. But from what has been said on this part of the subject, I think it is made evident, that such a limitation in the arrangements on any important line of communication would be very inexpedient, to say the least. I have consequently revised this estimate, and the following appears to me to be the minimum expense at which the atmospheric apparatus could be applied to any extensive line of railway.

Cost per Mile in Length.

Vacuum tube 15 inches diameter . . .		£7,000
2 engines of 250 h. p. each, (at 33,000 lb.) with pumps, &c. complete, at £25 per h. p.[1]	£12,500	
Engine-house, chimney, reservoir or well .	1,500	
Total for 3½ miles	£14,000	
Cost per mile in length		4,000
Total cost per mile		£11,000

[1] The power of each of these engines appears at first very great when compared with that given in Mr. Samuda's estimate, but the real comparison upon the same standard of commercial h. p. will be 125 to 100.

This amount exceeds Mr. Samuda's estimate very considerably, but the cause has been sufficiently explained: I will merely now add that this branch of the inquiry has been entered upon and pursued with the most anxious desire to under rather than over estimate the cost, and that I am convinced the amounts now put down are below those which would be found in practice. This is undoubtedly the fact, for it will be seen I have taken the size of vacuum tube which was proposed by Mr. Samuda, who I think does not appear sufficiently to have appreciated the importance of fully providing for the large amount of traffic which oftentimes flows simultaneously into a trunk line; which will be understood by those who are well acquainted with the traffic of the London and Birmingham Railway, where it is not unfrequently the case, that on the arrival of the Irish Mail Packet, the train is augmented to twenty and sometimes thirty carriages, equal in weight to 90 or 130 tons, which could not with due regard to the convenience of the public be divided, and started at such intervals, as would of necessity be the consequence of working with this size of tube. It must also be borne in mind that the present traffic consists of a mixture of quick passenger trains with slow goods trains; and upon the atmospheric system, the latter, which are very heavy, sometimes amounting to 250 tons, must be divided into several trains, not only to bring them within the capacity of the tube, but also to prevent their interference with the lighter passenger trains: this it will be necessary to consider when the cost of working is discussed.

The power of the engines, that I have assumed, may at first appear large, but taking the engine on the Kingstown and Dalkey Railway as our guide, it will be found that the power reckoned upon does not exceed that which would be required to ensure sufficiently high velocities, with only the average passenger trains which now travel on the London and Birmingham Railway; and we must bear in mind, that the atmospheric system involves the necessity of employing very nearly the same power with light as with heavy trains. The maximum power must therefore be regarded as continually in operation: this is not strictly true, but the difference of power of working the air pump at low and high vacuums within the ordinary practical range, is confined to such narrow limits as to render this statement substantially correct. The engine at Kingstown may be taken at nearly 200 horses' power and capable of moving a train of about 36 tons upon a gradient of 16 feet per mile at 35 miles per hour. If we extend the length of tube to 3½ miles, when the increased leakage is added, the power required to move even such a load, which is below the average load of the London and Birmingham traffic, at this velocity, will exceed the 250 horses power, which I have assumed as requisite, and which makes the gross expense £11,000 per mile.

By referring to the half-yearly statements of accounts of the London and Birmingham Railway Company, it will be seen that the capital invested in locomotive engines up to 31st December, 1843, was £171,974. 17s. 6d. For the purpose of arriving at the whole capital actually invested under the head of power, we must add locomotive engine stations for repairing, &c.: this item is not separately stated in the accounts, but we shall be safe in taking it £150,000, making the total investment for power £321,974.

It must be understood that I am not attempting here to comprise all the sums which might come under this heading, supposing the accounts to be fully dissected: my only object is to make a comparative estimate, which is done correctly enough without introducing such items as would be common to both systems. The comparison of capital expenditure for power upon this basis, on the London and Birmingham Railway, would stand thus:—

Locomotive engines and stations	£321,974
Atmospheric apparatus for 111 miles, at £11,000 per mile	1,221,000

Making a difference in favour of the locomotive system, as far as capital in power is concerned, of £899,026. This large disparity in the cost of the two descriptions of power, might, it is urged, be more than saved by a reduction in the original cost of construction of the railway. This is partially true in the case of the London and Birmingham Railway, but not by any means to the extent generally imagined.

I cannot now attempt to enter into the minutiæ of this part of the subject, because it would involve a complete revision of all the original plans, and numerous considerations which could not now be fairly weighed. For the purpose, however, of carrying out the comparison regarding capital in this particular case, we may suppose that a saving of £900,000 might have been accomplished in the original design, by the application of the atmospheric system; still it would only have been a transfer of expenditure from excavations, tunnels, and bridges, to steam engines and pipes. The ultimate capital would thus have been the same.

If we now take some other lines of railway with the view of ascertaining how far their cost could have been diminished by the application of the atmospheric system, we shall find, that, as the surface of the country becomes more favourable, the economy in construction entirely disappears; and when we arrive at a perfectly plain country, such as exists in the eastern counties of England, where few provisions are required in the form of excavations, tunnels, and bridges, the application of the atmospheric system would certainly double the original cost where a double line of rails is employed. The Grand Junction Railway is a case where no reduction of original outlay could have been effected, since the gradients already conform to the natural surface of the country throughout a very large proportion of the whole line. The adoption of the atmospheric system in this case would therefore have caused a very large augmentation in the capital of the company; probably as much as £8000 per mile, being the difference of cost between the two descriptions of power.

I will now proceed to the comparative cost of working the London and Birmingham Railway upon the atmospheric and locomotive systems; and in doing this I shall exclude all such items of expense as are common to both. These calculations, as well as those which have been entered into for determining the relative original outlay in construction must be looked upon as merely approximate statements, without any pretension to absolute accuracy. In adopting this method, it must recollected that while the cost of locomotive power is taken from the accounts of the company, the principal items, and only those which may be taken as certain, in the cost of the atmospheric system, are introduced into the comparative statement: in the latter, many minor expenses, in the absence of experience, must unavoidably be omitted; thus giving some advantage in the comparison to the atmospheric system.

The expense of locomotive power upon the London and Birmingham Railway, for the year 1843, was as follows:

Wages of engine drivers and firemen . . .	£9,673
Coke	25,541
Oil, hose pipes, and fire tools, pumping engines, and water	4,099
Labourers and cleaners, waste and oil . . .	4,194
Repairs of engines and tenders	12,521
Coals and firewood, expenses of stationary engine at Wolverton, repairs of buildings, gas and incidental charges	3,172
Superintendent, clerks' and foremens' salaries, and office charges	4,634
	£63,834

The expense of working the atmospheric system for one year, I estimate approximately as follows:

Wages of engine men, 64 at 6s. } „ stokers 64 at 3s. }	£10,512
The same during the night	10,512
Coal, 172 tons per day at 9s.	28,332
Oil, hemp, tallow, and repairs at 5 per cent. on cost of engines	20,000
Superintendence same as locomotive	4,634
Annual cost	£73,990[2]

I have already stated that the above sum has no pretension to precise accuracy, but since I have intentionally omitted numerous items of expense, which must arise, (the exact amount of which no one can venture to predict, or to introduce into such a calculation with much confidence,) I prefer making the comparison under that aspect which is the most favourable to the new invention under discussion; because I conceive the question between the atmospheric and locomotive systems does not by any means, after what has been advanced, depend on the mere annual cost of working. I shall content myself with the above statement, which in my opinion sufficiently establishes the fact, that the cost of working the London and Birmingham Railway, or any other line with a similar traffic, by the atmospheric system, would greatly exceed that by locomotive engines.

The items of the above estimate need some further explanation; I will, therefore, now proceed to give the views that have led me to adopt the data upon which it is founded. The item of engine men and stokers is of course based upon what I believe would be required if the atmospheric apparatus were organised in the most perfect manner, that is, with a double series of engines. The second item, which is simply a repetition of the first, is considered to be necessary, because the London and Birmingham Railway, and several others, are in point of fact at work day and night, in consequence of either mail or goods' trains occupying all parts of the line, during some hours of the night. The mail trains of necessity do this, but the goods it may be said should be transmitted by day: this may appear practicable on a cursory view, but a more intimate acquaintance with the character of the traffic will satisfy any one that the transportation of merchandize between various parts of the kingdom absolutely calls for the use of most railways during the night. We must, therefore, look forward in making all our arrangements upon the arteries of communication throughout the country, to their being made available at all hours of the night, and during all seasons. Whatever exceptions any peculiar locality may present to this position, they will not be found to affect the broad question which is now under consideration.

The item of coal, in the estimate of working expenses, is obtained by supposing each section of 3½ miles to be occupied by two stationary engines of 250 h.p. each, that this power is exerted during six hours per day of 24 hours, and that the rate of consumption of coal is 4lb. per h.p. per hour, including all the waste which would arise arise during the 18 hours when the engine is not working, but the fire alight. This time of the engine's working, six hours per day, is determined by taking the present number of passenger trains, (12,) and doubling the number of goods' trains, which now amount to three, averaging 164 tons each, in order to reduce their weight to the capacity of the tube at a moderate velocity, thus making in all 18 trains per day in each direction: and I have estimated 20 minutes as the least time requisite at each section to exhaust the tube at its maximum uniform velocity. This consumption, it must be understood, applies to the actual horse power, and not to the nominal power, which should in the present state of engine building be rejected altogether, as much vagueness has been introduced into the subject by two different standards of horse power having been adopted. I have throughout this Report adhered to 33,000 lb. as the standard horse power.

The two remaining items require no explanation.

Before leaving this estimate, it is desirable to make an observation upon the items omitted, and the reasons for doing so. The wear and tear of the longitudinal valve, and the degree of attention which it will constantly require, are points upon which we yet have no information. At Kingstown, about two men per mile are appropriated to the application of the composition, for the purpose of maintaining the tightness of the valve. These items are problematical, but by excluding them from the calculations of cost, the result is exempted from doubt and dispute. On the other hand, I have thrown the maintenance of way entirely out of the comparison, which would undoubtedly be against the locomotive system; but this has been strangely overrated by the advocates of the atmospheric system. They have taken for comparison the contract price of maintaining the London and Birmingham Railway, namely, £350 per mile, and assumed, without stating any reasons, that the cost of maintenance would be, when the atmospheric system was applied, reduced to 175*l.* per mile. To show the fallacy of such an assumption, it is only necessary to state that on many public railways, the whole maintenance is let by contract to responsible parties, under 150*l.* per mile. Such discrepancies are easily explained by the different materials through which the railway is constructed, the character and extent of the works, and other circumstances in no degree connected with the abstract question of maintaining the rails, blocks, and sleepers in working condition. As a proof of this, it may be stated, that less than one-half the aggregate amount of expense, included under the general head of maintenance, is expended in preserving the rails in proper order; hence it is that I have given no credit for the saving under this head, and considered it more than covered in the items I have excluded from the cost of working the atmospheric apparatus.

Having concluded my observations upon the question of power, original outlay, and cost of working, the two latter having reference chiefly to the London and Birmingham Railway, I will now offer one brief remark on the application of the atmospheric system to lines where the traffic is of very moderate extent. The London and Birmingham Railway having an unparalleled traffic, it is one of the best cases, in a general point of view, to which the atmospheric system could be applied.

Let us now conceive it applied to a case of an opposite character; for example, the Norwich and Yarmouth Railway, which has cost about 10,000*l.* per mile, including carrying stock and every appurtenance. This line passes over a country in which the application of the atmospheric system could have effected no economy whatever in the formation of the line, which has not exceeded a cost of 8000*l.* per mile. The application of a single line of the atmospheric apparatus, would, in this instance, have added at least 5000*l.* per mile, which upon 20 miles, the length of the railway, would amount to 100,000*l.* The mere interest of this sum, at 5 per cent., is 5000*l.* per annum, whereas the actual working of this line, including maintenance of way, booking-offices, porterage, and all other constant traffic charges, has been let for 7000*l.* per annum, being only 2000*l.* above the bare interest of the extra capital which would be required to lay down the atmospheric apparatus; an amount which would be quite inadeqate to meet the wear and tear of the machinery alone, leaving nothing to meet the current cost of working. Here, therefore, we have a case where the country is favourable, the original capital small, and the traffic moderate, where the cost of the atmospheric system would be so burthensome as to render it totally inapplicable.

The Report then procceds to comment upon the comparative velocities, safety, and casualties, arising from defects in the machinery of both the

2 In this estimate it has been assumed that the atmospheric apparatus is laid down at the time that the railway is constructed, and that a saving is effected in the construction equal to the additional cost of the apparatus: if however it were applied to a line already construted, such as the London and Birmingham Railway, the interest on the additional capital required at 5 per cent. would in that case amount to 44,963*l.* per annum, supposing the original expenditure on the present stock could be realised, which must then be added to the annual cost of the system.

Atmospheric and Locomotive systems, and concludes his report with the following conclusions to which the investigation has led him.

1st. That the Atmospheric system is not an economical mode of transmitting power, and inferior in this respect both to locomotive engines and stationary engines with ropes.
2nd. That it is not calculated practically to acquire and maintain higher velocities than are comprised in the present working of locomotive engines.
3rd. That it would not, in the majority of instances, produce economy in the original construction of railways, and in many would most materially augment their cost.
4th. That on some short railways, where the traffic is large, admitting of trains of moderate weight but requiring high velocities and frequent departures, and where the face of the country is such as to preclude the use of gradients suitable for locomotive engines, the Atmospheric system would prove the most eligible.
5th. That on short lines of railway, say four or five miles in length, in the vicinity of large towns, where frequent and rapid communication is required between the termini alone, the Atmospheric system might be advantageously applied.
6th. That on short lines, such as the Blackwall Railway, where the traffic is chiefly derived from intermediate points, requiring frequent stoppages between the termini, the Atmospheric system is inapplicable; being much inferior to the plan of disconnecting the carriages from a rope, for the accommodation of the intermediate traffic.
7th. That on long lines of railway the requisites of a large traffic cannot be attained by so inflexible a system as the Atmospheric, in which the efficient operation of the whole depends so completely on the perfect performance of each individual section of the machinery.

The report concludes with an appendix by Mr. Bidder, on the application of the atmospheric principle to the Blackwall Railway, for which we cannot now find space; there are also attached to the report no less than 86 indicator diagrams, showing the pressure upon the air pump piston, and the state of exhaustion in the valve pipe.

This report we strongly recommend to all those who may take a lively interest in the working of railways.

The "Meteor."—Messrs. Miller, Ravenhill, & Co., have been again successful, by bringing forward another iron steamer built by them for the Gravesend and Blackwall station; she is propelled by a pair of 40 h.p. beam engines, taken out of an old Gravesend steamer: although the new vessel, is of larger dimensions than the old one; the speed with the same engines very far exceed the old vessel: this shows what judicious management will do in the construction of iron boats. The speed of the "Meteor" is very triflingly inferior to the renowned Margate "Prince of Wales," reported upon by us in last month's "Journal."

The New Royal Exchange.—The last Report submitted to the Gresham Committee, states that the following additional Decorations are directed to be made:—A statue of Queen Victoria, to be placed in the centre of the merchants' area; a statue of Elizabeth at the south-east, and of Charles the Second, which stood in the centre of the area of the late Exchange, to be placed at the north-east corner of the merchants' area; and the statue of Sir Thomas Gresham, to be in the great niche over the east entrance, and the Royal arms above the doorway at the west entrance, by which arrangement the statues of the three sovereigns in whose reign the edifice has been erected will appropriately decorate the exterior; a tesselated or mosaic pavement for the merchants's area, instead of the pavement contemplated by the contract; and an embellishment in the ceiling of the ambulatory, by a series of consecutive painting or paintings in wax on the forty-six compartments thereof. The additional sums necessary to carry out the great object of affording appropriate and highly-finished works of sculpture for the embellishment of the building were voted by the Joint Gresham Committee.

The Iron Duke.—We have previously noticed the extraordinary speed of this splendid steamer, and we have now to record the result of her first Kingstown voyage, which we should hope would satisfy the most sceptical and prejudiced that she is unrivalled. The most curious circumstance connected with her passage to and from Ireland is the fact, that both occupied precisely the same time, proving, as her voyage to Douglas had previously done, that her velocity is uniform under different circumstances. We give some details, which have been kindly handed to us by Mr. J. C. Shaw, who accompanied her, and we doubt not that but nautical men will appreciate them as affording data for comparisons with other vessels. To those who are not nautical, we beg to state, that the distance from Clarence Pier, Liverpool, to Kingstown outer pier, is 114 nautical, or 130 statute miles:—

	To Kingstown May 2.		Return trip May 3.	
	h.	m.	h.	m.
Clarence Pier to Rock Light	0	10	0	9
Rock Right to N. W. Light-ship	0	42	0	45
N. W. Light-ship to Great Ormshead	1	26	1	35
Great Ormshead to Point Lynas	1	5	1	1
Point Lynas to Skerries	0	50	0	44
Skerries to the Kish Light	3	56	3	54
Kish Light to Kingstown	0	35	0	36
Total passage	8	44	8	44

She derived no aid from wind, inasmuch as she made a "head wind" both going and returning. The above passages are considerably the shortest ever made between the two places; and we ought to be proud of a vessel which is entirely indebted to Liverpool talent for her success. She was built by Mr. T. Wilson. Her engines are from the celebrated works of Fawcet & Co., they have wrought iron standards for the framing instead of cast iron.—Liverpool Paper.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM APRIL 27, TO MAY 23, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

Pierre Armand Lecomte de Fontainemoreau, of Skinner's Place, Size Lane, merchant, for "A new mode of constructing barometers and other pneumatic instruments." (Being a communication.)—Sealed April 27.

John Dixon, of Wolverhampton, iron master, for "Improvements in heating air for blast furnaces, and for other uses."—April 27.

Arthur Wall, of Bistern Place, Poplar, surgeon, for "certain Improvements in the manufacture of steel, copper, and other metals."—April 27.

Josiah Clarke, and Samuel Fletcher, of Hulme, Lancaster, machine makers, for "certain Improvements in wheels to be used in slubbing or bobbin frames, and in roving or jack frames, and for other purposes, and also in the engine by which such wheels are or may be cast."—April 27.

Isaiah Davies, of Birmingham, engineer, for "certain Improvements in steam engines, part of which improvements are applicable to impelling wheel carriages."—April 27.

Edward Cobbold, of Melford, Suffolk, master of arts, clerk, for "Improvements in the preparation of peat, rendering it applicable to several useful purposes, particularly for fuel."—April 27.

William Clarke, of Nottingham, lace manufacturer, for "Improvements in machinery for manufacturing ornamented bobbin net, or twist lace."—April 30.

William Jeffries, of Little Sussex Place, Hyde Park Gardens, for "Improvements in sweeping chimneys, and in apparatus to prevent chimneys from smoking."—April 30.

Robert Gordon, of Heaton Foundry, Stockport, millwright and engineer, for "Improvements in grinding wheat and other grain, and in dressing flour or meal, which improvements in grinding are also applicable to grinding cements and other substances."—April 30.

William Fairbairn and John Hetheington, of Manchester, engineers, for "certain improvements in stationary steam boilers, and in the furnaces and flues connected therewith."—April 30.

Jacob Samuda, of Southwark iron works, engineer, and Joseph D'Aguilar Samuda, of the same place, engineer, for "certain Improvements in the manufacture and arrangement of parts and apparatus for the construction and working of atmospheric railways."—April 30.

John Melville, of Upper Harley Street, esquire, for "Improvements in the construction and modes of working railroads."—April 30.

James Hayman, of Mount Street, Lambeth, corndealer, for "An improved construction and arrangement of certain parts of omnibuses and other vehicles."—April 30.

Robert Corden, of Nottingham, tobacco manufacturer, and Sidney Smith, of the same place, engineer, for "Improved economical apparatus for making gas for illuminations."—April 30.

John Constable, of Lime Street, London, merchant, for "certain Improvements in the manufacture of sugar." (Being a communication.)—April 30.

William Colborne Cambridge, of Market Lavington, Wilts, agricultural machine maker, for "certain Improvements, first, in machinery for rolling or crushing ground; second, for cutting and thrashing agricultural products; and third, an improved adaptation of horse power to threshing machinery, which may also be applied to other purposes."—April 30.

Charles Watterson, of the firm of Macguire, Watterson, and Co., Manchester, soap manufacturer, for "certain Improvements in the manufacture of soap."—May 8.

Joseph Wright, of Gough Street, Gray's Inn Lane, coach builder, for "certain Improvements in railway and other carriages." (Being a communication.)—May 8.

James Grant, of Vine Street, Westminster, gas-fitter, for "Improvements in the means of ventilating buildings and other places where a change of air is required."—May 8.

William Vose Pickett, of Tottenham, esquire, for "certain methods for preparing in metal, or other substances, the parts and features of architectural construction and decoration, and for applying the same in the construction and arrangement of houses and other buildings."—May 8.

John Loach, of Birmingham, manufacturer, for "A certain improvement in corkscrews, which improvement is also applicable to cocks or taps, and valves."—May 8.

Alfred Toy, and Edward Hanson, of Castle Street, Holborn, lamp manufacturers, for "Improvements in consuming tallow and other fatty matters in lamps."—May 8.

Thomas Grimsley, of Oxford, sculptor, for "A new method of constructing a self-supporting fire-proof roof, and other parts of buildings, with bricks and tiles formed from an improved machine."—May 14.

John Browne, of New Bond Street, esquire, for "Improvements in apparatus for protecting the human face, or part of the human face, from the inclemency of the weather, part of which improvements is applicable to protect birds in cages."—May 14.

Edward Hill, of Hart's Hill, Worcester, iron manufacturer, for "Improvements in the manufacture of railway and other axles, shafts, and bars."—May 14.

William Walker, jun., of Brown Street, Manchester, hydraulic engineer, for "Improvements in warming and ventilating apartments and buildings."—May 14.

William Palmer, of Sutton Street, Clerkenwell, manufacturer, for "Improvements in the manufacture of wicks for candles and for lamps, and in the manufacture of candles." May 15.

Charles Hancock, of Grosvenor Place, Middlesex, esquire, for "certain Improvements in cork and other stoppers, and a new composition or substance which may be used as a substitute for, and in preference to cork, and a method or methods of manufacturing the said new composition or substance into bungs, stoppers, and other useful articles."—May 15.

Hesketh Hughes, of Chiswell Street, Middlesex, gentleman, for "An improved machine for crimpling, fluting, and quilling muslin and other fabrics."—May 15.

Peter Armand le Compte de Fontainemoreau, of Skinner's Place, Sise Lane, London, for "A new and improved mode or method of paving and covering roads and other ways or surfaces." (Being a communication.)—May 15.

Henry Holmes, of Derby, cutler, for "Improvements in the manufacture of bricks, tiles, and other plastic substances."—May 15.

John M'Intosh, of Glasgow, gentleman, for "certain Improvements in revolving engines, and an improved method of producing motive power, and of propelling vessels."—May 17.

James Pilbrow, of Tottenham, civil engineer, for "certain Improvements in the machinery for, or a new method of propelling carriages on railways and common roads, and vessels on rivers and canals, &c."—May 17.

Thomas Martin, of Withybush, Havertordwest, Pembroke, for "certain Improvements in the construction of slated roofs, flats or floors, tanks or cisterns, or reservoirs for water, and in pipes, tubes, or channels of the same material, for the conveyance of water."—May 22.

James Petrie, of Rochdale, Lancaster, engineer, for "certain Improvements in steam engines."—May 22.

James Perkins Chatten, of Saint Martin's Court, gentleman, for "Improvements in the manufacture of dead eyes for the purpose of setting up the rigging of ships and other sailing vessels."—May 22.

James Bremner, of Pulteney Town, Caithness, civil engineer, for "certain arrangements for constructing harbours, piers, and buildings in water, for cleansing harbours, and for raising sunken vessels."—May 22.

George Gwynne, of Princes Street, Cavendish Square, gentleman, and George Fergusson Wilson, of Belmont, Vauxhall, gentleman, for "Improvements in treating certain fatty or oily matters and in the manufacture of candles and soap."—May 22.

Joseph Meeirs, of Ludgate Hill, for "certain Improvements in weaving, and in weaving machines."—May 22.

John Henry Moor, of Lincoln's Inn Fields, gentleman, for "certain Improvements in the construction of carriages generally."—May 23.

William Johnson, of Bury, Lancaster, agent, for "Improvements in machinery or apparatus for preparing cotton, wool, flax, and other fibrous substances."—May 23.

Richard Wilson, of Newcastle, builder, for "Improvements in the manufacture of tiles."—May 23.

John Wilkie, of Glasgow, mechanic, for "Improvements in machinery or apparatus for working wood into the various forms required for making doors, window-shutters, window-sashes, mouldings, flooring, and other purposes."—May 23.

John Taylor, of Duke Street, Adelphi, gentleman, for "certain new mechanical combinations, by means of which economy of power and of fuel are obtained in the use of the steam engine."—May 23.

William Archibald, cooper, of New Mills, Ashbourne, Derby, gentleman, for "certain Improvements in machinery for spinning cotton wool, and other fibrous substances."—May 23.

A FEW PLAIN WORDS TO THE CAMDENISTS.

By Candidus.

The two Universities seem of late to have been bewitched, and to have entered into a very extraordinary kind of flirtation with Romanism. While Oxford has been endeavouring to edify us by means of Tractarianism and Puseyism, Cambridge is zealously exerting itself to correct and enlighten us with its so-called Camdenism—a sort of theologico-politico-architectural "movement," conducted in such a manner as to betray very ominous yearnings after that strange compound of hyper-spiritualism and materialism which is so prominent a trait in the character of the church of Rome. And along with it, it seems to have been borrowed from the same quarter, no small quantity of priestly intolerance, and of dogmatism and jesuitism. The architectural "revival" seems to be the least part of the matter, for that such very virulent zeal as is that of the Camden Society and its adherents, should be excited merely by a regard for the interests of art and antiquarian taste, is highly improbable.

No doubt, it is all very proper and commendable on the part of the clergy that they should pay greater attention than they have been wont to do, to the buildings committed to their charge, and endeavour to rescue them from the clutches of churchwardens and "beautifiers." Commendable also is it that they should apply to the study of Ecclesiastical Architecture and Antiquities, as one, if not absolutely indispensable to, sufficiently becoming to their profession,—quite as clerical pursuits as fishing, hunting, shooting and whist-playing. But the satisfaction we might else feel at seeing the clergy of the Church of England taking an intelligent interest in such matters, is greatly abated when we also find them banding themselves into Societies and Associations which, as it now appears, have an ulterior and covert object, they claiming paramount authority not in regard to church architecture alone, but in such manner as must greatly affect both the study and practice of architecture generally. The characteristic *Odium Theologicum* manifests itself very naturally perhaps, yet somewhat indiscreetly in the bitter enmity they show towards, and the reproachful terms they bestow on, every style and mode of building other than Gothic: and in their utter intolerance of all views of art that do not precisely accord with their own. Whatever it does not suit their purpose to countenance or approve of, must be formally laid under ban and interdict, and be excommunicated as heterodox and heretical. Therefore, to do the Camdenists justice, they so far act up to the spirit which prevailed in the church during those very excellent and "pious" times, which they now hold up to us as an express pattern for our imitation and edification.

In fact, architecture is looked upon by them as being edification in the figurative no less than in the primary meaning of the word. To speak of it as an art or a science, as a matter of taste, or even as a matter of feeling, influenced by associations, is according to them highly reprehensible, for they regard it as something intimately connected—almost in a manner identified with religious belief and sentiment. Invariably are we reminded that, as an art, architecture originated in, and was fostered by, religious worship. Yet the argument endeavoured so to be established in favour of the pre-eminent excellence of architecture is but a lame one, the art being but a mere passive instrument ready to be employed in the service of any religion, and by the followers of any creed who choose to employ it. To remind us of its antiquity, is only reminding us of what it has done for *False Religions*, and what a lustre that and the sister art of Sculpture shed around that Paganism of which the Cambridge exorcists are now endeavouring to expel even the remembrance from us, as something polluting and unclean. False religions stand in need of the aid of art and all other appliances in order to render them imposing, and to dazzle the eyes of the multitude. Superstitious creeds again, require to be kept up by all the pomp, the ceremonies and the *spectacle* of religion, and accordingly inculcate the grossest *Hierolatria*,—an almost equal reverence for the material church and all belonging to it, as for the spiritual one. Shall we say that it is just the same in regard to Protestantism?—that it cannot afford to dispense with those externals which have proved so efficacious in the cause of Romanism?—Let the men of Cambridge solve for us such question.

Our reverence for the peculiar sanctity—so to call it—attributed by some modern mystics to architecture—at least to Gothic architecture as the expression of religious feeling, is somewhat lessened when we reflect that it flourished most in the palmy times of Priestcraft and Superstition, and when the Church of Rome was most profligate and corrupt. We do not say that the style itself is one whit less admirable on that account; but let us be content to value and admire it for what it is, without striving to recommend it by cant and maudlin claptrap. "The Piety of our forefathers"—the "Faith of our forefathers" are very pretty phrases, and serve very well to grace and give emphasis to a period; but to be taunted, as we sometimes are, with the reproach of having departed from the faith of our forefathers, is intolerable—at least absurd, when such accusation comes from whom it does. While it is no more than natural and consistent on the part of such writers as Welby Pugin to stigmatise the Reformation as an awful heresy; it becomes not a little contradictory and startling to hear those who actually boast of having shaken off Romanism and all that belongs to it, as a cunningly and craftily devised system of religious policy rife with superstition and hypocrisy, fraud and deceit,—holding, when it is convenient for them to do so, nearly the same language. Of course we have renounced—Camdenists, it may be presumed, included—the faith of our Popish ancestors and Roman Catholic forefathers; and of course also, by some it is called an awful heresy, by others orthodoxy and a return to pure Christian faith as it existed before it became defiled by the carnal inventions and delusions of a tyrannical priesthood. The Reformation may be matter for either great sorrow or great joy; but that it should be both the one and the other at the very same time, in the estimation of the very same persons, is not a little strange. Having so lustily applied the shears to the garment of Popery, and lopped off its train and its skirts, to regret the loss of the trimmings and fringes, is childishness and idle affectation.

After having willingly parted with so much, and even congratulating ourselves upon having got rid of it, why should we now all at once be so eager to recover some of the mere remnants and semblances of it? It may be said, in excuse, that the forms and observances which some are now exerting themselves to revive, are in themselves perfectly harmless—not to say unmeaning—and matters of indifference. Perfectly so:—then why make so much stir about them; why make them the subject of so much contention, scandal, and heart-burning? Why treat them as grave and serious questions, if they are only frivolous ones?—frivolous, at least, as far as religion is at all concerned with or interested in them. Appeal to our taste, if you will, openly, honestly, fairly: call upon us to admire—and who is there so dull as to be insensible to?—the varied beauties and excellences of Gothic Architecture—so copious and consistent as a system, and so capable of powerfully captivating both the eye and the imagination. Hardly does it stand in need of other claims to our regard, therefore if we no longer look upon the noble structures which it has bequeathed to us, with exactly the same sort of admiration and veneration as did those by whom they were erected; if we no longer appreciate that abstruse architectonic mysticism which their builders sought to impress upon them, and inform them with, let us be thankful that the superstition which attached importance to such hidden meanings and hieroglyphic conceits has passed away as well as the intelligence of them.

In endeavouring to revive the latter, there is also some danger of our backsliding into the former; or if the "intelligence of the age" is such as to render all apprehension of the kind quite chimerical, it is not likely to receive with much gratitude or respect, the zealous exhortations and instructions of the Camdenists. Such "intelligence" is anything but favourable to the efforts of that centaur-like compound of religious and antiquarian quixotism which would fain reinstate discarded, exploded, and all but quite forgotten ordinances and usages, that are unfitted for us in proportion as they were suited to the temper and the belief of the times when they prevailed,—times which, as far as religion is concerned, certainly well deserve to be called the "Dark Ages," notwithstanding that they are apt to dazzle those who look at them only through poetic and antiquarian *specs*, and contemplate them as the palmy days of ecclesiastical splendour, and of knightly chivalry and romance.

It has been made a bitter reproach against the architects of the present day that they pay no attention whatever to,—in fact are utterly ignorant of, ancient architectural symbolism. Yet that such should be the case is no more than quite simple and natural, symbolism itself having gone altogether out of fashion, and being neither thought of nor understood, or if thought of at all, put into the same category with judicial astrology and witchcraft. Now, however, a sort of enthusiasm in favour of it has been *got up* all of a sudden by certain "learned clerks," who are endeavouring to impose their own hobby-horsical fancies, and quaint mystical riddles and conceits upon us, and to make the observance of them binding upon architects. Henceforth, the latter must renounce allegiance to their arch-pagan luminary Vitruvius, and must guide themselves by the light of, and become spiritually enlightened by, that mystical Doctor and worthy, Durandus. From him they may learn how pregnant with meaning, how luminously significant, the architects of former days, working in faith and animated by zeal for the honour of the Church, contrived to render every part of their fabrics. To the eyes of us unenlightened people at the present day, there appears to be no other meaning in the plan of a cloister than its architectural one: we see indeed, that it has four sides, but so has every other quadrangular space, therefore have no suspicion that there can be any sort of symbolism lurking in what is so very commonplace a circumstance as its *four-sidedness*, until we learn from Durandus, that those four sides are expressly intended to signify—1. Contempt of Self. 2. Contempt of the World. 3. Love of God. 4. Love of our Neighbour!—whether the fourth would not be more properly expressed by that being made much the shortest side, is not said. Again, the Refectory means—not, as might be supposed, carnal appetite, but the love of Holy Meditation! the Cellar—even nothing less than the Holy Scriptures!! and the Dormitory a clean Conscience. This may suffice to give some idea of the architectural spirituality and devout mysticism inculcated by Durandus, and now promulgated under the auspices of the no less intelligent than zealous Cambridge Camden Society, to whom two of their own fraternity not long ago dedicated a translation of Durandus' mystical rigmarole—almost too strong a dose, we should fancy, for the strongest Camdenist stomach among them.

If to be matched at all in his crazy fancies, the Durandus of old is most nearly approached by a modern and living mystic who thus expounds to us a profound piece of symbolism: "The *three* buttresses below and the *three* sides of the triangle above, give the *six* days of the creation, and the light in the centre is the *seventh*. The buttresses in Trinity, support the Light, which is the Law. The triangle or upper part in Trinity supports the Law. From the apex of the triangle, the cross is made to appear an emanation of the Trinity. Also the cross is shown by the centre buttress at the shaft, the base of the triangle as the arms of the Light for the Head, denoting that the Cross was from the Beginning!!" Almost might one suppose that this was intended as a wicked caricature or quiz, instead of being penned in seriousness, and recommended with earnestness as being a notable example of Christian architecture in regard to perfect "intelligence of design," and spirituality of meaning.

In regard to such "intelligence of design," being now revived in practice, were there no other objection, it is to be apprehended that it would be completely thrown away upon the uninitiated, to whom it would be as unintelligible as were Irving's Unknown Tongues; and that instead of contributing to edification, it would be looked upon as a sort of religious mystification any thing but in character with the spirit of Protestantism. The ideas and the feelings which once gave meaning and value to such enigmatical language in ecclesiastical architecture, having utterly passed away, the imitation of it at the present day would be only mere *make-believe* and architectural masquerade. It avails not to say that such allusions ought to be revived, if the time is quite gone by for them. The merely putting on the costume of former ages when the institutions themselves to which it belongs are extinct, would be only solemn mummery, and disguise. It would be like dressing up a child to personate its grandfather,—pleasant as a brief joke, but preposterous if intended in earnest—sincere but moon-struck. To lament that we no longer continue in the "faith of our forefathers," is very much like saying that the Reformation *ought not* to have happened,—as perhaps it would not but for the foul and barefaced iniquity of the Romish church, and its abominable superstitions. Happened, however, it *has*; and it is now all too late to think of repairing the mischief. Even if we are so far to return to the usages of our forefathers as to revive "Christian principles of design," and symbolism, in our church-architecture, it must be a work of such time, that in the interim the zeal which now so loudly calls upon us to do so, will have sunk to the freezing point. That the present generation of architects are utterly unfit for the task cannot be doubted, after no less an authority than Welby Pugin himself has told us: "The student of Christian architecture should also imbue his mind with the mysteries of his Faith, the history of the Church, *the lives of those glorious Saints and Martyrs* that it has produced in all ages;" and among other things be acquainted with the "liturgy and rubrics of the Church;"—meaning, we suppose, not of the heretical Church of England, but of that of Rome. It is therefore, perhaps, out of compassion to the ignorance of architects, that the Camden Society have kindly come forward of their own accord to instruct and *indoctrinate* them in the profound mysteries of canonical architecture. The Camden Society must not, however, expect too much from their pupils; because if they reckon upon their ready docility, their implicit obedience, and their sincere gratitude, they may find that they have reckoned without their host.

The Camdenists would do well also to reconsider some of their own arguments. By identifying Gothic architecture in a special manner with religion—that is the religion which prevailed when that particular style of ecclesiastical building (for which the epithet Christian is now claimed no less exclusively than emphatically) attained its perfection, the Camdenists set up as argument *for*, what should rather be an argument *against* it. For why should we be at all anxious to recover the hiero-mystical language in architecture belonging to an exploded Faith whose altars we have banished, whose shrines we have desecrated, and in whose Saints we put no trust? From the manner in which the Pointed style is spoken of by them and some others, it might naturally be supposed that it was actually part and parcel of Christianity itself, and appeared together with it, whereas, in fact, full ten centuries of the Christian era had elapsed before it began to manifest itself at all as style, that is not till after Christian doctrine had become defiled by the numerous and gross superstitions engrafted upon it by wily and ambitious priests. To use the words of Sir Walter Scott, "the primitive Church differed as much from that of Rome, as did light from darkness;" consequently it is the Church of Rome and our own Anglo-Romish Church in the middle ages which may more justly be charged with having departed from the Faith, than we who have renounced their corruptions and their superstitions. Why then should any among us—more especially those who profess strict allegiance to the Protestant Church of England, excite idle yet, perhaps, dangerous—at any unseemly disputes in regard to matters which are entirely conventional at the best. To retain and keep up is one thing, but to revive customs and practices which have long since fallen into desuetude, and now lost all meaning, is a very different one, in fact nothing less than positive innovation. If we are to be guided in such matters by Christian Antiquity and its precedents, we may as well go back to what was the original Christian style, which prevailed for many centuries, and of which so many noble and interesting examples remain in Italy. Although the *Basilica* be undoubtedly of Pagan descent and origin, it may be allowed to be sufficiently consecrated to us as a style and mode of building strictly ecclesiastical, in consequence of having been the one adopted by, and —so to say, *converted to* Christianity, in such manner that the stain of its former paganism was completely obliterated, and an entirely new and solemnly religious character impressed upon it.

Still, it may be argued, however such style may be recommended by historical traditions and associations, it is not at all so, as far as we ourselves are concerned, by any national ones. Neither is the style alluded to, at all to be compared with the Gothic for its intrinsic merits and qualities. Very true: but then this is entirely shifting the argument, and what we are called upon to reverence implicitly out of zeal for the pure Faith, is thus, after all admitted to be preferable, rather upon *Æsthetic* than Religious grounds! We do not say that the preference is therefore wrong in itself; we object only to the shamming insincerity of those who make Religion a stalking horse to architectural and antiquarian taste; or else, on the other hand, affect a prodigious zeal in behalf of the architecture and arts of the Middle Ages, in order to mask some ulterior policy of their own. It does look somewhat suspicious that, not content with endeavouring to improve Church architecture among us, the Camdenists should insist so strongly upon an observance of symbolism and other antiquated fancies; and likewise that they seem quite as eager to arrogate to themselves a dictatorial authority over professional men, whom they treat as incapable of thinking for themselves, unworthy of being trusted to themselves, therefore requiring to be held in a state of close pupilage to the Cambridge Conclave. Yet on what is the self-assumed infallibility of the latter founded? They seem to have no other standard or test of architectural merit than Precedent;—to have no suspicion that a building may be concocted according to precedent, with authority for every part, and nevertheless prove entirely naught as a piece of architecture,—a mechanical compilation in point of design, and feeble, perhaps even mean in its general character. As well might our Fresco-painters offer up their prayers to St. Luke to grant them success in their operations in the new Palace of Westminster, as our architects look to being inspired by the precedent-recipes of Camdenists, and the mystical lore of religious freemasonry. It is idle to expect at the present day that artists of any kind should be animated by the same motives, or partake of the same enthusiasm as is generally imputed to those who dwelt in cloisters, and devoted their talents to the service of their church. Were such enthusiasm at all felt, it would inevitably be chilled by the reflection that the public have no sympathy with it, and that even were its sincerity not questioned—than which nothing is more likely—it would be regarded with cold indifference by all, except those constituting a special party. The tendencies of the age lie in a different direction. We cannot possibly revive the mental habits, the feelings and purposes belonging to other creeds and to other states of society; why, then, should so much pains be taken to resuscitate the mere phantoms of by-gone things?

There are ultra-Revivalists and Restorers who preach up almost as if it were an express duty, that of refashioning our architecture altogether,—of discarding every other style of the art, except that which prevailed prior to, or just about the time of the Reformation; and of employing this last on every occasion and for all sorts of purposes, both in town and in country. This is so egregiously preposterous—so thoroughly impracticable, that to offer objections to its being done would be a waste of words. Suffice it to observe that however deficient it may be in "the expression of faith and of country," our present domestic style is upon the whole far more of a piece with our actual habits and ideas than would be the antiquated *black-letter* fashions which are so outrageously cried up by Welby Pugin.

Even in regard to Church Architecture, if a fresh impulse is now to be given to it, it must be not so much by scrupulously copying ancient precedent and patterns, as by studying them artistically for the purpose of modifying such examples so as best to adapt them to actual and altered circumstances. Instead of this, the Camdenists would enforce *literalism*—a plodding-observance of canonical etiquette in ecclesiastical architecture, which, in their opinion, is to be principally attended to, and makes ample amends for all deficiencies in other respects. They seem to make Precedent and Symbolism the very Alpha and Omega of their architectural creed, and to merge all criticism—all æsthetic considerations in them alone, as if they operated with the power of some holy charm and sanctifying spell. Great as is the horror of Paganism which the Camdenists profess to entertain, as good Christians, they feel no reluctance, as Protestants, to revert to practices which now look very much like the remains of Popish superstitions. Their so-called *Ecclesiology* busies itself most curiously about such orthodox matters as orientation, couplets, triplets, roodlofts, candlesticks, vestments, church-furniture, and even church needlework, as if "tromperie" of that kind conduced to edification, or insured purity of doctrine. Pity! that nothing has yet been said as to the extra-ecclesiastical purpose to which a Vestry may be turned by being made to do double duty, serving the reverend person or parson himself as a business-room or office on week-days. That such has been the case before now, we well know from our own experience, having attended by appointment on a reverend Doctor, in the vestry of his church, then and there to discuss some matters of literary business;—the upshot of which proved that promises made in a church are very much like promises made elsewhere.

Whatever be the intent, or ultimately the effect of the ecclesiological fancies which the Camdenists exhort us with so much *unction* to observe, and would so bigottedly compel us to believe,—whether they ought or not to be met by a "No-Popery" cry, the "No-Paganism" cry now raised by that party is very needless alarm. As well might they warn us against Judaism or Mahometanism, at the present day, as against Paganism. We are, no doubt, more familiar with the last, but not at all as connected with any religious sentiment or creed, therefore its orthodoxy or heresy is altogether out of the question. For the degree and kind of Paganism, too, which exists among us in relationship to art, we are indebted to those who make classical, *alias* pagan literature and antiquities so very considerable a portion of a liberal education—both an indispensable one, and the prime one. A stranger utterly unacquainted with European civilization, might reasonably enough suppose that the writings of the pagan ancients were our sacred books, so great is the veneration with which they are spoken of, and the pains taken to indoctrinate youth in the study of them, from their tenderest years. Instead of being restrained by scruples of any kind—moral or religious, as to the impropriety and danger of familiarizing unformed and susceptible minds with pagan fancies and pagan principles,—with the detestable impurity, the grovelling brutality, and the fiendish ferocity, which distinguish the deities and heroes of heathen mythology,—and which, to express ourselves in the very mildest terms, are eminently Anti-Christian,—the pious instructors of youth seem to consider a knowledge of the classics the basis of all knowledge, and as something that cannot by any possibility be too highly extolled, or too diligently applied to, insomuch that a proficiency in such studies is termed learning, *par excellence*. Of late years, indeed, the world have discovered that there is other knowledge, and some have ventured to speak rather disparagingly of the system of education pursued at Eton and Westminster and other schools of that grade, as tending very little to either the intellectual or the moral improvement of the pupils. But it was reserved for the Camdenists to aim a parricidal blow at their Alma Mater, by fiercely denouncing Paganism, and therefore by implication calling that worthy Old Lady, no better than an old Jezebel, who together with her no less worthy sister of Oxford, does all she can to keep the spirit of Paganism alive in a Christian land.

If any thing derived from, partaking of, or in any way associated with Paganism, is to be tolerated at all, surely the most innocent, the least dangerous, and least exceptionable form in which it can be now admitted, is that of architecture. Nevertheless, it is precisely this which the Camdenists make their scape-goat, making it to bear all the iniquities of Paganism. In all other respects, the Camdenists, give us, it seems, full license to indulge in as much Paganism as we please. It is only Greek and Roman columns and pediments which excite their holy horror, and are accordingly put into their Index Expurgatorius, as unpardonably heretical and Anti-Christian. Such is the meek theological hatred which they entertain against classical architecture and every style derived from it, that they would fairly extirpate it, and blot it out from recollection altogether, by prohibiting the very study of it. Could they have their own orthodox way, they would establish a censorship over the architectural press and allow nothing to be published except what related to Gothic Architecture and that alone, and perhaps not even on that unless the writer entertained precisely the same views as themselves, and treated the subject with all due unction. That this is something more than a gratuitous conjecture on our part, is tolerably obvious from their organ, the Ecclesiologist having treated as a high misdemeanour the insertion of other articles than upon Gothic architecture, in Weale's "Quarterly Papers." Did the title of that publication imply that it was intended to be exclusively on the subject of so-called Christian architecture, there would have been some grounds for the complaint, whereas, since it does not, some may think that Gothic obtains more than its fair share of attention. Another complaint on the part of the Ecclesiologist is, that all the articles are not written in the same tone, and do not advocate the same opinions, although they proceed from different pens;—a rather curious accusation seeing that the most orthodox High-church reviews do not scruple to allow themselves the utmost latitude as to variety of subjects and the mode of treating them, for it is by no means unusual to find a heavy article of polemical divinity immediately followed by one on the "Novels of the Season," and a dissertation on the Poor Laws or Political Economy succeeded by a sprightly paper on the Opera, or on Cookery.

The Camdenists, however, are most orthodoxly and virtuously intolerant, and we sincerely rejoice that such is the case, because now their narrow-minded bigotry altogether overleaps its mark, and must cause them to be regarded as canting enthusiasts and fanatics, and to be looked upon with suspicion by those who might else give them credit for being actuated by a sincere love of art. If not their sincerity, they certainly do leave their moral courage to be questioned, for else they would show themselves in earnest by boldly attacking the architectural heresy they affect to deplore, in its head-quarters, whereas their valour now seems to be of that sort whose better part is discretion. They are of that godly race who are never scandalized at wickedness when it happens to sit in high places; who are "shocked and amazed" at the iniquity of an old woman's selling apples on a Sunday, but can wink at the doings of noble and honourable Sabbath-breakers. Since the Camdenists claim for themselves indisputable authority, let them assert it boldly, without respect to persons or regard to consequences. Instead of snarling at petty offenders whose dulness must counteract the "mischievousness" of their opinions, and who are therefore hardly worth powder and shot, let them hurl the thunderbolt of their godly ire against the nurseries of Paganism—against Academies and Professors, against galleries and museums where the spoils of Pagan art are treasured up by an enthusiasm no less besotted than profane—in their opinion at least—as precious relics. Let them publicly excommunicate Athenian Stuart and Athenian Elgin; let them sentence the works of Pausanias and Vitruvius, of Winckelmann and Visconti, to the flames, let them denounce Jones and Wren as apostates and arch-heresiarchs. Let their motto be *Delenda est Carthago*: let them bravely assault the citadel of Paganism, exterminate its garrison, and raze its foundations. In their sublime wrath, as Champions of the Faith, let them spare no one, nor tolerate any thing connected with the adverse cause. Soldiers of the Church Militant, let them not quail at the sight of that hydra Paganism, which is not to be slain by lopping off its heads one by one, but by stabbing it in its vitals. Not even the semblance of Paganism ought to be tolerated in any shape among a Christian people: it must be expelled not only from our churches but our houses; not only from our museums, but our drawing-rooms. Wedgewood's pagan pottery, and Hope's heathen furniture, must be destroyed; casts from the antique must no longer be permitted; plaster of Paris must no longer be employed in manufacturing miniature Apollos and Venusses as ornaments for chimney-pieces, but the Italian boys may now return to their former innocent trade of hawking about poll-parrots. Adieu to Anacreontic poetry, Pindaric odes, Bacchanalian songs—to Cupids and Hymeneal Altars,—to gallant Sons of Mars, and Sons of Neptune, and to all the pagan slang of the newspapers. Certes! there is a pretty Augean stable for them to cleanse out, if the Camdenists intend to sweep away all that according to their opinion partakes of Paganism.

Luckily for their credit, they do not purpose to engage in any such herculean task: we have their permission—at least their examples for retaining as much paganism as we please, so long as we eschew it and shun all similitude of it, when it presents itself in the terribly profane and pestilential character of Architecture.

Of course, Camdenists are at liberty to entertain and maintain their own opinions; and if they really think that they are at this time of day promoting the cause of religion by endeavouring to bring symbolism again into vogue, and by busying themselves about trivial external formalities, as if they were not less than matters of vital importance; they stand excused *foro conscientiæ*, however ridiculous and extravagant their devout fancies may appear in the eyes of the world. But they greatly exceed such liberty when they actually band and confederate together for the purpose of assuming to themselves a positive, direct, and irresponsible control over Architecture and those who make it their profession;—when they form themselves into a HOLY ALLIANCE, invested, it would seem, with despotic authority;—when they erect themselves into a formidable tribunal from which there is to be no appeal,—and when not satisfied with recommending Gothic Architecture for its own merits, they insist not only upon our admiring that, but upon hating and detesting every other style of the art. In order to terrify into submission those whom their arguments fail to convince, they resort to the *ultima ratio* of their Holy Inquisition—the terrible charge of "Paganism," and denounce all those who differ in opinion from them, as little better than apostates, infidels, and scoffers.

Although it may serve to scare old women, to talk of Paganism in Architecture as if there was something actually profane and unholy in employing a style of the art which has descended to us from pagan Greece and Rome, is mere paltering with words and names; and as argument is most contemptible, and disingenuous, most jesuitical, and hypocritical;—of a certainty it is ludicrously inconsistent on the part of those who *hug* Paganism with such unholy fervour as they do, when forgetting their own legitimate orthodoxy, they take for their favourite doxy, that very same Paganism only in a different dress. Still to give the Camdenists their due, they are sufficiently consistent in one respect, for while they labour to revive and re-instate among us the recondite architectural mysticism, and ecclesiological etiquette of our forefathers, they themselves display all the bigotry of Monkish times, and a spirit worthy of the Dark Ages.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By Henry Fulton, M.D.

No. 10.

It has been said that "architecture is a creation of the mind," the sister arts have subjects and models in nature, but architecture is almost entirely dependent on invention. The accounts which we have of the paintings of the Greeks raise them in our estimation; in their sculptures which time has left us, our admiration is still more excited, and in them we realise the perfection of art, which the page of history alone would fail to convey to us. But still it is in the ruins of their temples that we read the lesson of a people's greatness. Let us ask ourselves the question, what will posterity conceive of us, judging of us merely by the architectural monuments of the age? When our railroads and our numerous improvements in science and arts shall be mentioned with honour, a blank must be left for our achievements in architecture. But it is easier to foresee all this than to furnish a remedy.

When a knowledge of the art was confined to the Freemasons, and the people for whom they constructed must have been incapable of appreciating its beauties, a certain *esprit du corps*, or perhaps we should rather say *esprit des arts*, existed, which produced the happiest effects. Would that something of this mind existed amongst architects of the present day; and that even although they might combine and confederate to keep all the knowledge and information in their own body, still that they would let us feel that knowledge and information really did exist, and that their works were fit to be handed down to posterity to show the proficiency of this age in architecture as well as the other branches of science and art.

It must be admitted that the architects are few in number who have the opportunity of erecting large edifices; but still even in erections of the smallest description, and of every day occurrence, the architect can show what he is capable of doing, had he a more extended field of operation—but what is the fact? if the edifice be on a small scale, he too often makes it also trifling in character and insignificant in detail; and if the scale be large, as in the National Gallery, it is merely a multiplication of trifling parts, shewing that he is unable to conceive any thing grand or noble on any scale whatever. Few are the architectural features in London, at least in the Greek style or its immediate derivatives, which exhibit the character of nobleness and grandeur. Mr. Rennie's three bridges are every way worthy of admiration, but they are rather the works of an engineer than an architect. We may mention Mr. Barry's cornicione on the Reform Club House, Mr. Hardwick's London Terminus of the Birmingham Railway, Mr. Wilkins' portico of the London University, and Mr. Tite's of the Royal Exchange, and a work of much less importance, yet still showing considerable good taste, Mr. G. Smith's facade of the New Corn Exchange in Mark Lane. There may be other works in the horizontal styles which I overlook in the crowd of paltry, tasty, tawdry erections of the Palladio-Vitruvian school, or the cold, stiff productions à la Smirke. Wax figure workers copy nature, yet their copies are not pleasing; the Greeks unable, Pygmalion-like, to give life to the productions of the chisel, compensated for the deficiency by an ideal beauty which is not to be found in the model; the compositions of the Smirke school hold the same place in the scale which characterise those of the wax worker—they want the life or beau ideal of the original, if I may so express it, they are mere copies, above censure perhaps, but certainly below praise.

But although the bold cornicione of the Reform Club merits unqualified approbation, yet it covers a multitude of sins; and the misfortune is, that these architectural peccadilloes having been perpetrated by the great Mr. Barry, all the little Messrs. Barry will follow in his wake, and as men are more apt to copy the vices than inclined to imitate the virtues of others, we shall have little columns, little pediments, little pulvinated friezes, and vile, ugly little balusters, to the end of the chapter, all because by such devices has the Reform Club been *ornamented*, and it is to be feared that little use will be made as a precedent of the redeeming feature, the noble cornice. Of Mr. Barry's designs for the Houses of Parliament as yet it is hard to judge, the scale of the drawings is necessarily so small; but the fact of his having the courage to introduce so bold a cornice, as well as the style for the Houses of Parliament admitting of a combination of trifling parts, and therefore more likely to prove successful in modern hands, gives us great promise, which I trust may not be disappointed, notwithstanding fears have been expressed on the subject.

The Railway Terminus is a specimen of good taste for this or any other age, and although there is nothing of novelty in the design itself, yet the taste and ingenuity of its architect are not, on that account, to be less highly appreciated. In one sense it is altogether new, it presents us with a successful adaptation of an ancient model, the Propylæa, to modern use, and I trust that long after the hand of time shall have swept away the rubbish which ornaments our metropolis, this terminus shall stand a monument to the fame of Mr. Hardwick. In this example, the exception as regards the number of triglyphs has been followed, and perhaps justifiably so, as sufficient breadth might not otherwise have been obtained *in the composition* with only two columns in antis, and the aerial effect of it as a detached structure and mere screen, render the introduction of the additional one on the centre intercolumniation, less objectionable than it would be in any other case. Still it is the exception, not the rule. It should be mentioned that for this structure, so creditable to the architect and the directors of (I believe) the best conducted railway in the kingdom, that there was no competition.

But the cry is still for *something new*, and even Candidus, with whose views on many points mine so much coincide, talks (if memory serves me right) of things being stereotyped without stopping to draw a proper distinction. I think the cry should rather be for *something good*, which in itself (as in Mr. Hardwick's Terminus) would be something new: and as soon as we are satiated with good examples, then there is no doubt of our appetite for wholesome variety being duly gratified. For my part I would rather see good architecture cover the length and breadth of the land than any novelty which the most exuberant fancy could suggest, if deficient of that quality. It was the love of novelty which occasioned the decline and fall of architecture, and it is not by the same means it is to be restored again. In other things as well as architecture, a longing after novelty irrespective of intrinsic merit indicates a diseased state of mind, which is increased by a supply of the food it desires. When good taste, which in many respects with us is yet in its infancy, shall have arrived at manhood, then, but not till then, shall we be able to appreciate novelty without the danger of being dazzled by its meretricious charms: in the mean time the production or reproduction (if you will) of such works as this Terminus, will do more towards placing architects and architecture in a proper position in the scale of public estimation than all the works of all the ancient and modern Palladios, Inigo Joneses, Wrens, and Chamberses put together.

The porticos both of the University and the New Exchange present a goodly array of columns in front, but they want the depth and solidity of the ancient phalanx, so much to be admired in the Pantheon of Agrippa, and which might and should be attended to in the portico of the British Museum, as pointed out in Observation No. 3, vol. VI. of this Journal.

Our knowledge of the façade of the New Corn Exchange extends no further than the view given of it in Mr. Leeds' Illustrations of the Buildings of London (a work by the way we should rejoice to see continued), but we promise ourselves much gratification by a pilgrimage to Mark Lane to see the reality. Mr. Smith appears to have been very happy in selecting a substitute for triglyphs; but over the internal pilaster of the coupled or rather grouped antæ, which flank the four angles of the wings, there is none, nor could there well be; therefore, they ought, for the sake of uniformity, to have been omitted in the centre of the wings altogether, and some appropriate piece of sculpture should have been introduced on the frieze instead. The Roman and not the preferable Greek method of arranging the ornament at the angles of the frieze has in this case been pursued—still it is a chaste and beautiful composition.

II. It is indisputable that all knowledge of the principles of taste in architecture can no longer, like the secret of the Freemasons, be confined to the craft; men will now think for themselves, and unless guided in the right course, most probably think erroneously. On the profession it must depend to give a proper bias to public taste. Why does not the British Institute stand forward in the cause, and, instead of making a collection of the works of Vitruvius (which it would have been well for good taste had his works never been discovered) give the public a popular guide to instruct students, just as far and no further, than would be necessary to ground a perception of the beauties of architecture. This field in architectural literature is almost untrodden, and promises a rich and abundant harvest. Of all the works which we have of this description, Mr. Hosking's Treatise is the best, but it does not go far enough for the purpose. If that accomplished architect could be persuaded to remodel it on a more extended scale, the work could not be undertaken by one better qualified; of which, in the treatise alluded to, he has given ample proof.

III. I fear that a glorious opportunity may be lost in the façade of the British Museum. I don't know how it is, but the tone (as painters would say,) of Sir Robert Smirke's compositions is cold, the Post Office for instance—this does not occur in the façade of the Terminus, already alluded to in this paper. I think it must partly arise (though not in the case of the Post Office,) from the columns not being fluted, and the absence of sculpture on the frieze; indeed, it would be better to omit columns altogether unless they can be fluted. It is worthy of observation that in a drawing the want of fluting is not felt, as the draughtsman can easily give shade enough to the picture, but which shall in vain be looked for in the solid. In this respect models have a great advantage over drawings, more particularly with those who profess "to understand nothing of architecture;" and, unfortunately, committees of selection are for the most part composed of professors of the science of ignorance, men perfectly innocent of any knowledge of the subject on which they are called to sit in judgment. Sir Robert himself who is attacked from all quarters on account of the Museum, if deficient in the talent of pleasing, has at least, it must be admitted, like Lord Burleigh, a great talent for silence.

Clonmore, Dublin,
June, 1841.

MR. BARRY—THE LORDS, AND THE PARLIAMENT HOUSES.

Mr. Charles Barry, the Architect of the New Houses of Parliament, has it seems, incurred the displeasure of some members of the Upper House of the Legislature, and for aught we know, of some of the Lower One also, on the subject of some matters connected with this building. For the greater part of five days has he been subjected to the trying ordeal of a Select Committee of the House of Lords, appointed to inquire into the progress of the works.

The complaint against Mr. Barry would appear to be generally comprised under three heads: first, they are impatient for the completion of their house, and seem to think that if a proper number of workmen were employed in the various departments connected with the fitting up of the interior, that they would be able to sit in it by the next Session of Parliament. Secondly, they have taken objection to various details connected with the internal arrangements of the building, more immediately connected with their own portion of it, which they alleged involved considerable deviations from the original plan; and thirdly, they came to the conclusion that Mr. Barry had not authority for those alterations.

After a careful perusal of all the evidence given upon that committee, we confess we think Mr. Barry has fully justified himself for all he has done—has successfully defended all the interior details which subsequent circumstances had caused to be introduced, and though the Committee came to a resolution to the contrary, we say it with much respect, established that he had sufficient authority for the certain modifications, additions and alterations, made in the plan now being carried into execution.

With regard to the question of time, it was said that their lordships might use their chamber next February, but it could only be done with temporary fittings, which as they could not be ultimately used in the final completion of the interior, would be so much additional expense. The great quantity of rich wood carving that was to be done by hand rendered it difficult to procure a sufficient number of skilful workmen to execute it as expeditiously as it was considered it might be done, and besides a good deal of time was necessary to complete the drawings and designs for this interior decoration, it was inexpedient to hurry that part of the work. And it is rather a curious illustration of the contradictory mode by which humanity will sometimes endeavour to accomplish a direct object, that notwithstanding their impatience to have their house finished, the very proceeding of this committee have considerably retarded the building, a number of hands having been discontinued in consequence of some contemplated alterations which their lordships intended to make, and which, if carried into execution, would require a total change in the ornamental designs for the proposed internal decorations. So much for the question of time and expedition.

Now with reference to the charge of making deviations from the original plan, without authority, it will tend to make such extracts of the evidence as we may hereafter lay before our readers, more intelligible, to enter into a brief preliminary history of this original plan, which from all that subsequently occurred, must be admitted now to possess but a very shadowy sort of existence, and also a very vague sort of indictment upon which to found any accusation.

After the memorable conflagration which rendered it necessary to erect a new edifice for the legislative business of this empire, and when a site had been fixed upon, a commission was appointed to examine the various plans that might be submitted to it, and to select one from the same. Of the various plans contributed by the competitors for the building of the New Houses of Parliament, Mr. Barry's design was the one finally approved of. It is not easy to trace the complicated history of this *original* plan, through all its stages, but we will endeavour to be as clear upon the subject as we can. The area of this plan which at first only comprized an extent of 5½ acres, was afterwards increased to 7½ acres, and a great deal of additional accommodation for various public offices not contemplated at the commencement, was required to be provided. In addition to this, the application also of the new and approved system of warming and ventilating, invented by Dr. Reid, was to be introduced; and subsequently a further consideration was to be entertained with respect to the rendering of the New Houses auxiliary to the encouragement and effective display of works connected with the Fine Arts. All these ulterior matters necessarily and naturally led to great subsequent changes in the carrying out of the details of the plan; and as during the progress of these works, a throne changed its occupant, governments were going in and out,—public departments altering their heads—commissions terminating, committees of parliament non-existent, it was not we think just to expect that Mr. Barry should be running about here and there, consulting perhaps inexperienced or incompetent individuals as to the details of the plan which he was carrying out, exercising the discretion which he believed, and which ought to be left in his hands, to the best of his judgment and ability, and still however keeping in view the main features and leading principles of the plan subsequently sanctioned by Parliament. However, we do not by any means wish to convey that he did not consult the competent authorities when it was necessary—for he did do so, and furnished them with special estimates of any new alteration that was generally ordered. But we contend for it, he was substantially right in reserving to himself the conception and execution of the details. As he observes himself in a statement he made to the Committee, and which we shall furnish by and bye, he alone would be responsible for anything faulty in the building when completed, and that in his opinion all great works were brought to a proper termination only on an individual responsibility.

On the first day of his examination before the Committee, which was the 21st of March last, Mr. Barry having said that the house might be ready for their Lordships, but with temporary fittings, by the following February, proceeded to apprize them that he expected the works would be ready for the iron roof in about six weeks from that time, and that they would be covered in in six weeks more; the ceiling was to be of painted deal with a fire-proof flooring above. There never had been any intention of having an iron ceiling in consequence of the great weight, and not being so good for hearing.

The Committee then began to question him with respect to the details of the interior, and particularly on the subject of a great apartment proposed to be called the Victoria Gallery, to which some of their Lordships expressed considerable objection, in the following terms:—

You have put two side galleries inside ?—Yes.

Do you apprehend that there would be any thing unsightly in the height of the wall not being broken by the gallery ? Is it for ornament or for use ?—It is for the purpose of getting the required accommodation within the walls of the building, and to assist the voice of speakers on the floor of the house.

Without the galleries, how many peers could be accommodated on the floor ?—I can answer that question by a reference to the plan. This is a plan of the ground floor of the house *(producing the same)*, which will be entirely devoted to the accommodation of the peers, and the number which can be accommodated, according to the arrangement of the sittings there shown, will be 310. The original instructions were for 300.

Supposing there is room for 300 members on the floor, at the allowance of two feet for each member, crowding their lordships a little, how many more would the same space hold without any very great inconvenience ?—Perhaps fifty or sixty more. If on those benches where I have provided for seven sittings you were to consider them to be for eight, that alteration alone would accommodate forty more.

Was it determined that there should be a gallery simply for the sake of the plan, or was it not determined that there should be a gallery on account of the sound ?—No; I do not think that sound was in the first instance a consideration in adopting them; but I do think they would assist the voice of speakers upon the floor of the house very materially.

How far do you propose the projection of the floor of the gallery to extend ?—It would be about three feet beyond the line of the wall.

How many of these benches will it cover over ?—Only one.

Will it not add to the appearance of the room as a deliberative chamber to have a gallery ?—I think so; it will diminish what would otherwise be an excessive height below the windows.

If you were to remove that gallery you would require to change the ornaments of the wall ?—Entirely; it would involve an entire change of the internal design.

The committee wish to call your attention to the plan of the Victoria gallery, which, according to the present plan, opens directly to the House of Lords, and the house opens into that. Now several of their lordships think that there will be great inconvenience in such an arrangement, in consequence of the necessity of having this gallery always lighted and heated to the same temperature as the house, if there is no intermediate lobby; and the committe wish to know from you what evil there would be in making a permanent separation of the gallery, by a continuation of the corridor across the end of the gallery ?—Under any circumstances I imagine it would be necessary to heat this gallery, because as it is proposed to make it the chief place for paintings, it would be necessary always to keep it heated. As to lighting, if it was merely for the purpose of passing across it there would be no difficulty, for by means of candelabra placed across the end of the gallery it might be made light enough for passing from one corridor to the other without lighting the whole space. I would, however, beg to say, that any screen placed across the end of the gallery would very much injure the effect and importance of the room.

The dimensions are 120 feet by 45 ?—They are.

Do you see any objection to having the entrance for the Queen by Westminster Hall ?—The only objection that might be urged would be, the great distance that the Queen would have to walk from the entrance in New Palace Yard to the house.

There would be no other difficulty ?—I am not aware of any other difficulty.

In what manner do you propose to secure the throne from the draught that would come in from the Victoria gallery ?—The door at the back of the throne, as proposed, would only be opened when the Queen came to the house. It would not be one of the ordinary entrances to the house.

Supposing the gallery remains without a lobby behind the throne, would not the air from that gallery, if it be not heated, circulate through the passages so as to enter the ordinary doors of approach to the house ?—I should say not.

Would it not be constantly open ?—The door at the back of the throne would be constantly closed.

Is your reason for supposing that the cold air in this great hall, if it were not heated, would not affect the house through the doors of entrance, only that it is cut off from the passages to the house by folding doors ?—The temperature of the house would not, I think, be affected by the temperature of the Victoria hall, in consequence of two pairs of intervening folding doors at a considerable distance from each other.

After observing that it was not yet decided on whether the painting of the walls was to be in oils or frescos, and giving his opinion as to the degree of temperature necessary to preserve either, the examination is then directed to the subject of warming and ventilating of the building, which is not very interesting to the general reader, and then the question of expediting the preparation of the fittings is thus pursued:

As to fitting up the seats, the seats in the plan are divided into forty, each of which is fourteen feet long ?—Yes.

Each of these seats will be made separately ?—Yes.

Then if one could be finished by the 1st of next February, could not the whole forty ?—Yes; if a sufficient number of skilful hands can be found, unquestionably they might. The Committee will very soon have an opportunity of seeing the specimens of the carving that have been delivered for exhibition in St. James's Street, and they will then be better able to judge.

In the same way with respect to the doors; the doors will be folding doors, will they not ?—Yes.

Then, in the same way, if a proper number of hands were employed, if one door could be done, the whole might be done by the first of next February ?—Yes; if a sufficient number of skilful hands could be procured.

How many doors will there be to the house ?—Five double doors on the floor of the house, besides the door at the back of the throne.

And there are some more in the surrounding corridors ?—Yes; as many more at the least, in the surrounding corridors and galleries.

Do you think it would not be possible to find a sufficient number of skilful hands for the execution of those works by the 1st of next February ?—Yes; I think it is possible they might be executed before the month of February next.

Have you a drawing of the doors ?—No.

Have you a section of the interior of the house ?—No. I thought it quite unnecessary to bring it, as the model is before the committee.

You are talking of the lower part of the house. We have neither a section, nor is it in the plan ?—That I could show the committee when the drawings are completed, which will be the case, I expect, in about a fortnight or three weeks. But if the committee are thinking of any alteration in the design of the house it would be better to defer going on with these drawings.

Are the committee to take the plan as exactly what is intended ?—As far as it goes, they are. After Easter I shall be in a condition to lay before the committee, I hope, the whole of the details of the fittings of the house; but I cannot undertake to be responsible that they will be ready by next February. All I can say is, that no effort shall be wanting on my part in expediting them, and I am in great hopes that by the month of February they will be all ready; but they will take a considerable time to fix.

And so ended the proceedings of the Committee for their first day's meeting,—and it must be apparent to any that their object of expediting the works is not likely to be the result of their Lordships' efforts, namely the 24th of April.

On the second day of the meeting of the Committee, one of its own members Lord Sudely, a nobleman of considerable experience and taste in architectural matters, was examined at some length. Having said that as one of the original Commissioners appointed to decide upon the plans sent in for their approval, he had made himself master of the details of that of Mr. Barry, so far as the House of Lords was concerned. In the opening part of his evidence he speaks as follows, and his observations require no comment with respect to the position of the architect, "and I must observe, in justice to Mr. Barry, that it never was *the idea, the expectation, or the wish of the Commissioners that Mr. Barry should be confined to the plan that was approved of*, because in our report, although we stated that the plan of Mr. Barry, as a design altogether, was one that we most approved of, yet still we knew full well that it was susceptible of great improvement, and we recommended to the Crown, that some alterations should be made, which in consequence were adopted, and they were of trifling importance."

Was it in your recommendation that alterations implying alterations of the plan, should be made without any reference to you for your approval ?—Certainly not.

Was it your intention that these improvements should be submitted to you severally ?—I can hardly say that we knew nothing of the plan, from the moment the alterations alluded to were made—we were from office from the time our report was made.

From this it will be tolerably clear that Mr. Barry could not be expected to look about for individuals to consult as to all the details of such alterations and additions, and increased accommodation as were ordered to be made, even supposing he thought he could meet any one as capable of properly arranging and considering them as himself, which was by no means likely.

The noble Lord then proceeded to read to the Committee extracts from the evidence given before a Committee of the House of Commons by himself and others of the Commissioners, in explanation of these reasons for selecting Mr. Barry's plan in preference to any of three others also submitted to them, and showing that the Committee were unanimous in that selection, at the same time that they thought some improvements might be made in it. The only objection which he saw in that plan was to the Victoria Tower, into which he thought it next to impossible, for the great state carriage to pass without great inconvenience, then turn round a pillar, and then out by the southern gateway. That portion, however, had been since materially altered, but then a great increase of area had been added to the site.

Lord Sudeley's examination is then continued as follows, and it will be seen that he states at length all his objections to the plan as it at present exists.

Then your objection to what has been done is, not that there has been an alteration, but that that alteration, considering the increase of area, has not been sufficiently effectual to accomplish its purpose?—Yes. I object to the present plan, because I think it is not nearly so good a plan as the one before you; and, secondly, I object to it because the architect has not carried out his own idea in the best possible manner. But perhaps I had better now explain the second plan, taken from the Illustrated London News, and which is now being carried into execution. The committee now perceive that the Queen will enter the Victoria Tower precisely as she did in the former plan, but, instead of going round a pillar, the royal carriage will now pass through the tower, and under the Queen's robing room, into the royal court. Your lordships will recollect that the plan before you is not that of the basement, but the principal floor. The royal carriage drives through the tower, the Queen is set down on the left-hand side, and ascends a flight of nine steps to the first landing; she then ascends three steps to the second landing, when, turning to the right, she has to ascend a further flight of twenty-five or twenty-six steps into the lobby; from the lobby she enters the Victoria gallery, and thence into the robing room on the right, and from the robing room proceeds through the Victoria gallery to the House of Lords. Such is the present plan of Mr. Barry executing at this moment. Now my objection is to every part of this plan except the tower, which is very much improved. But I leave it to your lordships to consider whether the stairs is a fitting one. even for a common mansion. An ascent of five or six and twenty flyers without any landing is inconvenient, and any thing but ornamental. Your lordships can scarcely supply any instance of that in any mansion where appearance has been studied.

Are the steps six inches?—Six inch steps, as I am informed; but if they were four and a half, or five, I should still object to it. I am not aware of any instance of a mansion in which ease, beauty, or convenience has been considered where there is any such objectionable ascent to be met with.

Would it be practicable to alter this?—I will show the committee presently that in my opinion it is. My next objection is, that in the lobby, on looking at the plan, you will observe that in the centre of it there is a pillar, intended for groining the ceiling; at least I presume so. If a line is drawn from the centre of the stairs to the centre of the door it will be seen that the pillar stands directly in the way of the peers' approach. I now come to the Victoria gallery itself. I object to the Victoria gallery on several accounts. There was a gallery, but that was of very different character; that was literally a gallery: whereas I contend that this is neither one thing nor the other. It is too short for a gallery in proportion to its width, and it is too long for a hall. Therefore, as a matter of taste, I object to its proportions. But that is not the only objection. It deprives the Queen of her robing room immediately adjoining the House of Lords. Another very important point is, that in consequence of this gallery there will be a continuous roof from the House of Lords to Little Abingdon Street. The roof will be from 90 to 100 feet in height; contrary to Mr. Barry's own principle, as stated in his prospectus or paper which he delivered with his plan; for he there observes that he has carried up the houses of parliament greatly above all the rest of the buildings, for the benefit of air and light. Now I need not observe to your lordships, that both the light is obstructed and the air is impeded by this arrangement. Besides, we shall be deprived at one end of the House of Lords of the power of lighting it, if it should be required. Then, as I before observed, the Queen is deprived of her robing room immediately behind the House of Lord; the very situation which Mr. Barry himself by his former plan recommends that it should be placed, but which has since been altered. In fact, as it appears to me, everything has been sacrificed to this Victoria gallery. There is no communication whatever from north to south, or from east to west, except through this gallery. And if there was no other objection to it, the circumstance that the gallery must be lighted and must be ventilated the same as the House of Lords throughout the year, although it would otherwise be required to be used only on state occasions, would be a sufficient one.

You are aware that it was stated by Mr. Barry that it would be necessary to keep up a certain temperature on account of the fresco paintings?—If the buildings of the houses of Parliament are meant for the fine arts, I think then that Mr. Barry's observation may be perfectly right; but I consider the houses of parliament are built for no such object; that the fine arts ought to be called in to embellish the houses of parliament, and that no necessary architectural arrangement shall be sacrificed for their display. I have now endeavoured to show the difference between the two plans, and I believe I have stated all the objections I have to the present one.

Are there any other differences besides those you have mentioned?—There is. The plan is all re-cast. The committee will see that in my evidence, in answer to Sir Robert Peel, reference is twice made to alterations that might take place, in addition to what the commissioners had suggested. Now the word "suggested" requires some explanation, because it might naturally be supposed that when the commissioners were suggesting some alterations, they might as well have suggested others as well as those they did suggest; but the reason was this, we confined our objections entirely to such parts of the elevations and the ground plan as might be altered without any recasting of the plan.

Assuming the plan to be substantially preserved?—Yes; because we thought we should do injustice to the others, if we went upon any other principle than that of removing actual objections.

You preserved in each case the principal plan, and suggested alterations in the detail?—Precisely so. There is one great objection to this plan which does not apply to the original. Your lordships will observe that there are no corridors from one end of the house to the other along either side of the Victoria gallery.

Were there in the old plan?—There were. It may perhaps appear to be vanity in me to state to your lordships that I think I see a remedy for this evil. No doubt Mr. Barry could find a much better one than I can suggest. At the same time it is necessary, before I state what it is at all, that your lordships should be convinced, with me, that there is an inconvenience demanding a remedy. If you are so convinced I will lay before you a plan of the alteration I would suggest. *(His lordship produced another plan.)* The Victoria hall, according to this alteration, is, although not so long, in my opinion a very fine room. It is 100 feet long by forty-five.

You have made it avowedly a hall, and not a gallery?—Avowedly a hall, and not a gallery.

Would you light this Victoria hall by skylights?—It may be done by a skylight, if it is necessary; but it is unnecessary, because there are sufficient means of lighting it without having recourse to any.

You make the ascent much more gradual?—Much more gradual; and there are two additional landings.

Have you any other observation to make?—I am not aware of any, except upon one point. I am very sorry that this investigation should take place at the eleventh hour. These plans ought to have been settled years ago. It is going on nine years since the commissioners made their report. From that hour, until lately, I have never seen the plan. During the Easter recess I was anxious to see how matters stood, for as the buildings grew up I perceived that many alterations had been made, and having obtained a copy of the plans, by which I became better acquainted with the intentions of the architect, the result of my observations I have laid before your lordships. I have only now left to state to you the situation of the work when I last looked over it, and to request your lordships to attend to the plan. I went to the top of the walls of the Victoria gallery, which are raised to the line of the floor of the House of Lords, the heads of the windows of which to the West were nearly set, and the windows to the east going on very rapidly, and I have no doubt that in the course of another month we may consider that the walls will be fit to receive the roof. With regard to the corridor that immediately adjoins the house at the back of the throne, I found that there the springers for the groining of the roof had been set. All on the South side of the buildings, barring the river front, which is now roofing, is in the same state of forwardness; some parts of it rather more advanced than others. Of the staircase, I regret to say that the side walls are nearly up to the flooring of the Victoria gallery, and therefore if any alteration takes place in those stairs that part of the building must be taken down.

Taken down to what extent?—To no very great extent, and when we are expending near a million the cost of such an alteration is not worth a consideration. It is, however, a great pity, that from the advanced state of the work we are placed in this position, that we must either put up with what we consider a defect in the plan, or pay the expense which its removal may occasion.

So terminated his Lordship's examination, after which Mr. Barry is called in, and on being questioned with respect to the alterations alluded to in the foregoing evidence, maintained that whatever had been done, and he admitted it had been done without consulting any other authority than his own judgment, had been alteration in details only, and that the main features and principles of the original design had been adhered to, but in his opinion very considerably improved. There had been a staircase originally as well as he could recollect, but not so imposing a one as that now contemplated; and there had also been an approach through a gallery, but such as did not deserve the name in comparison with the present. With respect to the distance of the robing room from the throne, that objection could be easily met, for there would be no difficulty in getting space for one at the back of the throne. As to the staircase of twenty-five or twenty-six steps in one flight, he could give instances of the same in some of the most celebrated palaces and buildings on the continent. Mr. Barry here handed in the original instructions which he received with respect to the interior accommodation and proportions of all the various departments and subdivisions of the building, which he said were the only instructions generally that he had ever received. Then entered necessarily into many statistical details which would too much burden our columns and be totally uninteresting.

When the Committee next assembled, three days later, Mr. Barry said he wished to hand in a certain document as evidence, which he had drawn up since the last day's meeting, as there appeared to be an impression on their Lordships' minds that he was open to censure for alterations made in the plan originally adopted by Parliament. He is then questioned as to the extent of ground gained from the time the original plan was selected, and having stated that it was from $5\frac{1}{2}$ to $7\frac{1}{2}$ acres (as we have already mentioned,) he informed the Committee that any departures which had taken place from the original sealed instructions, were done upon the authority of Committees of both Houses of Parliament.

The following was then read—

Mr. Barry's Statement.

"My Lords,—At my last interview with the committee, I admitted that alterations had been made without authority; but, I must beg of your lordships to bear in mind, that that admission extends merely to the mode in which they have been effected, as they have generally been the consequence of express orders received from government. Your lordships must, I am sure, be convinced upon reflection that the original design, recommended for adoption by the commissioners, for a building of such extraordinary magnitude and complication of detail, as the New Palace at Westminster, could in the first instance (for want of all the practical information requisite, and the time necessary to devote to the study of it,) consist only of leading principles; and although the design, after the commissioners had made their report upon it, and the committee had ceased to exist, underwent a very considerable modification and enlargement, in consequence of the suggestions of the committee of both houses, before whom it was laid, yet the time allowed to me for effecting the change, was far from sufficient to enable me to improve it so much in detail as I have now been enabled to do from the continued and deep study which I have ever since devoted to it, aided by the information which I have been able from time to time to collect from the heads of departments, and other officers connected with the practical working of the houses of parliament. The modified design which was ultimately adopted by parliament, by the recommendation of a committee of both houses, was, therefore, still in a crude state, as regards many of the internal arrangements; and as, upon being ordered to carry this design into effect, I was not instructed to adhere strictly to the details of it, I conceived that it was intended by the committee that I was to be left at liberty to improve them as much as was in my power, provided I did not depart from any of the leading principles and features of the design, diminish the accommodation and convenience of the building, or cause any ultimate excess in the estimated cost; and in the correctness of this impression I have ever since been confirmed, inasmuch as that whenever I have been required by the government to make any addition or alteration in the building, I have never been called upon to deliver any plan to show in what manner I proposed to effect it. In all the alterations which I have made in the internal arrangements of the building, which have not been the consequence of express orders given to me by government, I have strictly adhered to the conditions to which I have adverted; and in all those which have been expressly ordered by the government I have invariably delivered estimates of the extra cost previously to receiving authority to execute them. With regard to the latter class of alterations, I beg to observe that in the first place I was required to make the necessary arrangements for the new system adopted by parliament for warming and ventilating the entire building, which alone has caused many serious and important changes: then to provide accommodation for the A division of Police—then to provide a residence for the Librarian of the House of Commons—afterwards to provide a residence for the Clerks of the House of Commons—then to provide accommodation for the Clerk of the Crown—and lastly, to make arrangements for the whole of the public records of the kingdom, and their future increase; together with the requisite accommodation for the establishment connected with them. All these orders alone, have necessarily caused very important changes in the distribution of the building, and many others have been the consequences.

"Your lordships can scarcely, I think, be aware of the enormous extent of labour, responsibility, as well as anxiety of mind, which I have to endure in conducting this great national work, which, when complete, if there should be anything faulty, I shall be sure to be visited with the entire blame. I am not, however, disposed to shrink from the almost appalling task imposed upon me, as I am firmly persuaded great undertakings are best accomplished under an undivided responsibility. On the contrary, I am ready, as I have hitherto ever been, to devote the best energies of my mind to the perfection of a work, which it is my earnest desire to render an honour to the country, but unless I am supported, nay encouraged, in the performance of my task by the cordial and kind indulgence of your lordships, and all who are interested in the success of this the greatest undertaking of the kind of the present or any former period, it is quite clear to my mind that it cannot be brought to a satisfactory termination."

The proposition here laid down, that "all great undertakings are best accomplished under an undivided responsibility," is most incontrovertible. The observation might be used as an apothegm. Every example of ancient and modern times will prove its truth. Would Alexander have perfected his Indian conquests under a divided responsibility? Would Hannibal have carved his course through the Alps had he to send to Carthage for instructions how to proceed every other thousand paces? Would Cæsar have conducted his army across the Rhine, by his simple but ingenious and effective bridge, had he to wait for advices from the Roman Senate how to construct it? Would Mechelangiolo Buonarotti have built St. Peters, had he been obliged to go gossiping amongst the College of Cardinals about every portion of his stupendous design? Would Sir Christopher Wren have reared so glorious a monument to his fame and genius, as St. Pauls, had he allowed himself to be influenced by the worthy aldermen of the good city of London? (But even here the interference of petty minds prevented the original colossal design from being more than half carried out.) Would Napoleon have achieved the brilliant military and engineering results which marked his career, had he to send expresses to the French Directory for further orders in every emergency? Would Wellington have won Waterloo under the constraint of restricted authority from the War Office or the Horse Guards? And we trust that posterity will add to the category of queries, would (Sir) Charles Barry have covered seven acres and a half of the north bank of the Thames at Westminster, with that splendid and extensive, and complicated pile which adorns it, had he been forced to go to my Lord This or my Lord That, for his opinion as to how he might best manage its various details?

The first question Mr. Barry is asked after the foregoing statement had been read, is a specimen worthy of even forensic ingenuity to entrap a witness into a self-condemnatory admission. We give it, as well as a portion of the subsequent examination.

You mention that you departed from the principle on which you set out. Was not it a recommendation which you gave to the Commissioners, in your statement to them of the principles of your plan, that the two houses of Parliament should be carried up much higher than any of the surrounding buildings, for the sake of air and ventilation?—*I have not said that I have departed from the principle upon which I set out.* Not having the original plans and the memoranda I delivered, I am not able with confidence to answer the latter part of the question; but I will refer to a paper which I hold in my hand, in which is detailed the principles on which the original plan was formed, and which, I imagine, will answer the question. The passage referring to the houses is this: "That the situation of the houses be in the centre of the mass of the proposed building, for the sake of convenience, quietude, and freedom from all disturbances from the exterior; that all the lobbies and corridors adjoining them be only one story high, to admit of the houses being well lighted and ventilated, also for affording the means of making them of the forms and size best suited to the wants of each house, without interfering with the unity of character maintained throughout the exterior." That is the best answer I can give to your lordship's question.

In the plan, as you are now executing it, that principle will not be maintained, because it is intended to have the Victoria Gallery of the same height as the House of Lords?—It is intended to be so; but laterally the house will be above its adjoining corridors. Perhaps I may be allowed to state why it is that the house is not perfectly insulated; that is one of the changes which has been brought about by the arrangements absolutely necessary for the warming, ventilating, and carrying off the smoke of the building.

Are the Committee to understand you, that the Victoria Gallery has been carried up to as great a height as the House of Lords itself merely for the sake of ventilation?—No; not merely on that account. That is only one of the reasons which has induced me to carry it up to that height.

What is the other?—The other reasons I will explain to your Lordships. Exercising the discretion which I have always done, within the limits before adverted to, as to the internal arrangements of this building, I will proceed to point them out to your Lordships on the plan adopted by Parliament.

Is the plan you have just shewn precisely that now shown to you which was approved by the Committee?—Yes, I apprehend it is, as it appears to be a copy; but, whether it is or is not accurate as a transcript of the plan put before the Committee, I beg to say that this plan which I now produce is the identical plan approved by the Committee, and from which the estimates of the building have been made. Referring to the plan sanctioned by Parliament, I will now state to your Lordships the reasons which have induced me to raise the Victoria Gallery. The objections to the state entrance in the plan adopted are as follow: loss of space in the principal floor by the height of the inner hall, loss of space in the passage to the refreshment rooms; inconvenience of situation of refreshment rooms; difficulty of accommodating spectators to witness processions on the staircase; necessity of lighting inner hall by lantern, rendered impossible by means of ventilation arrangements; impossibility of duly lighting transverse corridor at head of stairs, as well as the robing room at the back of the throne, in consequence of the ventilating arrangements in the roof; want of a large hall adjoining the house, as in all former houses, for the convenience of Peers on great public occasions, the Commons being much better accommodated in that respect than the Peers. These appear to me to be the objections that applied to this plan.

Having been asked why he had not communicated these arrangements when he thought of them to some authority, he answers—

I have already stated the reasons why I have not communicated the details of this and other changes to the government; but the plan exhibiting them has been deposited in your Lordships' Library for more than twelve months I will now state the advantages which I suppose to accrue from the alteration in question. First of all, a great economy of space, otherwise wasted; the removal of the refreshment rooms to a more convenient situation near the libraries; the acquisition of a grand hall of approach, suitable to the dignity of the House of Peers, and available for state trials, which seems desirable, since Westminster Hall is now to become the main public entrance of the new palace, for the due accommodation of spectators in witnessing the procession of the sovereign to and from the house, for conferences of the whole houses, and for the purpose of affording the means of encouraging the higher departments of art in the decoration of its walls; the acquisition of two fine rooms to the south on the principal floor, being available either for the Queen's robing room and ante-room, or if the ordinary entrance to the house be by the Victoria Tower, one might be for marshalmen and others in attendance upon Peers, and the other for a committee room or writing room; also the acquisition of several rooms and other accommodation on the ground floor for the record establishment. Those are the advantages which I presume to accrue from this alteration of plan.

On being questioned as to the authority he had for any alterations which were not the immediate consequence of direct orders from the Government, Mr. Barry informs the Committee that he had the authority of the Woods and Forests Board, *in writing*, and that he could produce the same. And here it may be as well to state at once, that at a subsequent stage of the investigation, Mr. Barry did hand in a quantity of correspondence with different public boards and functionaries, as well as give evidence of *viva voce* communication with, and instructions from others, fully substantiating his assertion that he had received orders to make certain additions and alterations, and that all the subsequent ones in detail, against which the present outcry was made, had been the necessary and inevitable result. Over and over again did he reiterate that he had received general orders to do certain things and make certain arrangements, but that he did nto think himself called upon, nor was he required to explain to any one how these orders were to be managed in detail. Yet still did some members of the Committee, with stolid pertinacity, persevere in asking him what right he had to make this change, and by what authority he introduced that alteration, and whom did he consult on the other deviation from the original plan, which original plan we have already observed was as vague and ill-defined a matter to ground an inquiry on, as it is possible to conceive.

Oh! but then there is a staircase which is the greatest stumbling block in the whole concern—their Lordships cannot get over it for the life of them; and they ask how many steps are in it, and what depth is each step, and the length of the tread, and the height of the top from the ground floor; and they are dissatisfied with it because it consists of 26 steps, of a rise of 5 inches, and a tread of 16 inches each, without a landing or break in the middle. And although Mr. Barry tells them that in the Palace of Caserta was the finest staircase he had ever seen with a flight of 27 steps unbroken; and in the *Scala Reggia*, in the Vatican, considered the finest staircase in the world, there were two flights of 40 steps each, and that in the University of Genoa there was a staircase of 24 steps, and in the Ducal Palace of the same city, one of 39 steps in one flight; their Lordships will not "seriously incline" unto this unlucky staircase in the New House of Peers, and challenge Mr. Barry to point out a *single instance of such a one in London*. Will our readers believe, that any man, or any set of men, could require in this metropolis a precedent for any extraordinary matter of architectural taste? This question of the staircase has haunted the Committee through all its proceedings—up it will start like a ghost in the middle of every other detail, and its tread and height, and unbroken flight come over their Lordships with as many anticipations of fatigue as a pickpocket's dream of the treadmill. On the very 2nd last day's examination down comes the staircase again after the following fashion. And we crave our readers' admiration for the brilliancy of the architectural imagination that could fancy an analogy between the stairs under the York column and that intended for the House of Lords.

And you still persist in saying that a flight of twenty-six steps is not at all objectionable?—I should prefer leaving it entirely as it is. I have given the subject a great deal of consideration, and I am satisfied, under all the circumstances, that it is better to leave it as designed.

You have mentioned a great number of instances abroad; but you have not mentioned a single instance of one in London?—Because it has not occurred to me; but those noble lords who have been in Italy will doubtless recollect the fine staircases I have mentioned, particularly that of the Vatican.

But the Committee must know the size of the steps, which you did not mention the other day. Can you mention any staircase in London which you would recommend the Committee to look at, to show that your opinion is good?—I am not aware of any staircase in London where the width and rise of the steps accord with those which I propose. I could give your Lordships a correct idea of what the proposed staircase would be, by having a model erected on the spot. I could have it done in wood, so that your Lordships might judge for yourselves.

Is not the reason why this staircase under the Duke of York's column, going out of Saint James's Park is handsome, and does not offend the eye, first, that it is broken two or there times, but, secondly and chiefly, that it forms a grand pedestal to the column; and would not that staircase, even with those breaks, be an unsightly object, if it were not a pedestal to the column?—I should say, with deference to your Lordship, that the steps alluded to are not convenient, owing to their want of width in the tread, and that if the two landings which divide the flights had been given to the increase of the width of the treads of the steps it would have been far preferable.

Mr. Barry defended his staircase, step by step, to the last, announced his intention of leaving it unaltered as he had planned it, provided the discretion was left in his hands, and told their Lordships that having ascended staircases in all parts of the world he had found that the most convenient of all was one with a rise of 5 inches and a tread of 16, and this, he contended, required scarcely more effort than was necessary to walk from one end of a room to the other. The absence of any landing in the centre, he also thought was calculated the more to prevent the possibility of tripping.

Amongst the others objections taken, was one to the position of the Queen's Robing Room, but this Mr. Barry proposed to meet by providing one not exactly at the back of the Throne, but adjoining the lateral corridor of the House; his reasons for such an arrangement are explained in his reply to the following question.

How comes it that you never made these inquiries respecting the importance of having the robing room in a particular place until the plans were so far advanced that you could not place it there without an inconvenience? I beg to state the inquiry was made in time, as the plans are not so far advanced but that the change may be made with the greatest facility. I had the honour the other day of going over the whole building with Prince Albert, and it was a source of regret with His Royal Highness that there was a great want of large spaces for fresco paintings. On my pointing out, however, to his Royal Highness, that an opportunity might be afforded of obtaining large spaces in the now proposed robing room at the throne end of the house, he was pleased to express his satisfaction at the change. That is one reason I have for proposing a room of this magnitude, which is much larger than the room required by the original instructions, which was to be thirty-six feet by twenty-four feet. The room which I now propose to be called the painted chamber, or Queen's robing room, will be fifty feet by thirty-two feet, and thirty feet high, and it would immediately adjoin the throne end of the house.

That their Lordships' proceedings upon this enquiry have probably been the cause of serious inconvenience and loss to many parties, may be suspected from the intimation here conveyed.

It appears to be highly desirable that the works of the Victoria Gallery should be stopped till the Committee has decided upon the plan?—I have the pleasure to state that I have anticipated your Lordships' wishes in that respect, by stopping that portion of the work; but it is right that I should at the same time state that I have done so at considerable inconvenience to the contractors, in consequence of the number of hands they have now in employment, and the vast quantities of stone which are continually pouring in; and therefore if any change is to be effected in that portion of the building it is of absolute importance that it should be decided upon as speedily as possible.

After another question or two on the old subject of the authority he had for making the alterations referred to, and again explaining that they were the consequence in details of direct orders received from Government, the examination goes on thus:—

For what object have the alterations with reference to the Victoria Gallery and the staircase been made?—That alteration has been made for the reasons I have already stated, but mainly with reference to the warming and ventilating arrangements. It is necessary the roof should communicate in the same level from the outside of the building to the central tower, rather rising than otherwise, but forming one continued communication in the roof.

The whole way from the outside walls to the centre of the building?—Yes. I may here perhaps be allowed to state, that I think the government has exercised a sound discretion in not interfering with the mode of effecting various changes that have been made in the internal arrangements of the building, and in leaving the entire responsibility with me, as being better acquainted than any one else with the principles and details of the plan of the entire building, to carry them into effect in the most judicious and effective manner.

In the contract made with Messrs. Grissell and Peto is it not stated that no alteration shall be made without the sanction of the Commissioners of Woods or the Lords of the Treasury?—Yes; without the sanction of the Lords of the Treasury, or the Commissioners of Woods and Forests, or myself.

Mr. Barry then hands in as evidence an extract from the contract for the works, entered into by Messrs. Grissell and Peto, which fully bore out the statement above made by Mr. Barry; and at this portion of the investigation, which closed the architect's examination for the third day, we have only one more observation to make, and that is, that we fully agree with Mr. Barry, that the Government exercised a sound discretion in leaving to him the carrying out of the details of the internal arrangements of the building, and all the alterations consequent upon the subsequent additions and the increased accommodation which was required.

Dr. Reid, whose inventions in warming and ventilating buildings are intended to be applied to the New Houses, was called on then to give his evidence, and though his examination consisted very much of what lawyers call "leading questions," evidently with a view of endeavouring to make him impugn the practicability of the perfect application of the principles of his invention, to certain alleged arrangements of the structure referred to, he does not admit the existence of any difficulties that might not be overcome even in the cases put to him. His testimony went generally into an explanation of the principles of his plans of heating and ventilating, and he concludes his evidence by observing that all the smoke of the building, none of which would be at all seen, would be carried off by one shaft, except from a few apartments of great altitude and minor importance, if the plan formerly adopted by the Committee was carried into execution.

During the greater portion of the time of the sitting of the Committee on the next day that it re-assembled, they were occupied in reading over the correspondence and documents handed in by Mr. Barry, to which we have above alluded, and which were received by him from the respective boards, authorizing the general alterations and changes to which reference had been made so often in the course of the present enquiry.

The following few little facts relative to the comparative height of different parts of the building, as stated by Mr. Barry towards the close of the fourth day's proceeding may be interesting to our readers. The general line of the building was not intended to be the same throughout; there was a difference of between three and four feet, to be on the ground level between the north and south sides of the houses, which we take it means the river side and the land side. A height of about sixteen feet was to be maintained between the ground floor and that of the principal one. The principal floor was to be twenty feet above Trinity high water mark, but a portion of the basement story which was to be called the crypt was to be in part below Trinity high water mark, but not below the river.

On the last day upon which the Committee met, which was the 6th of May, Mr. Barry's examination was again resumed by a series of questions, directed as heretofore with a view of eliciting from him an admission if possible, that the alterations which he had made, and about which so much had already been said, had been done without authority, because he had not consulted any one with respect to their details. But their Lordships did not succeed in extracting any such concession from the witness, who maintained all through that any alterations he had introduced, were either in pursuance of direct orders, or the consequence of them. If he had not any direct authority, he had, as he conceived, an implied authority for his acts; and as he had never been called upon to consult or explain to any person as to how he was to effect the changes proposed, in detail, he had not conceived himself bound to do so.

With reference to another subject connected also with the subsequent arrangements which he was expected to make, and devote consideration to, he is asked;

Have you made, up to the present moment, any alteration in consequence of communication with the commission of fine arts?—I have proposed an alteration, in consequence of a regret expressed by the Commissioners of Fine Arts, that there were not sufficiently large spaces for paintings; namely, that a change should be made in the design of the Victoria Hall or Gallery to afford the large spaces for pictures which are wished for.

Does that occasion any material alteration?—It makes no alteration in the arrangement of the plan; it is only an alteration in point of taste. I beg to take this opportunity to observe, that there are various reasons which induced me to shift the robing room: one the difficulty of lighting it, in consequence of the roofs being continued from the south front to the central tower upon one level, for the purpose of carrying out the adopted mode of ventilation, and the still greater difficulty of lighting the cross corridor. I beg to say that in my opinion these are alterations exceedingly to the advantage of the building.

We shall trouble our readers with only one more extract from the evidence given upon this occasion—it comprises the termination of these proceedings. It is the raciest, as well as the

Last scene of all
That ends this strange and eventful history.

And furnishes a very fair specimen of the *spirit* in which the entire investigation was carried on, as well as the *spirit* and independence with which the inquisitorial style adopted towards the individual assailed, has been so manfully met.

While their Lordships were deliberating on the evidence, of course Mr. Barry was ordered to withdraw. The Report however goes on to inform us that in a brief space afterwards,—

The witness is again called in, and is informed, that the Committee have come to the following resolution: viz., Resolved, that it appears from the evidence of Charles Barry, Esquire, that during the progress of the building of the Houses of Parliament certain departures have taken place from the original plans approved of by the Committees of the two houses of Parliament, and ordered to be carried into execution, under the direction of the Boards of Treasury and of Works, which alterations have been made by Mr. Barry without any authority from either of those Boards, to which circumstance they think it right to call the particular attention of this House.

(*Mr. Barry.*)—I beg to be permitted to say that it is not true that I have made alterations without authority. I have only admitted that as to the mode of making those alterations I had no authority.

Your argument is, that because you were directed to provide certain things there was an implied authority to do other certain things which became necessary; but you have not submitted those plans?—Yes.

Did any of the original plans which were laid before the Commissioners contain the column in the very centre of the Victoria Tower round which the Queen's carriage was to turn, landing Her on the eastern side, and then going out through the archway to the south?—In the plan approved by the Commissioners that was the case, but in the plan approved by the Committees of Parliament that was not the case.

Did not Lord Sudeley often converse with you on the impractibility of your plan, and did not you as often say that you were correct?—Very likely, and I am not sure now that I was not right.

Then why was a change made?—Because I have since had the means of ascertaining all the difficulties of the case. I have communicated with the Master of the Horse, and have had an opportunity of ascertaining correctly the space in which the horses of the state carriage can turn; and though I beleive they might have been made to turn in the space originally allotted for the purpose, yet if the horses were restive there might perhaps be some difficulty.

Still you told the Committee you thought you were right?—I still think that the carriage and the horses might have gone round the pillar, but from the information since received I thought it better to give up that arrangement, and avoid all risk.

You say that it is not true that you made these alterations without any authority?—I do most explicitly.

Supposing the Committee were to insert any "sufficient" authority?—That of course is a matter for your Lordships to determine as you may think fit. I conceive that I had sufficient authority, and have fully stated the grounds upon which I think so.

On that point you will have to defend yourself to the Board of Works?—I am quite prepared to do so, if necessary.

And so ended this prolonged and extraordinary investigation. It will be for the public to judge how far their Lordships were justified by the circumstances in arriving at the conclusion to which they came, or agreeing to the resolution they have adopted. That Mr. Barry has passed most triumphantly through as trying an ordeal as one man could well be put to by his fellow man, we have not a second opinion. That he has told the Committee bluntly and boldly the truth, the whole truth, and nothing but the truth, can hardly be denied. And he has as bluntly and boldly told them that *it was not true that he had made alterations without authority*, and that he should be prepared to defend himself, if necessary, to the Board of Works. For ourselves we have but little to add to what we have already observed on this subject. The entire case resolves itself into a very narrow compass—it may be briefly summed up thus. Mr. Charles Barry drew a plan, for an erection upon a space of ground of 5½ acres, which was approved of. That area has increased by 2 acres, and changes came in governments, and new ideas struck the powers that were, and increased accommodation for various persons and things not before thought of was required, and then came the application of new principles for warming and ventilating, and subsequently the consideration of the embellishment of the house for the purpose of encouragement of the Fine Arts. All these matters necessarily called for great and important changes, and as Mr. Barry well knew, that he alone would be held responsible in the end, for anything defective in the whole, he gave all these changes his most serious consideration, and devoted deep study to their designs, and as he could find very few able to instruct him, and was not called upon to ask any one's advice, he used his own best discretion in the matter. We have no hesitation again and again in saying, we think he was perfectly right, and we firmly believe that the public, and posterity will think with us.

ARCHITECTURAL DRAWINGS, ROYAL ACADEMY.

(Concluded from p. 184.)

No. 1144 is an interior of a different class, namely, that of a design for a Chapel at Nunhead Cemetery, in which Mr. Allom treats us with a *rifacciamento* of St. Stephen's, Walbrook, preserving and refining the original idea, enriching yet simplifying it by rendering the whole more of a piece and more uniform in taste. To say this will, no doubt, seem very bad taste on our part, to those who have been taught to consider the interior of that church as Wren's chef-d'œuvre, and so perfect a piece of architecture that the very notion of improving upon it, or altering it in any way except for the worse, must strike them as preposterous. Still it may fairly enough be suspected that Walbrook church has now fewer and less enthusiastic admirers than formerly, and that many others besides ourselves feel it falls short of the high reputation which has been established for it. Should the species of plagiarism which Mr. Allom has here ventured upon, not incur reproach—his design will nevertheless scandalize those tender consciences which will be shocked at its paganism. They will therefore rejoice to learn that neither this, nor No. 1240 has been accepted for the Nunhead Cemetery.

The last-mentioned design, which is by Mr. R. Brandon, is shown in a model, and therefore in such a manner as to convey an adequate and most satisfactory idea of the peculiar character arising chiefly out of plan and richness of columniation, which are such as to occasion great variety and apparent intricacy, and striking effect both of perspective and light and shade, notwithstanding that the general arrangement may be termed simple, at the same time such that clearly to describe it with the pen would be rather difficult. For its unusually picturesque quality—this design is by no means indebted to positive decoration, it being very unostentatious and sober in its style, which is a very plain Roman or Italian Doric. The body of the structure or Chapel itself is comparatively small—no doubt large enough for its actual purpose, but the whole exterior would form an architectural object of considerable magnitude. Whether the merits of this model as a design were appreciated by the Directors of the London Cemetery Company, is questionable, but at all events they have given the preference to separate chapels (1195 and 1206, T. Little), one to be erected on the consecrated, the other on the unconsecrated ground at Nunhead, both of them in the "Decorated English" style, and of far better quality than the average of our modern "ecclesiological" architecture; nevertheless we would rather behold Mr. Brandon's idea realized as being a greater novelty in design.

Among the designs for mansions and villas there are comparatively few in the Italian style, and those for the most part rather mediocre,—hardly deserving to be so termed, could any other epithet be found for them. Of Ultra-Italian, however, we have an egregious instance in No. 1204, which though it professes to be a design for a "Villa," exceeds in ponderousness and mass such piles as Caprarola and Blenheim. Mr. Batson's ideas are all upon a very Titanic scale: such was his "Street Architecture" last year—with which he then made his début among the exhibitors,—but his present subject is still more extravagant—in fact a piece of mere architectural rodomontade and bombast, yet not manifesting much invention or originality. No. 1228 "The Belvedere, proposed for a Residence in the Isle of Wight," E. B. Lamb, manifests a happy medium between the hyperbolical Italianism of the preceding, and the prosaic quality of most of the other specimens of modern villa architecture. Among them is one which we hope is not of recent date, for it must be a most strangely perverse taste which could at the present day adopt as Italian such a mongrel jumble of uncouth and amorphous features as is No. 1057, with its Venetian windows of most absurd and detestable shape,—namely, with little square holes over the lateral openings and their entablatures. In the Catalogue, this precious sample of design is described only as a "View of a Nobleman's residence near Hampton," therefore it is not very clear whether the name attached to it be that of the architect, although it is not very likely that any one else would have been so smitten with the building as to delineate it *secundem artem*—it being, apparently, put into perspective from an elevation.

For mansions or residences on a larger scale than the term "villa" generally implies among us English, the Tudor style seems to be most in request; and Mr. Hardwick gives us a good specimen of it in No. 1145, "The Hall at Barnstable, as proposed to be rebuilt by Robert Chichester, Esq.," with some intermixture of our English renaissance, but chaste and sober in its ensemble. No. 1179, "Knebworth, Herts., the ancient seat of the Lyttons," attracts notice if only as being now the property of that *distingué litterateur* Sir Edward Bulwer Lytton, who intends, it seems, to alter his mansion according to the present design by H. E. Kendall, jun.; but there being no sketch of the house in its present state, we are unable to judge of what kind or to what extent the suggested alterations are,—whether this drawing shows a complete renovation of the exterior, or whether any portions of the original design are retained. We must also be satisfied with perceiving that the style and general character are rich and imposing, the drawing being so placed as not to favour critical examination. No. 1225, "Manley Hall, Staffordshire, the seat of John Shawe Manley, Esq.," (T. P. Wood,) is another Tudor mansion of considerable extent, sober in style and decoration, but rendered more than usually striking owing to the line of front being broken and brought forward in the centre, and to there being great variety in the outline of the elevation; consequently it tells well in perspective, although here shown so much foreshortened that some portions of the general elevation are concealed. The name of the architect is quite a new one to us, therefore, we cannot say what else he has done, as nothing, however, is said to the contrary we presume that this drawing is not an unexecuted design, but a representation of an erected building. Still we will not be positive that such is the case; for in regard to architectural works of this class scarcely ever do we receive any information, or does any intelligence reach us; wherefore we take this opportunity of reminding our professional readers that communications relative to such subjects will always be highly acceptable to us; for though the buildings themselves are private property, it does not therefore follow that secresy should be preserved in regard to them.

Designs for Churches and Chapels are numerous, and all of them are Norman or Gothic, with the single exception of No. 1099, "St. Mary's church, now erecting at St. Peter's and St. Paul's colleges, Prior Park," J. J. Scoles, giving a sectional perspective of the interior, which is in the Italian style, and of the Corinthian order. As a drawing this is very poor, and even in point of design not very much better—certainly not at all calculated to find favour in the eyes of the architect's Catholic brother artist, Mr. Pugin. Among the other designs for churches there are none remarkably prominent for any peculiar merit; the average quality shows improvement, but what is good in them appears to be borrowed, and confined too much to the same ideas; the two interiors, No. 1076 of the Church now building at Notting Hill, and No. 1149 of that building at Turbiton, Surrey, by Messrs. Stevens and Alexander, are among those most deserving of particular notice, being very tastefully yet soberly decorated, and altogether free from side galleries, which totally destroy the effect of ailes, and derogate from the character of a Gothic interior.

We now take leave of this year's exhibition, hoping that the next will prove more satisfactory—and as far as it depends upon the Academy they have certainly the power of rendering it so, by merely receiving no more drawings than can be properly hung. Were that done, such as were worth looking at would not be thrust out of sight, and the absence of such as are not, would not at all lessen the attraction of the Architectural Room.

Aerated Sea Water.—Long since the inhabitants of the sea-coast have employed salt water either as a purgative or as a laxative. Several physicians, and especially Russell, have written on the advantages which might be derived from its internal use. But the experiments have been few in number, and entirely limited to localities situated near the coast, because the sea water could not be preserved and transported without undergoing alteration. M. Pasquier has, by overcoming this difficulty rendered great service to therapeutics. Being moreover convinced that the disagreeable taste of the sea water was the principal cause which prevented its general use, he has endeavoured to disguise and destroy it, without in the least altering its chemical composition. For that purpose he takes his sea water from a certain depth, and at several miles distant from the coast; he then filters it, in order to remove all the animal and vegetable substances which it holds in suspension, and which are the cause of its rapid decomposition; and lastly he charges it with carbonic acid gas, in order to destroy the disagreeable taste. One hundred bottles thus prepared by M. Pasquier were placed at the disposal of the Commission; they had been kept from four to six months, and we found that they had undergone no change whatsoever. Being requested to verify the exactitude of the facts stated by M. Pasquier, I have employed sea water prepared by him in the Hopital de la Charite, and I have been able to confirm—1st, that it is a powerful laxative: that a bottle of sea water acts more strongly than a 32-grm bottle of Seidlitz water; 2d, that the patients took it without repugnance, and found it agreeable to taste; 3d, that no accidents, no inconveniences, have resulted from its employment. We consequently believe that the purified and aerated sea water prepared by M. Pasquier may be employed with advantage in all cases where saline laxatives are recommended. We have moreover observed that it has a special and favourable action on individuals affected with scrofulous diseases.—"Chemical Gazette."

NOTE ON THE STATE OF THE NAVAL POWER OF FRANCE, CONFORMABLY WITH THE ORIGINAL TEXT.

Note sur l'Etat des Forces Navales de la France, conforme au texte original. Paris: Paul Masgana, Libraire, 12, Galerie de l'Odeon, 1844.

[We have availed ourselves of the deep interest now felt in the pamphlet of the Prince de Joinville, on the steam power of France, to present our readers with a translation of a work more peculiarly affecting all connected with marine engineering. The remarks of a personage, like the Prince, of some experience, considerable ability and high rank, cannot fail to exercise much influence immediately in France, and indirectly in this country, and the marine engineer is of all men most deeply concerned in the progress of the question. It has been the endeavour of the translator to give as close an idea as possible of the author's style, particularly in the commencement where the Prince de Joinville has indulged in declamation. This will account for the apparent want of freedom in some parts, and the peculiarities in diction and punctuation.—Editor C. E. & A. Journal.]

The object of the present note is to call the attention of serious and reflecting minds to our navy.

The country, to which the instinct of its true interests is never wanting—the country requires a navy; it requires one strong and powerful. This wish reveals itself by many incontestable facts.

Only we do not well know what are the essential elements—the true conditions of that force of which we see the necessity; we do not sufficiently enquire into what is going on; we do not sufficiently study the manner in which the funds voted by the Chambers are employed. We always live on the old prejudice, that one must be a sailor, that is to say possess all the purely special theoretical and practical knowledge to be able to understand nautical affairs. And this prejudice, kept up by several circumstances, has prevented until now many good minds from applying themselves to the study of the real state of our naval power.

The author of this note, would wish by certain facts of the clearest evidence, by a few very simple calculations, and in fine by reasoning within every body's comprehension, to dissipate the obscurity in which this question has been enveloped as if willingly; and if he succeeds thus in rendering it accessible and familiar to each of those, who may be called to decide upon it, he will consider that he has rendered a true assistance to the service, to which he belongs.

I believe that I can establish, without fear of contradiction, that the popularity which the navy enjoys in France, that the ardent and so often manifested design of having a strong and powerful navy, take their source in a sentiment, which may be rendered thus:—

"By sea as by land, we wish to be respected. There, as elsewhere we wish to be in a condition to protect our interests, to maintain our independence, to defend our honour, from whatever quarter may come the attacks which may threaten it."

And before going further I wish that it may be well understood that I do not pretend to enter upon politics in this note, devoted only to the affairs of the navy. If I speak of England, as of every other power, it will be in no narrow spirit of animosity or even national rivalry,[1] but only for the purpose of showing, from what passes among foreign nations, what we ought to seek, what we ought to avoid.[2] If I speak of war, it is not that I wish to see my country change the benefits of peace for ruinous hazards:—No. I believe only that to make peace honourable and durable it must repose on a force always capable of making itself respected.

Taking then the case of war as the groundwork for my argument, I will seek an example which explains my idea, and I will suppose France[3] obliged to defend herself against the strongest of the maritime powers—that is to name England. That assumed, and proceeding in a manner quite abstract and quite hypothetical,[4] I enter on my subject.

One fact of immense import, which has been accomplished of late years, has given us the means of raising our fallen naval power, and of making it re-appear under a new form, admirably adapted to our resources and national genius.[5]

This fact is the institution and progress of steam navigation.

Our navy could only be an artificial creation when the empire of the sea belonged to the one who put afloat the most seamen. Our ruined mercantile navy no longer furnished us seamen enough;[6] we should have vainly struggled to avenge affronts, to efface melancholy remembrances;[7] but when even temporary success had attested the courage of our seamen, numbers would in the end have stifled our exertions. The steam navy has changed the face of everything; now it is our military resources which are about to take the place of our impoverished naval personnel.[8] We shall always have enough officers and seamen to perform the part still open to a seaman on board a steamer.[9] Machinery will supply the place of hundreds of arms, and I need not say that we shall never want money[10] to construct engines, still less that we shall never want soldiers when the honour of the country is to be maintained.

With a steam navy, the most audacious war of aggression is permitted by sea. We are sure of our movements, unshackled in our actions. Time, weather, tide, no longer disturb us. We can calculate to the day and hour.

In case of continental war, the most unexpected diversions are possible. In a few hours the armies of France may be transported to Italy, Holland, or Prussia.[11] What has been once done at Ancona with a rapidity which the winds seconded, may be done every day without them, and almost against them with still greater rapidity.

As I said just now, these naval resources become us admirably,[12] and the form of war thus modified no longer leaves chances such as they were, thirty years ago, between France and enemies she may meet.[13] So too it is curious to see to what extent the progress of steam and its probable occupation excite the attention of our neighbours.

The Duke of Wellington in his evidence before the Committee on Shipwrecks appointed by the House of Commons, said, in relation to the coasts of England opposite the coasts of France:—

"In case of war, I should consider the want of protection and refuge now felt would place the trade of that part of the coast, and the coast itself in a very precarious situation."

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1 We are bound to believe the royal author, when he asserts that he is animated by no narrow spirit of hostility or of national rivalry, but he is not only unfortunate in the time he has chosen for giving any stimulant to the prevalent Anglophobia, but in the measures he suggests. He could have alluded generally to the value of a steam navy in invading an enemy's country, but there was no call to make the special application, and propose the invasion of England for the express purpose of destroying the confidence of her people in her insular position and maritime commerce. Such a measure is no necessary concomitant in any general war, and must perforce be taken as emanating from the bitter feelings of malice and revenge.

2 If the author were so desirous of eschewing any feeling of political animosity, he could have illustrated his position equally well by the example of the United States or Holland, each of which has a commerce equivalent to that of France, and equivalent interests of maritime policy.

3 It would be just as easy to suppose the United States or Holland engaged in a war of defence with England, as to suppose France in such a position, yet the politicians of the former countries have not, when discussing such a contingency, been seized with such morbid fantasy for humiliating the English, coute qui coute, nor attempted free like to make their navies equivalent to that demanded by the commercial wants of England. The weakest maritime powers, Naples, Austria, Prussia, Sardinia, Denmark, have equally the possibility of contending with the first class naval power, yet they have not the insanity of attempting to make a navy of the first class.

4 This abstract and hypothetical manner will be best appreciated by the practical application, for France has just as much reason to fear a maritime war with the United States as with England, and such war has occurred, while it is not so many years ago since it was again imminent, yet the United States are not used to furnish forth practical exemplifications.

5 The author who when he chooses is a man of much common sense, as he subsequently shows, is at this present moment engaged in a declamation à la jeune France, but he figures here marvellously like Scaramouch. How any one, even a Frenchman, could conceive that a steam navy is marvellously adapted to the resources and national genius of France baffles conjecture. The mineral resources of France, its mines of coal, iron and copper have been too little turned to account as yet to bear this out, and certainly no one but themselves will give them credit as being an engineering nation. They have, indeed, as little genius for the engine factory as they have for the trader's shop, and the Prince's grave appeal to his countrymen as marine engineers puts us ridiculously in mind of Elliston's application to the Duke of Newcastle to be put into parliament for one of His Grace's boroughs. "What," said the Duke, "Punch wanting to be in Parliament; Punch in Parliament! I can never stand that." So it will be said "Punch have natural resources and a national genius for iron mines and steam engine factories!"—It is too rich!

6 It is to be observed, that no benefit is gained by the French under the new state of affairs, for if their merchant navy be unable to afford them seamen, so they have not factories and mechanics to afford them marine engines, and they can compete with England neither in seamen nor mechanics.

7 'Effacer de tristes souvenirs.' Effacing melancholy remembrances of defeat, does look marvellously like the emanation of political spleen. Englishmen do not talk of effacing the 'tristes souvenirs' of Walcheren, Corunna, Rosetta, Buenos Ayres, or New Orleans; the Americo-English do not talk of effacing the 'tristes souvenirs' of Washington and the Chesapeake, 'ces sont des faits accomplis;' but a Frenchman can scarcely endure the 'souvenir' of St. Vincent or Trafalgar, though we have almost forgotten them, and left the monument of the victor of one battle incomplete and neglected. We say, whatever may be the will of the author, his expressions are but too well calculated to keep alive feelings of national animosity.

8 Surely the author must have forgotten that the population of England, 29 millions to 34, is not so disproportionate to that of France, and that England has military capacities too for the invasion of France, as Poitiers, Cressy and Agincourt, the victories of Marlborough, the days of Toulouse and Waterloo, still attest. We are not a small people, to be walked over by military force, and the author confesses our superiority in naval resources. It is much more easy for the English, as they have before done, to occupy Paris, than for the French to occupy London.

9 The author has here forgotten that as seamen are still necessary, though in a diminished proportion, on board of steamers, that this only gives England additional power, instead of diminishing it. If five thousand men now are only required, where eight thousand formerly were requisite for the armament of a fleet, the effect can be, not to give the French greater resources, but to enable the English to equip a still greater number of vessels, and turn out a greater weight of metal with the myriads of men at their disposal, that is to say, supposing the English with 60,000 seamen can now fit out a force equivalent to 60 sail of the line, under the steam system, with the same number of men, according to the Prince's calculations that 4529 men with steam are equivalent to 7767 men in sailers, the English would be able to fit out a force equivalent to 100 sail of the line, so that the Prince has nothing to gain on that score. Then it is to be remembered that steam will give the English better opportunities for boarding, an operation to which they are much attached, and which they practice with success.

10 Money alone is not enough to build marine engines, skill is a great thing, and the French have not yet come up to the English in that.

11 What right have the French to calculate on attacking Holland or Prussia, no political or commercial interests are involved, which can justify such a contemplation; but as to transporting troops to Holland by steamers we should like to know how they are to get ashore, the coast of Holland being rather to strongly defended to authorize the idea of war steamers being supremely successful.

12 See note 5.

13 See note 9.

In the sitting of the House of Commons on the 29th Feb., 1844, a motion was made relative to the establishment of harbours of refuge on the English coast and it is said in that motion:—"That it is the duty of Her Majesty's Government to provide the means of safety, not only for English trade, but also for the coasts of England. We are of opinion that if at the time of the camp at Boulogne, steamboats had been in use, Napoleon would easily have had the means of landing fifteen or twenty thousand men on the coast." It was added that they would not say such would have had much effect, but the effect it would have produced would have been "to have destroyed that confidence which we derive from our insular position." It concluded by adjuring the legislature to take into consideration the great changes effected in the last few years in steam navigation and the use which might be made of it in a new war.

The hint is a good one for England, it is also good for all those whom it teaches that her strength lies in that confidence, which her insular position inspires.[14]

Unfortunately we do not profit by it.

Those cries of alarm uttered in the midst of the English Parliament should have in our Chamber and in all France a salutary echo; our line of conduct should be traced to us by the hands of our neighbours themselves. But it is not so; we fold our arms—England acts: we debate on theories—she carries out facts. She creates with activity a formidable steam force and reduces the number of her sailors, of which she has found out the powerlessness. We, who should have preceded her in this reform,[15] and who at least should follow her in it with ardour,—it is as much, as to number of steamers, if we have six fit to be put in comparison with those of the English navy.

It is lamentable to say this, but they lull and have lulled the country with flattering words and erroneous figures; we are persuaded and they have succeeded in persuading us that we possess a strong and respectable steam navy. Deplorable error, source of a still more deplorable confidence.

I am not one of those who in the illusion of national self-love, believe we are in a condition to contend at sea as equals against equals with English power, but I do not on the other hand wish to be understood as saying that in no case can we resist it.

My firm opinion is that we can carry on war against any power whatever, even were it England, and that, re-establishing a sort of equality by the judicious employment of our resources, we can, if not achieve brilliant success, at least move surely towards our end, which ought to be that of maintaining France in the rank which belongs to her.[16]

Our successes would not be brilliant, because we should take very good care not to compromise all our resources at once in decisive actions.

But we should make way safely, because we should attack two things equally vulnerable; the confidence of the English people in their insular position, and their maritime commerce.[17]

Who can doubt that with a steam navy strongly organized we should have the means of inflicting on the enemies, coast losses and sufferings unknown by a nation which has never felt all the miseries which war brings on? and at the end of these sufferings would come the evil, equally new to her, of confidence lost. The riches accumulated on her coasts and in her ports would have ceased to be in safety.[18]

And that whilst by cruisers well managed of which latter I will develope the plan, we should act efficaciously against her commerce distributed over the surface of the sea.

The struggle would then no longer be so unequal.

I keep on reasoning on the hypothesis of a war. Our steam navy would have then two very distinct theatres in which to act; the Channel first where our ports could shelter a considerable force, which issuing out under cover of night would brave the most numerous and closely planted cruisers. Nothing would prevent this force from concentrating before daybreak on any point agreed on upon the English coasts, and there it would act with impunity. A few hours were quite enough for Sir Sidney Smith to do an irreparable injury to us at Toulon.

In the Mediterranean, we should reign as masters;[19] we should secure our conquest of Algiers, that vast field opened to our commerce and our civilization.[20] And then the Mediterranean is too far from England; it is not the arsenals of Malta and Gibraltar[21] which could maintain a steam fleet, so difficult and expensive to provision,[22] and always in fear of being reduced to inaction by want of fuel. Free then for France to act victoriously upon that theatre; all her plans, she could accomplish them with steamers, without troubling herself about sailing squadrons, of which all the vigilance would be deceived, of which all the speed would be surpassed.

To the steam navy and to it alone is reserved the part of patrolling our coasts, and giving notice of the approach of enemies, covering our coasting trade, and opposing by main force, when it could be done, any landing or bombardment, and all agressions of the enemy, for it is a matter of course that the steam navy cannot give us advantages which cannot be turned against us.[23] The half of our frontier is sea frontier. Formerly this vast extent of coast could be defended by our land army; almost everywhere inacccessible or at least of dangerous approach for sailing vessels, disembarkations were little to be feared, and the important points, the great parts and those places for the defence of which nature had done nothing art stepped in and put them beyond attempt. Now everything is changed; with steamers, our coasts may be approached in all their vast extent; from Dunkirk to Bayonne England can attempt against us all that we can attempt against her. In a few hours an army embarked aboard a steam fleet at Portsmouth and in the Thames would appear on some point of our coast, would penetrate into our rivers, would effect a landing or would destroy with shells, our cities, our arsenals and our commercial riches. The rapidity of its movements would ensure its success. The French army its forts and its artillery cannot be everywhere at once, and we should learn at the same time the appearance of the enemy, the accomplishment of his plans, and his departure. At this moment if war were declared, we should perhaps learn to-morrow the destruction of Dunkirk, Boulogne, Havre, &c., which nothing can defend against a bombardment. We should have the grief of seeing the English flag flying in Brest Roads, our great arsenal, until now protected by the multiplied difficulties of navigation in its neighbourhood, difficulties which the employment of steamers would get rid of.

Thus by means of a steam navy England is in a condition to threaten all our coasts on the ocean, and to reign in the Mediterranean by cutting off all our communications with Algiers; she can besides closely and efficiently blockade all ports, and that from to-day, if she so thinks good. And to resist her, we have only one resource, only one means, that which she could use against us, a steam navy.

Well! it must be repeated, that is the lamentable side of the question; notwithstanding all the illusions with which we love to satisfy ourselves, notwithstanding all the facts asserted, all the figures put forward, we have only an impotent force, a force of which the purely nominal existence is on paper. Upon what indeed do they depend to console France, and prove to her that her navy is in a respectable position? On a squadron of sailing vessels perfectly armed I confess and certainly I am not the one to deny its merits and its glory; but if it be true, that by the mere progress of things, what was the main

14 If no political views of national animosity were involved, why should so much anxiety be felt about destroying the confidence of the English in their insular position, any more than destroying that of the Sicilians in their insular position, or of the Hollanders in their dikes and inundations?

15 Oh, Punch! Punch! we shall burst with laughter—"we of France, who ought to have taken the lead of England in the establishment of a steam navy!" This is almost as good as the national genius of the French in the mechanical arts, for which no one gives them credit. It is long since France could talk of taking the lead of England in anything, but now that France is a third-rate power, ranking after Russia, the idea is rich.

16 What the rank of France might once have been is one thing; in these days, when she does little and next to nothing for the advancement of civilization, it is a very moderate rank, and never can be anything else while Frenchmen go to work at the wrong end, grasping at more, instead of turning to account that they have.

17 Why should France attack our insular position, and our maritime commerce? We do not injure France, and it is open to France by fair means, to eclipse us in maritime commerce, as we and our American brethren, by fair means have eclipsed the Hollanders. Let France build up her own pinnacle of the hill to the height of ours, and not attempt to pull down our pinnacle to her level.

18 The author forgets one thing or is not aware of it, that with our immense resources it would take us very little trouble to cover the coasts of England with a million of 64 lb. iron carronades, were such a provision requisite. Our iron works would turn out such an immense arsenal in a year and hollow shot for it to boot.]

19 A few lines lower down the author shows that he has here made a blunder, and that we ought to read for "in the Mediterranean we should reign as masters," "in the Mediterranean the English would reign as masters;" for as he subsequently says, in case of war the English would immediately cut off the communication with Algiers, and sweep the seas of the French flag.

20 The misfortune that France has not been able to promote effectively either the commerce or civilization of Algiers, and never will on the present system. Had the English had it, they would by this time have made it a most productive colony.

21 The English have also their arsenals in the Ionian Isles, commanding the Levant and Adriatic, and have too great a stake in the Mediterranean as the route to India to abandon it. Supposing, an absurdity that they could not supply fuel as cheaply to Malta as the French do to Toulon, they would soon find means to obtain fuel from the numerous countries communicating with those seas. If it came to the worst Corfu, Zante, Cerigo, and Malta must become depôts for the wood of the Wolga, the Don, the Danube, and of Styria.

22 We do not find any difficulty with Malta, Gibraltar, and the Ionian Isles, and are not likely to do so.

23 This is the real truth of the matter, the beginning was declamation to amuse the épiciers and badands of Paris, but the naked truth lies here, France has much more to fear from a steam navy than England, and has no interest in going to war. There is such a thing as federalism, symptoms of it were shown in France soon after the Revolution, and it might be possible to promote the designs of local demagogues in forming the United or Independent States of Lyons, Marseilles, Nantes, Bordeaux, Brittany, or La Vendée. France is not yet so consolidated as to be active thus far, and the game has been effectually played elsewhere. Brittany would make a nice Celtic republic under the auspices of an English army of co-operation, turned more effectually to account than French intrigues in Ireland. The old provinces of France might find it to their account to throw off the yoke of centralization, and carry on governments on their own account. This is one among many purposes in which an English steam navy could be turned to account, as the author will see.

thing, what was the all in all twenty years ago, is now no more than an accessary to naval force—that fine squadron will be very near being only a useless expense. Let us investigate a little the facts, which have passed before our eyes, it is a cotemporary history, which every one can appreciate from his remembrance.

Since the progress of navigation has caused gallies to be abandoned (this is old enough), each state has had squadrons or reunions of sailing vessels, as the expression of its naval force. The French and English fleets, have during a century and half disputed with each other the empire of the sea,[24] and after long and sanguinary struggles, the English flag has been carried from one end of the globe to the other as a conqueror and a master. The French navy might have been thought to be annihilated.

It was not however and peace bringing back tranquillity, confidence and commerce, our merchant navigation employed and formed seamen enough in 1840 to allow of a squadron of twenty ships carrying with honour the French flag in the Mediterranean.

Many minds were dazzled with these brilliant results;[25] they saw with grief this fine fleet condemned to inaction at the moment when the national sentiment was in them so deeply wounded. We had at that moment over the English squadron a superiority in organization and number. Our seamen commanded by an able and active chief, were well-exercised, and everything promised them victory. I do not invoke on that point my own recollection, but that of one of the most able officers of the English navy.

Let us admit that a quarrel had then broken out; let us admit that the god of battles had been favourable to France; cries of joy would have been uttered all over the kingdom; it would not have been thought that the triumph was of short duration. It must be allowed in a conflict between two squadrons, French and English, victory will be always strongly disputed; it will belong to the most able, the most persevering, but it will have been paid for most dearly, and on both sides the loss will have been enormous, many vessels destroyed or crippled. It follows that each will return to its ports with a maimed squadron, deprived of its best officers and best seamen.

But I will suppose what is without precedent; I will allow that twenty English ships and fifteen thousand English seamen could ever have been brought prisoners into Toulon by our triumphant squadron. Would the victory be thereby more decisive? Should we have subdued an enemy who is cast down by the first blow, who wants resources to repair a defeat and who in wiping off disgrace, is accustomed to calculate the expense? To every one who knows the English people it is evident that in such circumstances they would be found animated with an immense desire of avenging a check unknown in their annals, a check which affects their very existence. We should see all the naval resources of that immense empire, its numerous personnel, its material riches, accumulated to wipe off the blot on the English navy, at the end of a month two or three fleets as powerfully organized as that which we should have carried off would be before our ports. What have we to oppose them? Nothing but wrecks. And here is the place to tear off the veil under which the secret of our weakness is hidden from us. Let us proclaim it aloud, a victory, like that seemingly promised to us in 1840, would have been for the French navy the commencement of a new ruin. We were at the end of our resources; our materiel was not rich enough to repair from one day to another the mischiefs which our ships would have suffered and our personnel [our crews] would have presented the spectacle of an impuissance still more distracting. It is not enough known what efforts it took to arm then those twenty ships, which gave France so much confidence and so much pride; it is not well enough known that the exhausted muster rolls of the inscription could furnish no more seamen. And what must be added is that on the first rumour of war, the nursery so impoverished of our merchant navy would have been reduced to nothing; the few hands which might have remained would immediately have taken to the profitable speculation of privateering.[26]

Many times in the course of its history, France, when thought to be without troops, has sent out thousands from her bosom, as by magic, but it is not so with fleets; the seaman cannot be made off-hand, he is a work of art, which if not modelled from his infancy, to the sea business, always exhibits an inevitable inferiority. From the time since we have been trying to make seamen, we have succeeded, it must be allowed in getting men, who are not sea-sick, but the name of seaman is not to be acquired so cheaply.

There then is the wreck of our victorious fleet either blockaded or attacked with numerous forces, which to the power of organization join the ardent desire of avenging defeat. The fruits of victory and of the blood shed is lost. It is no longer permitted to call by the name of victory a temporary superiority, which has only left behind it the certainty of defeats near at hand, and that because, without foresight for the morrow, we should have ventured all our resources at once.

No, we must not accustom the country to play in time of peace with fleets, and flatter itself with the false idea that they give it power. Let us never forget the effect which the recall of the fleet in 1840 produced; it was however what was necessary then, and what would be so still on the first threat of war.

It is clear therefore that the part of shipping can no longer be henceforward to form even the main body of our naval power; the employment of steamers reduces it perforce to the subaltern occupation of siege artillery in a land army. They will be carried in the train of a steam fleet (when sailers) the expedition has a determinate object, when employed against a fort, or a sea town, which must be attacked with a large mass of artillery brought to bear on one point. Beyond that, services will not be required of them, which they cannot, ought not to render, and we shall be cautious of persevering, from an exaggerated respect for ancient traditions, in a dangerous path, at the end of which there might some day have to be rendered a very serious account to France, disabused.

I should not hesitate myself, to strike at once into a contrary path, and I should put to myself plainly the question whether maintaining eight armed ships and eight in commission to obtain no other advantage than that of striking afar off the eyes of superficial observers is not a great deal too much.

I shall be answered perhaps that these ships are schools of officers and discipline.

But every reunion of ships, either sailers or steamers, would attain the same end. It is not necessary to have for that ships of the line, the most costly of all floating machines, ships, which on the approach of war, we should be obliged to disarm.

Would it not be better to employ the leisure of peace in preparing and sharpening a blade which would give certain blows in time of war? I am not afraid of affirming that from the formation of a steam squadron would arise more new ideas and true progress that there has been from all the lessons of the last war.

In fine, and everything lies on that, let us look across the channel, and see what England does: let us see the decision with which that country, so sagacious, and so enlightened as to its interests, has known how to give up the old instruments of its power and seize the new arm. (See Appendix A.)

Certainly if in any quarter sailing fleets should be kept up we should expect it in the English Admiralty, which has derived profit and glory enough from them.

But they have followed the march of events, they have listened to the voice of experience, and have comprehended that sailers would be useless when a new naval force, capable of doing everything in despite of them, had come into the world.

So too let us look at our fleet, nailed up by the force of circumstances in the Mediterranean, what do the English Government oppose to it? Three ships,* but on the other hand they have eleven steamers, of which nine are of large size, and with this force, they have enough to make their flag rule and their policy triumph. Our budget, I know, gives us an effective force of forty-three steamers; that is something; but in England they know what to make of the naval value of these vessels, and this is the total they have to set against ours.

In all, England now reckons one hundred and twenty-five steamers. Of this number, seventy-seven are armed, and to these must be added two hundred steamboats of superior quality, fit for carrying heavy guns and troops, which the merchant navy could furnish to the state on the very day they were wanted.[27]

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[24] Æsop's cock was a much more rational animal when he scratched up the pearl on the dunghill and rejected it as of no use to him. The Gallic cock according to his own account, must contend for the empire of the sea, which would have been of no use to him when he had got it.

[25] The author would have done well had he reprobated this insane practice of making a show of force without any grounds for its exhibition, or resources for its maintenance. It is this vile pandering to popular vanity which is doing so much harm in France and the United States. Let the French set to work to make themselves a commercial power, and then and then only talk about their naval force. The Hollanders now that their supremacy is lost, are too wise to waste their thoughts in display, but exert themselves soberly and steadily to improve their position.

[26] All this sounds like common sense, why then should the author address himself to engage his countrymen in a war, which could only brings them ruin and disgrace.

* The English Government reduces this year from seventeen to nine the number of its armed vessels. Three first class (three-deckers) will be employed as guard ships in their ports, Sheerness, Portsmouth, Plymouth; three in the Meditterranean, one in the Pacific Ocean, one in China, one in the West Indies and North America. Seven of these nine ships are to carry the flags of Admiralty.

[27] The author must have a strange idea of his countrymen to give them the soundest view of the resources of England, and show the impossibility of competing with them, and at the same time to recommend them to engage in an enterprize so worthless. There can be little doubt indeed that this is an appeal to mob prejudices, and the author knows

That if they will, they will you may depend on't,
And if they wont, they wont and there's an end on't.

That is not all: to form an idea of the real force of this steam fleet, we must have seen close at hand how formidable its equipment is, we must have seen the care and skilful foresight with which everything has been designed. The English war-steamers have not been designed warranted good for every kind of service without distinction, in their construction only one idea, one end has been in view—war. They conjoin with a marvellous fitness for sea purposes, high speed, powerful artillery, and plenty of stowage for passenger troops.

Yes this armament is formidable; yes, this exclusive care which England devotes to increasing and perfecting this branch of her maritime service is a warning which we should not neglect under pain of seeing some day in peril, all that is most dear to a people, the integrity of our territory and our national honour.

Then, I repeat, there is a very simple means we have of warding off this danger, and rendering the chances of the struggle if ever one should happen; that is to arm ourselves as they arm against us,[28] it is to give our steam navy which still languishes in the uncertainty of experiment a powerful impulsion and a large developement. With the resources which this navy thus perfected would supply for attack and defence, France could legitimately rely on the opinion of her strength. But, I must necessarily say it, in that as in everything, to do well, we must busy ourselves with it, and busy ourselves seriously with it.

Our steam navy dates from 1829: the expedition to Algiers was the theatre of its first essays. People were then struck with the advantages it was possible to gain from it, and we hastened to cast in the same mould a sufficiently large number of vessels, similar to those which had served in that expedition. However such was the daily increasing importance of the Algerine service, that these boats hardly finished were obliged to be immediately appropriated, and without ceasing urgently required, and often obliged to move without their repairs being completed, they could not furnish the basis of any fruitful experiment, or any amelioration. What they particularly wanted was to be employed on stations where they could be put in comparison with foreign vessels. This inconvenience together with the prejudices exclusively prevailing in favour of the sailing navy, was the reason why the progress of our steam fleet from 1830 to 1840 was nil. Science however had progressed. The royal navy of England having the leisure for experiments, and further, having under its eyes a merchant steam navy in which number and competition produced daily progress, turned out some magnificent vessels.[29]

The men who governed our affairs in 1840 were struck with this progress, and felt the bearing of it: an energetic attempt was made to give France a true steam navy, by the creation of our transatlantic packets.

Unfortunately this attempt has been the only one; notwithstanding the laudable and persevering exertions of the treasury to point out a path of improvement to the steam navy by the example of its packet boats, there was an obstinacy in leaving it to vegetate, and now it is not even sufficient for the wants of peace, and far from offering the resources which it should present in war.

And the Chambers cannot be accused of this lamentable insufficiency. Every time that funds have been asked to endow France with a steam navy, they have been voted with patriotic ardour. The money has never had to be waited for; but it was hoped that there would be some result equivalent to so much expense and so many sacrifices. This result is now apparent to our eyes. By an excess of foresight too common with us, the administration has thought fit first of all to create repairing establishments for the new navy. In all our ports now rise magnificent factories enclosed in stately monuments. These factories are for the purpose of repairing the damage, and providing for the wants of the steam navy, and this navy is only in its infancy.

However as these large factories cannot be left without employment nor the workmen without work; as besides in the nature of things, all the steamers we have are employed at Toulon, and that there are only steamers to repair at that place, what has been done with the factories constructed in the ports of the ocean? They have been employed in manufacturing engines, instead of giving the contracts for them, as a premium to private industry.[30]

We had already Indret and its costly productions. Was it necessary to add to this luxury of establishments? Was it requisite to employ the money destined for the increase and improvement of the fleet, in raising monuments of which the immediate utility is far from being demonstrated?

We have always been inclined to increase without limit the immoveables of the navy, to the detriment of everything efficacious and active in the department.[31] It would be good to try the other plan, and I am convinced that we should readily find the means of arming a true steam fleet and encouraging a useful trade, by requiring from private establishments, fine and good machines, such as they know how to produce.

If I were here to trace the true state of our steam navy, if I were to say that of this number of forty-three steamers afloat borne on the budget, there are not six fit to compare with the English vessels, I should not be believed, and I should still have asserted the strict truth. The greater number of our vessels belong to that class good in 1830, when they were turned out, but now, most certainly much behind present improvement. These vessels subjected in the Mediterranean to a navigation without repose, have almost all reached a premature old age. As I pointed out just now they are no longer sufficient for the service of Algiers and the political missions on which they are sent, for want of better vessels. The officers who command them blush at seeing themselves weak and powerless, I will not say alongside the English only, but the Russians, the Americans, the Dutch, the Neapolitans, who have better steamers than ours.

I shall be accused of decrying with pleasure our war resources, if I did not reckon our transatlantic packets and those belonging to the post office. Doubtless there is some use to be expected from these vessels, but in the first place they do not belong to the navy, which does not require them in time of peace, and it is deceiving ourselves besides if we believe that by their construction and equipment we can at once appropriate them to their own service and that of war. (See Appendix A.)

The objection of expense is raised against the general employment of a steam navy.

My first answer will be that so far as precautions are to be taken for the guard of her power and the defence of her territory, France has often proved that she did not reckon expense. But I accept the objection, and I allow that engines and boilers cost very dear; I add only that nothing obliges us to pay all the expense in a single year, for in the interest of such an extensive manufacture, it would be advantageous to distribute the expense over several consecutive budgets. We must consider then that engines properly kept in order will last a very long while, from 20 to 25 years, and that if the boilers are worn out sooner, it is possible to render them less costly, by substituting copper for sheet iron: not but the first metal is dearer than the other, but it lasts longer, and after the apparatus is worn, still preserves some value for sale of old material.

I have endeavoured to make some calculation as to the cost of establishment and maintenance of the material of steamers compared with sailers; unfortunately I have not been able to give to these calculations all exactness requisite, having no other basis to furnish them than hypotheses; the official publications only exhibit uncertain data in this respect. Baron Tupinier in a work full of interest* has formed, with the same purpose as I have, some calculations which are only learned probabilities, and which, like mine, are exposed to error in their basis, since they only rest on supposition.

In this unfortunate impossibility of giving results mathematically accurate, I have left out of the account the cost of the material of the steamers, confining myself to the observation that sailing vessels have also a materiel which wears out and at all times, while that of steamers only wears while the engine is going and doing work.

I have therefore taken the pay and clothing of the crews, and the consumption of fuel, the only appreciable data, and from these data I have drawn this conclusion, that a second rate entails an expense equivalent to that of four vessels of 220 h. p.

That therefore our present fleet at Toulon costs as much as a fleet would cost of

5 steam frigates of 450 h. p. each.
22 steam corvettes of 220 h. p.
11 steam boats of 160 h. p.

38 steamers capable of transporting 20,000 troops.

I now ask to compare the services, which on the one hand could be rendered by 8 liners, 1 frigate and 2 steamers, slow and uncertain in their movements, and absorbing an effective of 7767 seamen; and on the other hand 38 steamers manned with 4529 seamen and capable of

[28] Why should the author imagine that the English or anyone else arm against "us," against France. France is not a power so formidable as to excite English or Americo-English suspicion, and the latter nations have quite enough to do in looking after their interests without troubling themselves about France.

[29] This is the secret of naval supremacy, the French have always begun at the wrong end, instead of beginning by making a strong military navy, it should be by making a strong merchant navy.

[30] The advice of the author is here very good, it is by the developement of private industry that France is to be advanced, and England will never grudge the real advancement of France, nor even its superiority should it be gained by fair means, and in conformity with the great interests of mankind and of civilization.

[31] This is a very good hint, and shows up a very prevalent feature of French administration.

* Considerations sur la Marine et son budget.

ransporting 20,000 troops. Let war come, and we must disarm the former of these squadrons, while the second is always serviceable. (See Appendix B.)

I could have dwelt further upon these considerations relative to a steam navy, but I limit myself to general ideas, leaving to others the care of enforcing my views, and bringing out all they suggest. I believe however that I have demonstrated in a satisfactory manner that a steam fleet is alone good at the present day for offensive and defensive war, and alone good for protecting our coasts and acting against those of the enemy, and for seconding efficiently the operations of our land armies. It now remains for me to speak of a means of action, which we should have to employ in case of a war with England.

Without having been engaged in the long struggles of the French navy with the English navy in the time of the revolution and the empire, we may have studied its history and gathered its experience. It is a fact well ascertained now that if during those twenty years the war of fleet against fleet was always fatal to us, almost always also the cruises of our corsairs were successful. Towards the close of the empire divisions of frigates, issuing from our ports with the mission of skimming the sea without compromising themselves against an enemy superior in number, inflicted considerable loss on English commerce. To touch that commerce then, is to touch the vital principle of England is to strike her to the heart.[32]

Until the time of which I spoke our blows did not strike there, and we allowed the spirit of English speculation to increase by the war its prodigious profits. The lesson should not be lost to us now, and we ought to put ourselves in a condition, at the first shot which would be fired to act powerfully enough against English trade to shake its confidence. This end then France would obtain by stationary cruisers skilfully distributed in every quarter of the globe.[33] In the channel and the Mediterranean this part might very well be entrusted to steamers. Those which are employed as packets during peace would from their high speed make excellent corsairs in time of war. They might come up with a merchantman, plunder it, burn it and escape even war steamers, of which the progress would be retarded by their heavy construction.

It could not be thus on distant seas; there it is frigates which must be specially destined as cruisers, and although apparently there is nothing new in what I am about to say, I would wish to call attention to this point.

My opinion with regard to frigates is not the same as with regard to liners. Far from reducing the number I should like to increase them; in peace as in war, good service can be got out of them, and they would be obtained increase of expense by only distributing our stations in a better manner.[34]

The frigate alone appears to me proper to represent France at a distance, and moreover the frigate of the most powerful dimensions. It only can, in effect with an adequate force and a numerous crew carry provisions enough to keep the sea for a long time together; it only can, as I shall hereafter point out, bend itself equally to the wants both of peace and war. A thousand or two thousand leagues distance from the shores of France I admit of no distinction between these two conditions; distant stations, which may learn of a war some months after it has been declared, should always be constituted on the most formidable footing. Motives of economy should here disappear before greater and more elevated ideas. We must never by a ruinous parsimony, allow the forces of France to be sacrificed or even compromised.

Until now our distant stations have been composed of a frigate bearing the flag of the admiral in command and of several corvettes or brigs. Two reasons have produced this result; the demands of consuls, always desirous of having a vessel of war within reach of their residences; and secondly the great reason of economy so often appealed to, which has caused the force and class of vessels to be reduced, which could not be reduced in number.

It follows that wishing to be everywhere, we have everywhere been weak and impotent.

It is thus that we send 40 gun frigates* with a crew of 300 men where England and the United States have frigates of 50 guns and more, with 500 men aboard. Each is however only a frigate, and if it happened that they one day met in conflict it would be said everywhere that a French frigate had been taken or sunk by an English or American frigate; and although the force would not have been equal our flag would be no less humiliated by a defeat.

As a principle I should say that stations should be formed each of two or three frigates of the greatest dimension. These frigates would move together under the orders of an admiral, and would profit thus by all advantages of navigation in squadron. Constantly at sea commander and seamen would learn to know and appreciate each other, and we should not reproach our admirals with that lazy immobility which seems to nail them to the head quarters of their station. Everywhere where this naval division would show itself, and it should be constantly engaged in going over the extent of its district, it would be seen strong and respectable, having the means of repressing immediately the irregularities of foreign governments, without those costly appeals to the mother country of which Mexico and La Plata have given us such lamentable examples.

We should no longer have those small vessels disseminated over the points where our diplomatic agents reside, and so fit by their very weakness, to bring down insults which our flag should know how to avoid, but never suffer.

We should no longer be exposed to see at the commencement of a war, the greater part of these vessels of weak build snapped up without firing a shot by the enemy's frigates.

Far from that we should have on all points of the globe divisions of frigates, quite ready to follow in the track of those glorious squadrons which have so nobly contended for their country in the Indian seas. They would cruise around our colonies, around those new points seized in distant seas by a provident policy, and destined to serve as a basis to their operations,[37] as well as to become the refuge of our privateers.

I may add that this manner of representing the country abroad would be much more advantageous to our commerce, than the manner in which we now do it. In effect, the arrival of a squadron provided with all the means of making itself respected would be much more feared than the constant presence of a small vessel, which people are habituated to see and soon forget.[38] Either I deceive myself or this visit always expected, always imminent, would be for French interests a powerful protection, and our merchantmen would find much more benefit from the influence of our flag thus shown from time to time in countries which form an incomplete idea of the strength of France, than from the presence often annoying for them of one of our small vessels of war.

It may be observed that I have not spoken of steamers for those distant stations; I believe that we should only employ them incidentally, and with the determination to shut them up in our colonies on the first rumour of war.

In general, it is necessary that our steamers should never leave our coasts except for such a distance as allows of regaining them without a fresh supply of fuel. I argue always on the hypothesis agreed on

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32 This is another exemplification of the author's sol-disant non-political bias. Like most other Frenchmen he is however wrong in his view, it is not commerce which is the vital principle of England, but the spirit of energy and enterprise of which commerce is the external manifestation. The author might destroy our ships, check our commerce, and yet leave the vitals of England's power unscathed.

33 This amiable proposition has excited much attention and much reprobation. The author however forgets that there is hardly a part of the world where the English flag does not fly, and where England has not resources at hand to check those cruisers. In all our colonies now, even in Australia, are merchant steamers, which might be found a nuisance even to French frigates.

34 It will be observed that this is the American system. The Americo-English have only 10 ships of the line (4 building), but have 16 frigates (4 building). They seem however to be increasing their squadron of the line.

* Thus on the Brazilian and La Plata station we have a frigate bearing the flag of the admiral commanding the station. The English and American Governments have also a frigate; but here is the respective force of these ships.

France Africaine 40 guns 311 men.
England Alfred 50 ,, 445 ,,
America Raritan* 60 ,, 470 ,,

The rest of this station is composed of small vessels, and there also we are in inferiority in number and rating.

Another example. Our station of Bourbon and Madagascar, destined to protect our infant establishment at Mayotte and support the Catholics of Abyssinia, of whom the friendship preserves to France one of the keys of the Red Sea,[35] is thus composed:—

1 curvette 22 guns.
1 brig 20 ,,
1 Gabarre (transport).
1 steamer of 160 h. p.

Whilst the English station at the Cape,[36] is composed of:—

1 frigate of 59 guns.
1 ,, 44 ,,
2 corvettes of 26 ,,
2 brigs of 16 ,,
1 steamer of 320 h. p.

* The Raritan is rated as a 44 gun frigate.—Translator.

35 This is a specimen of French policy and glory. Madagascar and Mayotte! aggression and not civilization—and intrigues with the Catholics of Abyssinia, these are the staple. What interest France has in the Red Sea cannot be well conceived. The Indian trade of France is not worth mentioning, and requires no key of the Red Sea for its developement.

36 The English have not only in that neighbourhood the station at the Cape, but those of Aden, Bombay and Ceylon, which would clear off the French settlements in a twinkling. The English require these stations for the demands of their commerce and steam navigation.

37 This is sufficient as a hint. The French have invaded our territories in Tahiti, Hawaii and New Zesland, and those of our ally in the Comoro Isles, not for the legitimate purposes of carrying on their own trade, but with the more banditti-like end of preying on ours.

38 Why France should so constantly desire to make herself feared, we think it should have been for the author to explain.

of a war against Great Britain, and it is evident to every one that in such case we should have few friends on the seas;[39] our maritime commerce would not fail to disappear. How far from France then obtain fuel? Our steamers, deprived of that principle of all their action, would be reduced to make use only of their sails, and it is known that for the present they are poor sailers; they would make but a sorry figure against corvettes or brigs of the slightest mould.

Perhaps the use of the screw, by leaving the steamer all the power of a sailing vessel, will some day produce a change in this state of things. Steam will then become a powerful auxiliary to our cruisers, but this alliance of sail and steam would change nothing as to what I have before laid down. The steamer, destined to serve in squadron or on our coasts, should always have a high speed, by steam alone, as the first means of success.[40]

I have finished what I wished to point out in this note, and I have nothing to do but sum up in a few words.

Taking the chances, however distant they may be,[41] of a war with England, as the basis of our naval establishment, I have said that I thought it might be thus defined:—

Powerful organization and developement of our steam navy on our coasts and in the Mediterranean.

Establishments of powerful and well-managed cruisers on every point of the globe, where in peace our commerce has interests, or in war we can act with advantage.

To realize the first part of what I require, we must as quickly as possible stop the unfortunate current which drags the navy into useless expenses of material and establishments disproportioned to its wants, to the expenses of the fleet, real and living expression of our naval force.

This will give us the means of meeting the expenses really necessary.

We must then withdraw our confidence in ships of the line, and apply ourselves to designing and perfecting our steamers; particularly in trying them, before making a number of the same model, which in case of ill success causes inconveniences of which we have many instances.

Give each service its port.

Keep up a fleet of at least twenty steamers ready for war. Give up to this fleet the study of the tactics to be prepared for a steam fleet.

Assign to the service of the Algerine packet boats a sufficient part, but rigorously limited as is done for the Levant packet service. The wants of war are not so imperious in Africa as to require all the resources of the navy to be sacrificed to them, and every idea of order and economy. The navy might very advantageously get rid of its 160 h. p. steamers by giving them as the cost of establishment of this first service.

Create a certain number of light steamers, in which everything would be sacrificed to speed, to carry the orders of the government.

In fine keep at least two and twenty first rate frigates armed for the service of distant stations.

Leaving out the expense of creating the vessels, the expense of maintenance will not exceed those of our actual fleet. With a navy thus organized, we shall be able to resist any attempt to wound our honour or our interests and a declaration of war would never risk our being found without defence. In fine, we should have the means of acting immediately, without exposing all our resources to a single hazard.

And dwell upon this latter point all these results we should obtain without a serious increase of expense. (See Appendix C.)

What if, to belie my assertions, they were called Utopian, a term marvellously adapted to frighten timid minds, and to force them into the rut of routine, I would ask those who answered me in this way to consider attentively all that has been done in the last few years and what is still being done in England, and then to say in good faith, whether it cannot as well be realized in France.

It has given me pain, in the whole course of this short writing, to subject my country to an afflicting parallel with a country which so far exceeds it in the knowledge of its interests; it has given me pain to lay bare the secret of our weakness in sight of the spectacle of English power. But I should consider myself fortunate if I could by the sincere acknowledgement of these lamentable truths, dissipate the illusion in which to many intelligent minds are as to the real state of the naval forces of France, and determine them to demand with me a salutary reform which may give our navy a new era of power and glory.

39 We should think not.

40 The screw propeller is calculated for reasons before mentioned, to give much greater power to expand.

41 Why should it be assumed that there is even the chance of a war between England and France. There certainly is no reason for it. We have no wish to make an aggression on France, and if France is ever destined to enjoy the advantages of English privileges, it must be by the moral operation of events.

APPENDIX A.

The Navy List of the 1st January 1844, bears

43 steamers afloat.

18 building.

18 transatlantic steam-packets, of which several are finished and the others far advanced.

Finally, the Post Office reckons for correspondence with the Levant, Alexandria, Corsica and England,

24 steam-packets from 50 h. p. to 220 h. p.

Total 103.

In all 103 steam vessels. a considerable number, but one which it is necessary to reduce to its real value.

We must first of all remove from the list the 24 post office steam packets constructed and fitted for a peace service. Time would be required to adapt these vessels for war. This transformation, it should be well known, cannot be done at once, especially with the necessity of operating simultaneously on 42 steamers, mostly of large dimension. We should deceive ourselves then if we imagined that these steam packets, because they are solidly built and pierced for ports, would have nothing to do on the breaking out of war, than to take on board their guns and ammunition. Do we know besides, since no experiment has been made, whether the weight of the war equipment will not deprive them of the only advantage acknowledged in them till now, that of speed? We should have to make a clear deck from stem to stern. All those costly fittings, all those objects of luxury and comfort must make way for the severe nudity of a man of war's deck. A warcrew is not to be lodged like passengers who purchase the right of comfort; there must be large bulk for water, provisions, powder and shot.

Every thing would have to be created for a destination so new, and so different.

It must be repeated such a transformation cannot be made at once; it can only be slow and successive.

We can only then consider these 42 steamers as a reserve, and introduce them as such in the calculation of our naval power. It appears to us that it would be very wrong to reckon on the integrality of this amount, since on the commencement of war, a portion of these steam packets, employed in pursuing their pacific mission, would inevitably fall into the hands of the enemy's cruisers, or even remain blockaded in neutral ports by the mere fact of a declaration of war.

It only remains then, after this examination to occupy ourselves with the purely military portion of the steam fleet, if that which in time of war would present immediate and effective resources. This still exhibits a total of 61 steamers; but here we find we have a new deduction to make, for ships building cannot be reckoned among present resources; like the steam packets we must consider them as a reserve, and still on condition that they be advanced, to the 22—24 [nearly complete]; that then is what cannot be done with the greater number. Many of these vessels are not commenced; the *Coligny*, for instance.

In fine we reduce to 43 vessels our STEAM FORCE now disposable, now effective, that which on a sudden eventuality, would be called on to give and ward off the first blows.

It is this total of 43 that we propose to examine.

We first of all see in this list 3 vessels of 450 h. p.*, the *Gomer*, the *Asmodée*, and the *Infernal*, rated as frigates. The two first have given satisfactory results with regard to speed, but have not been able to take the equipment intended for them. The *Gomer* with its supply of fuel and its 22 guns, was unable to keep the sea; and it was requisite to reduce either the stock of fuel or the guns. The latter alternative was determined on. The *Gomer* has worked easily enough, but it is no longer a ship of war, but a packet; its whole artillery is 8 guns, of which 2 eighty pounders, and 6 thirty pound howitzers, enclosed in narrow ports on the sides of the vessel, an impotent and useless armament; and still in this condition, the vessel labours a good deal in bad weather.

As to the *Asmodée* it seems to have succeeded better than the *Gomer*; but both want power, and in rough weather, their machinery is paralyzed. However this may be, it is willingly acknowledged that by applying to them a suitable mode of armament, they might be converted into vessels truly adapted for war service.

Before going further it will perhaps be right to explain what is meant in

* See Table, No. 1.

speaking of war steamers by a suitable armament; it can be done in a few words.

It is known that in steamers, the machinery is placed amidships. That is then the vulnerable part, since the vitality of the vessel dwells here, and it is correct to say that in a steamer the centre or midship is the *weak point*.

The extremities on the contrary by their distance from the motive power, by the acuity of their forms and their small superficies exposed compared to the broadside, better protect the motive power and expose it less.

That is then the *strong point*.

This principle is fundamental, it establishes a marked essential difference between the sailing vessel and the steamer; between their mode of fighting; between the armament suitable for the first and that suitable for the second.

In the sailing vessel it is the broadside which is the strong side; and a numerous artillery has been developed on it: it is then suitable and rational to fight it by presenting the broadside; thence, the line of battle and every system of tactics of which it is the basis.

But in steam, where the conditions of power are no longer the same, where the broadside is on the contrary the weak side, it is equally suitable, equally rational to arm the broadside, since by placing guns there it necessarily follows it must be exposed to the shot of the enemy?

No: unless we deny the principle which has here been laid down, that is neither suitable nor rational.

Admitting this principle, it is easy to draw a conclusion; if the stem and stern are the strong points of the steamer, it is there that we must fight her, attack and defend; the stem and stern must be armed with guns. The want of space not permitting a numerous artillery to be developed on those points, we must as far as possible, make up for the power of number by that of calibre, uniting if it is possible the widest range with the greatest effect.

That is, according to us, the general mode of armament suitable for the war steamer.

This is no new theory: the principle laid down in its most general expression, has been long since applied in England and the United States; and this example has had imitators in Russia, Holland, Naples and among all maritime nations. We alone persist in withstanding it, in pursuing in our new navy an impossible and dangerous assimilation, and this persistency, we are compelled to say is for our steam fleet a general cause of inferiority. We point it out once for all, to avoid returning to it in the course of this enquiry.

That laid down, we continue.

The *Infernal*, the third of the 450 h. p. steamers, has received from the factory at Indret, a four cylinder engine, a new system of which the first application was made to a steamer employed in the works of the breakwater at Cherbourg; a second trial was shortly after made on board the *Comte D'Eu*, constructed at the works of Indret, and intended for the King, as a yacht. These two trials, have not been fortunate, and the *Comte D'Eu*, built at great expense, was judged unsuitable for its occupation.

However this might have been, they did not give in as beaten; two other vessels, the *Infernal* and *Ardent*, received machinery constructed on the same system, one of 450 h. p., the other of 220 h. p., and other similar engines are in the course of completion. Will this new experiment furnish more results more satisfactory and more decisive? It must doubtless be hoped for; for if it justifies the mistrust excited by the first results, there will be occasion to regret that in a fit of precipitation, we did not wait for a decisive experiment, before applying a new system on a grand scale.

The fourth vessel on the list is the *Cuvier* of 320 h. p. When in 1838 the *Gorgon* and *Cyclops* issued from the English ports, every one was struck with their power as ships of war, as well as with their fine sea qualities. Therefore a laudable anxiety was shown to obtain the necessary plans and data to enrich our navy with similar vessels, and on those plans, modified for doubtful ameliorations, if we are to judge by the result, the *Cuvier* was produced.

Unfortunately, far from resembling the type from which it was made, the *Cuvier*, has a very bad motion, neither can it carry together its artillery and fuel. We may refer to a recent fact which will attest its mediocrity. Having left Brest with the *Archimedes* of 220 h. p., which is only a vessel of very common capabilities, the *Cuvier* was obliged to slacken speed, while the other kept quietly on.

Next came the *Gassendi* and *Lavoisier* of 220 h. p., bad ships and bad engines; always under costly repairs, they are far from having rendered equivalent services, notwithstanding the exertions of the officers who commanded them;

Then the *Cameleon*, which can only reach 7 knots with all her steam up; lastly, the *Pluton*, *Veloce*, and *Archimede* of 220 h. p., like the preceding one. These three vessels are the best in our navy (although very heavy), if we consider the force of their motive power. They have good qualities and their working, without being superior, is at least satisfactory. Anywhere where they may appear on foreign stations, we shall not be exposed to humiliating comparisons; we shall not have, as recently happened on the Levant station, the spectacle of two steamers, one English, the other French, both leaving the Piræus to give assistance to one of our corvettes and save her from the coast on which she had grounded, returning both to the same port, in the sight of the united squadrons, one steamer, the English, towing the corvette, and notwithstanding that racing with the French steamer, which thus terminated the impotent part which it commenced on the scene of the casualty.

The 6 steamers of 220 h. p., are like the 450 h. p. reserved for political and other missions. One of them, the *Archimedes*, has just left Brest bound for the China seas, where she will form part of the naval division united there. The five others are almost constantly required for political wants, or to cooperate in the changes which are required in autumn among the troops of Algiers.

This kind of vessel seems to us, under actual circumstances, particularly adapted for the war service, which we expect from a steam navy. A double experiment is now being tried, one on board the *Cameleon*, the other on board the *Pluton*. Let us hope that the comparative study of these two systems, which both are an homage to the principle we have laid down, may serve to show the superiority of one to the other, or point out a better combination: be it as it may, it is to be wished that every exertion should be made for its general application in the navy, for our present system of armament or rather want of all system, is a serious cause of military inferiority much to be regretted.

We now arrive at the class of 160 h. p., a numerous class, constituting the majority of our steam fleet.

When the *Sphinx* appeared in 1829, the military navy was just beginning in steam navigation; it only possessed a small number of steamers, unhappy experiments, fit at the best to be turned to account as harbour tugs. At this period the *Sphinx* was a progress, and a real progress, which left far behind all that had been done to that time. During ten years consequently the *Sphinx* remained the privileged model faithfully copied, but often with less success. During the whole of this period our 160 h. p. were only copies of the *Sphinx*, and it is believed that even in 1840 a *Sphinx* came out of our docks.

Thus during more than ten years, we remained stationary, restricting ourselves to the exclusive worship of the only type, the 160 h. p. which of itself alone is almost all the fleet.

The necessities of the African service sufficiently justified their persistency. It was necessary all at once, almost in the infancy of steam navigation, to hit upon means of transport proportionate to the wants of a vast military occupation, organize an active and regular correspondence, and it was to the steam navy they applied. Thenceforth all the resources of this growing navy were absorbed by the imperious and ever increasing wants; no more experiments, no more improvements were possible; the urgency predominated over every thing; steamers were wanted, a model existed, a successful tried model, and of which the whole navy employed inthe Algerine expedition proclaimed the excellencey; in the same model therefore a number of vessels were hastened to be built. Thence the whole family of the 160 horse powers which now make such a number in the budget.

This circumstance must be enforced to explain the excessive developement of a model, which was no doubt good, when it appeared, but which has ceased to be so because it has not participated in improvement, and because we now require in war steamers other qualifications of force and power. We are no longer contented with qualities which by the force of the imperious circumstances we have explained, have made the 160 horse powers the object of such lasting favour. As a vessel of war, it is now too weak to be rated, and its inferiority of work makes it unfit for quick service. We acknowledge that it possesses one qualification, essential it is true, but insufficient when isolated; that is that it bears itself well at sea. Instituted expressly for the African service, the African service is its specialty; consequently in ordinary times we see that this service absorbs a considerable number.

First, three are employed in the conveyance of sick; they are the *Gregeois*, the *Meteor*, and the *Cerbere*. These three vessels have been fitted to give shelter to their passengers, and have been raised by giving them another deck. It may be easily understood that the construction of this shelter has not added to their good qualities, and that even under certain circumstances it may be a cause of risk and endanger the safety of the heavily burdened vessel. But at that price the sick are sheltered, whilst on board the other vessels, in the continual going to and fro between the two shores of the Mediterranean, between Algiers and the other points of occupation, our soldiers bivouac on the deck, summer and winter, wetted with rain and spray, and that has been going on for fourteen years; that is the model condition! Are there no sufferings which come less closely to us, and are less worthy of exciting the sympathy and solicitude of the nation?[42]

The ordinary relations with Algeria require the permanent service of 9 steamers as transports and for correspondence with France, Algiers and the several points of coast. In a service so active carried on by vessels of heavy construction, frequently overtasked, damage is frequent. It is generally reckoned that 4 or 5 are kept in port for repair. This number sometimes runs up to 6, especially in winter, when the causes of accident are multiplied. At least 4 or 5 vessels therefore must be kept in reserve to meet these casualties.

42 This is a remark which does much honour to the feelings of the author, and one which no doubt will not be without influence.

under penalty of breaking the regularity of the correspondence, and disturbing a service which cannot now be done without.

Thus besides a permanence of 9 steamers, 4 or 5 must be reckoned as a reserve; in all 13 or 14 steamers.

Besides, 4 steamers have been considered necessary for the stations of the Brazils, West Indies, Bourbon and the Pacific, and the 160 horse powers are still applied to for want of better.

For want of the better, it has been resolved to proclaim in every sea our inferiority, by putting to figure alongside rival steamers, such as the *Cyclops*, *Vesuvius*, *Spiteful*, and so many others, our shameful 160 horse powers, only good now-a-days to serve as transports.

Let us add to this account the *Ardent* which is making experiments at Indret, the *Fulton* at Brest, for unforeseen missions, one stationary at Tunis, one at Constantinople, under the orders of our own ambassador, another disarmed and out of service, that is to say 5, and we reach with the three hospital ships, a total of 25 or 26, reckoning the reserve necessary to keep up a regular communication with Algiers.

The services which we have just enumerated occupy, of the list of our steam fleet, all the vessels comprised between number 11 and number 34, in all 24 ships, whilst we have just seen that by including in those services a reserve of or 5 vessels acknowledged as necessaay, we should reach a total of 25 or 26.

There are then in ordinary occasions, one or two wanting to complete the African service.

Thence the state of discomfort and pressure which perpetually tortures that service.

Let us now suppose that the four 220 h. p. disposable in the Mediterranean on duty in the Levant or on the coasts of Spain; if a despatch arrives to be forwarded a pressing mission to be accomplished, instead of employing the *Asmodee* which costs too much, and which moreover on account of its draft, is not suitable for all missions, we must, whether we will or no, borrow from the resources already over-worked of the African service. A repair just begun must therefore be tinkered up in a hurry, as well as it can; as a vessel must be dispatched instanter. What happens in consequence? that under the rule of this system of hurry, steamers have times been known to leave the factory to fulfil missions, returning each time with more serious injury, and at last completely put out of service. This fact which has been pointed out is a reflection at once on the insufficiency of the factories and the means of repair, and the insufficiency of vessels.

At Toulon, where by the force of circumstances, the whole activity of the steam navy is concentrated, this regime of hurry has passed its model conditions. To satisfy the ever increasing demands ot policy and occupation, all the steamers afloat have been called in, all the services have been cast in a single agglomeration; military service, dispatches and transports; all the steamers are employed without distinction, without ever being able to arrive at completely satisfying ony one of them. In this kind of anarchy, everything suffers, everything is exhausted, and all the current expenses are swelled beyond measure, and still heavier charges are bequeathed to the future, arising from the premature wearing out and decay of a valuable stock.

That is one serious cause of expense which ought at once to be taken into account. The economical views of the Chambers are not less interested in this than the future and prosperity of the steam navy. Of two things we must choose one; we must put bounds to the ever increasing ever insatiable wants, or make equal to its wants the power of this navy of which the elasticity is paralyzed by the abuse made of it.

Reckoning from No. 34* there are reckoned 9 vessels afloat, all under 160 h. p. These vessels, too small to carry much fuel, too weak to carry guns, have been constructed for special and local services, either in our colonies or on our coasts.

Let us sum up this inquiry in a few words: first we have shown that the total of 103 steamers is reducible to 43, constituting what may be called the military portion of the steam fleet.

Of these 43 vessels 16 or 18 are in permanent request for the African service; 9 others, too weak to be rated as ships of war, are attached to local services.

There remain then 16 or 17 vessels disposable for casual missions or for foreign stations; of this number are 3 of 450 h. p., 1 of 320, 6 of 220, and the rest of 160 and under.

Such is the stake that at the commencement of a war we should have to deliver to the fortune of war.

It may be thought right at the end of this estimate to show the state of the English navy; from this comparison useful instruction may be drawn.

An official publication informs us that the total number of steam vessels was in March last 77.

* See Table, No. 1.

Of this number, the Mediterranean station employs 10 steamers, 1 of 450 h. p, 4 of 320, 4 of 220, and 1 of less power . . . 10
The West Coast of Africa 9, 1 of 700 h. p. (the *Penelope*), 4 of 320, 1 of 220 and 3 of 80 to 100 h. p. 9
The Irish station 12, of which 8 of from 220 to 320 h. p., and 4 of less power 12
The North American, Canada, Bermuda and Jamaica stations, 3 of 220 h. p. 3
The India and China station, 3 of 220 h. p. 3
The South Sea station, 2 of 220 to 320 h. p. 2
Nine others of different powers, employed on marine surveys . 9

In all 48 steamers [43] employed on stations 48

We devote 8 to the same service! The difference of these two totals will be enough to show the part allowed to the steam navy in the two countries, and the degree of importance attributed to it in the employment of naval power.

The other vessels completing the total of 77, are either disposable in the ports for casual missions and local service or employed as transports between the different points of the coast.

In the number of 77 are not included either the steamers built on the lakes of Canada, nor those employed in the colonies for local services, nor those of the East India Company.[44]

Neither are there included in it the vessels to the number of 11, in a state of disarmament in port; a situation unknown, and which, until now, has not in the steam navy, any equivalent among us, where the number is far from meeting our wants, but it is as well to point out, because it has this signification, that in England the steam fleet exceeds the demands of the ordinary service, and that this fleet reckons from henceforward a reserve afloat.

Our reserve consists if we please in 24 post office steamboats and in 18 transatlantic steamers, since it is on this ground that we have allowed them to reckon as part of our naval power. But who does not know that the great companies founded in England by private enterprise dispose of a considerable number, and that many of these companies receive allowances from government, and that the vessels they employ, agreeably to the terms of the allowance, must be capable in case of need of being converted into war steamers. It will not then be objected that the English packet boats are not like ours adapted for carrying guns.*

It may be considered very moderate to estimate the number of these steamboats at double that of ours; but if this estimate is erroneous it will not be the less certain that the English lines will form as a reserve a better contingent than we can supply from our transatlantic lines and those of the Mediterranean.

To complete our comparative estimate, it remains to speak of the vessels which are now being built in England.[45]

In July 1843, the number was 13, and in the beginning of 1844 we find it 27. Two steamers of 800 h. p. figure in this list; 11 others are of 450 h. p., and in the course of 1844-1845, there will be 6 vessels of 450 h. p. on the slips. Thus whilst on the list of vessels afloat we only reckon two of 450 h. p., the *Devastation* and *Firebrand*, that of vessels building shows us a considerable developement of this class, and which deserves to be pointed out. The 450 h. p. is still in its infancy; it has been preceded by the 320; which itself came some years after the 220.

These three classes mark three distinct periods in the military constructions of England and each of these three periods presents perfect models and of increasing power.

In 1822 [46] it was the Medea of 220 h. p. which opened this career of progress, and during six years we see it used as a model for the whole fleet. But before its adoption had become definitive, what wise slowness, what prudent reserve! Four ports were at first called on, as in a competition, to comply with the conditions of a plan laid down; then the four competing vessels were united in a squadron, subjected to comparative trials, and only after long examination was a new model that of the 220 h. p. introduced into the fleet.

Later in 1838 the same prudence prevailed in the introduction of the 320 h. p. The first models the *Gorgon* and *Cyclops*, were obliged to be modified, and there was every reason for congratulation in not having copied them until they had been well tried.

Private enterprise however, taking the lead of the military navy, had opened by bold experiments the way to more important constructions. The military navy, carried on in this path of aggrandizement, did not limit itself to the *Cyclops*, but the *Devastaion* appeared an admirable construction, and of

[43] The author includes Ireland which is a home service, and not an out station. This makes the number 36 to 8.
[44] Also those of the Ionian Government, Hudson's Bay Company, &c.
* The allowance to these companies is in the budget of the English navy this year estimated at £432,541.
[45] No account has been taken by the author of the English post office packets in England, the West Indies and India.
[46] This should be 1832.

which we have already had occasion to appreciate the brilliant qualifications.

The *Devastation* has kept all that was promised of her. We see consequently in 1843, this model reproduced and occupying almost exclusively the slips of the English dockyards, with the official rating of first class steamers.

The construction of engines has followed the same progress, and it will not be uninteresting to reproduce here from an official document,* the statement of the contracts made by the government with different makers from 1839 to 1843; for in England all the engines are required from the manufacturers, and the dockyards have only repairing establishments.

In 1839	the contracts	were	1565 h. p.
1840	,,	,,	2100
1841	,,	,,	1626
1842	,,	,,	5445

However they did not stop at the *Devastation*; the steam navy has not fixed there the limits of its aggrandizement and its progress; after having successively created the three classes which we now see figure, and after having gone through the three periods marked for their introduction by the appearance of the *Medea*, *Cyclops*, and *Devastation*, new experiments are now being made.

In fact without speaking of the isolated experiment of the *Penelope* of 700 h. p.,† which may be considered as out of the regular course of aggrandizement, we see figure on the list vessels building of 800 h. p., the *Watt* and the *Terrible*. It may be open to doubt whether such giant masses will succeed, and to dispute the principle of their construction, so long as science while reducing the motive power has not been able to shelter it in the submerged portion of the vessel. But science has not said her last word, and if this problem is not yet solved, we cannot at present foretell that it is insoluble. In the meanwhile, the Lords of the Admiralty will take care—the evidence of the past is a guarantee for this—that not to put on the slips other vessels like the *Watt* and the *Terrible* before it has been determined by trials duly carried on, what is the value of the new plan.

It is with that wise prudence, but also with that rational continuousness that they proceed in England. It is true it has not always been so, and there as elsewhere, there have been bitter and costly deceptions,‡ but at least the remembrance of them has been stored up, and this lesson from the past will not be lost for the present.

Why have we not to witness amongst ourselves the same prudent and measured course? Why on the contrary must we blame a precipitation which makes us proceed by tens in experiments at least uncertain, as if in naval architecture, we had the right of believing in our infallibility?

If this precipitation has created for the future a serious situation, Heaven forbid that our thought should be to throw the responsibility of it on a body as learned as elevated, and which is justly envied in us![47] No the responsibility belongs to the country at large. When we want a navy, a sailing navy or steam navy, it is not only at the moment when the want is felt that we must wish it; we must long wish it, we must always wish it, because in a navy nothing can be done off-hand, either with regard to vessels or men.

This truth has been outlawed from having been so often repeated, and yet why be weary of telling it, when we are not weary of forming such conceptions?

In 1840, we suddenly wished a steam navy; we voted millions [of francs]. Why could we as easily vote tried vessels! To reply to this impatience, which would not most surely have accommodated itself to the wise delays of prudence, which would perhaps have condemned them, we have been obliged to hurry on and put on the slips vessels of 450 and 540 h. p., and cover the slips of our dockyards with new and unknown constructions.

God will that this impatience, which has had to be obeyed at any cost, that this precipitancy, thus forced on by circumstances, as it always will be, every time we allow ourselves to be surprised, be not dearly paid, and we find ourselves as England once was with our Forty Thieves!

APPENDIX B.

If it be true that in commerce, sailing navigation is more economical than steam navigation, it is not so with regard to the military navy.

In a military navy, the services of steamers compared to those of sailing vessels are much less expensive than is generally believed.

This assertion shall be supported by the authority of figures.

The expense of maintenance of a steamer on service is composed; of pay, provisions and fuel.

It may be assumed, that in a steamer on active service, the steam is up one day in five. This estimate is above the average of the returns of the African service, the most active department. It appears from these returns that the mean of the days steaming varies from 1 in 5 to 1 in 6.

Let it then be 1 in 5, which will give 73 days per year as the number of days steaming.

It may be again assumed that the mean consumption of fuel is 9 lb. (8 kilogo) per h. p. per hour. This estimate is certainly enough, since under circumstances when wind is favourable or in calmer weather, cutting off the steam at part of the stroke will make a considerable saving.

Further documents have been referred to which have just been quoted, and it is not giving theoretical data, but purely practical results from official statistics.

As to the price of fuel, according to the contract price it is

At Cherbourg	24 franc	50c. per ton	
Algiers	31	90	
Toulon	32	44	
Brest	23	80	
The mean is	29	40	
In round numbers	30		= 24s.

On this basis, and by referring for pay and provisions, to the data given by the budget of 1843, the Table No. 1 has been drawn up.

From this table it appears that the cost of a steam frigate of 450 h. p. (pay, provisions and fuel) costs less than that of a sailing frigate of the second class (pay and provisions). With the expense of a second rate would be maintained 2 frigates of 450 h. p. or 3 of 320, and with that of a first rate, we should have nearly 6 steamers of 220 h. p. capable of quickly and safely carrying 3,000 men.

We have at Toulon a squadron of 8 liners, which reckons besides a frigate, 1 steamer of 450 h. p., and 1 of 220 h. p. This is the gross expense. Is it required to be known what steam power we shall have at the same price, not in a state of immobility, but working one day in five, that is to say employed in a service as active as that of Africa? By means of that table, the estimate may be easily made.

First we have	1 of 450 h. p.
And	1 of 220 ,,
which are attached to the fleet.	
For 1 first rate	5 of 220 ,,
And	1 of 160 ,,
For 2 second rates	4 of 450 ,,
For 3 third rates	14 of 220 ,,
And lastly for 2 fourth rates	10 of 160 ,,
The frigate may be reckoned as	2 of 220 ,,

That is to say for the same outlay may be kept in active service.

5 steam frigates of 450 h. p. with 1000 men each	5,000
22 steam corvettes of 220 h. p. with 500 men each	11,000
11 steamers of 160 h. p. with 300 men	3,300
38	19,300 men.

In all 38 vessels capable of carrying nearly 20,000 men.

This is what might be had at the same price.

An easy objection may be foreseen to this; it will be said that the duty of a military navy is not confined to the transport of troops. Doubtless not; but when steam appeared with the mission of favouring evasive war, it is just and national, to bear in mind, in face of the continental force of France, this important function of the steam navy.

Is this saying that in time of war the duty of this navy will be limited to the work of the transport service, or to carrying burdens?

Again we say no.

Let the most incredulous, let those who from conviction or interest, persist in denying the military force of a steam navy, be pleased to tell us what would be the issue of a contest between a second rate and two 450 h. p. steamers, or even between the same vessel and three 320 h. p. steamers, which offer an equivalent for the same expense of maintenance; let them oppose six 220 h. p. steamers to a first rate.

Are the chances so unequal, that there must be inevitably success on one side and defeat on another? It is not thought so. It is thought that chances will be at least balanced.

The development of this opinion, which now reckons numerous partisans is beyond the limits here laid down. It is sufficient to say here in a general manner, and it is to be hoped it will be understood by every body, that even sailers and steamers power is not to be reckoned by the number of guns; that other elements have to be taken into account; if the sailer have the greater number of guns on its side, the steamer has advantages of its own. It is *always* at liberty to accept or refuse an engagement, *whilst in almost all cases* it can compel its opponent to either; having the command of its means of motion, it can choose its point of attack and distance, and whilst the mass of its adversary presents a wide mark, to the well pointed aim of an artillery powerful in calibre and effect, the steamer escapes by the special mode of attack suitable to it, from most of its adversary's shot.

Whatever may be the solution to be given to this question, it is in these

* Return to an order of the Hon. the House of Commons. Dated 15th March, 1843.

† The "Penelope" is a regular frigate, which has been fitted with a engine, 700 h. p. after having been lengthened 40 feet. She has made experimental trips without much success, and is now part of the squadron on the west coast of Africa.

‡ During the last war 40 vessels put on the slips at once were found so bad that they were named the Forty Thieves.

47 We are not aware that England envies this blessing, for we do not know what portion of the naval administration it can be.

terms that it must now be put, and it is believed that thus put, it is not necessary to be a seaman to comprehend it, if even to judge it.

If, in the comparison attempted to be instituted above, no account is taken of the expences of maintenance and renewal of material, it is because on this point only hypotheses more controvertible could be brought forward. However some data exist derived from official documents, and which may be considered suitable to furnish an important element of comparison. Experience proves that in the African service, the mean duration of boilers is five to six years. Then, if this duration be admitted, and if it be admitted at the same time that in steamers, the deterioration of boilers is one of the most active and efficacious causes of expense, it may be asked if sailing vessels subjected to the same duty, on duty summer and winter, subjected moreover to the chances of shipwreck from which steamers are free, if these sailing vessels would not occasion expences for maintenance and renewal of material equally considerable. It is besides to be remarked that the expense arising from the wear of boilers would be materially diminished if the use of copper boilers were generalized on board of the steam navy. Not only do these boilers require almost no repairs, but they last at least three times longer than sheet iron boilers, and when arrived at the limits of workability, the materials produced on their demolition still preserves almost all their value.[48]

Moreover, on this point [of comparative expense] all we ask is equality; but if it is not thought right to concede this to us, if it be proved to us that we have been deceived, our calculations will not the less have served to demonstrate our proposition, namely that in a military navy, the services of steamers, compared with sailers are much less costly than is thought.

If another thing had been asserted, if it had been attempted to discover which of the two navies, costs the state most, it would have been necessary to have taken an account of the expenses of first establishment, and calculate the primary value of the two sets of stock. We however know that for steam stock this primary expense is more considerable than the stock for sailing vessels. But what will that come to? That in ordinary times France must take fifteen years instead of ten to put its steam fleet on a right footing; that is all.

Such is not the end which we have proposed; we only wished to contest false or exaggerated notions, still more dangerous as they would naturally have for their auxiliaries the economical views of the Chambers.

APPENDIX C.

Explanation of Table, No. 3.

On the data furnished by the budget for 1843, the expense of maintenance in pay and provisions of armed sailing vessels, and sailing and steam vessels in commission have been calculated, and it has been found to amount to 18,553,616 fr. £742,144

From the same data the expense has next been calculated of the maintenance in pay and provisions of armed steamers; to this is added the 1,800,000 francs (£72,000), put down in the same budget as the cost of fuel, and it has been found that the expense of steamers is . . . . 5,517,004 fr. £220,680

Total for the maintenance of vessels put down in the budget . . . . 24,070,620 fr. £962,824

The expense of a fleet composed according to the ideas laid down in the preceding note has been sought, always on the same terms, and this is the result:—

1st. *For Political Purposes.* [*War and Demonstration.*]

Fleet thus composed.	1 ship of line, first rate 1 „ third[49] 1 „ fourth	3 ships of the line.
	5 steamers 450 h. p. 5 „ 320 „ 10 „ 220 „	20 steamers.

2d. Stations: *West Indies and Mexico, Brazil, Pacific, Oceanica,* [Tahiit], *South Sea, Bourbon and China.*

Large frigates only have been put down because they only are fit to oppose with success the new English frigates, such as the *Warspite, Vindictive,* &c., armed with 50 guns and also 500 men. . . . 22 first class frigates.

3d. *Missions.*

Steamers	1 of 450 h. p. 4 of 220 „ 5 of 160 „	10 steamers.
20 gun brigs	. . . .	5 „

4th. *Local Service in the Colonies, Fisheries, and West Coast of Africa.*

Gun boats, sloops, cutters, &c. . . 27 „

In time these 27 vessels might be replaced at the same cost of maintenance and with advantage to the service by 18 steamers of 120 to 80 h. p.

5th. *African Service—Correspondence, Transport of Troops and Stores.*

Steamers of 160 h. p. . . . 20
Corvettes or transports . . . 13

A considerable reduction on the maintenance of the corvettes might be effected by fitting them out commercially.

6th. *Dockyard and Colonial Service.*

Steamers of 120 h. p. 10

7th. *Sundry Duties.*

Marine school ship 1
Batimens de servitude.

According to this plan, the cost of armed vessels would be

Sailing vessels . .	15,219,107 francs	£608,764
Steamers . . .	8,916,565	356,682
	24,135,672	965,426

The expense of vessels put down in the budget of 1845 is:

Sailing vessels . .	18,553,616 francs	£742,144
Steamers . . .	5,517,004	220,680
	24,070,620	962,824

Balance of increase on the plan 65,052 francs (£2,402).

Note. The steamer appears to be the most complete solution of a problem now attracting much attention, and which the Minister of Marine is having examined by a Commission, and which the budget of 1845 introduces in the composition of armaments. We mean the Commission of road or port duty, (commission de rade,) that is to say, an intermediate position between armament and disarmament, between active service and inactivity, a state which unites at once economy and the obligation of keeping up a naval force immediately or speedily disposable. On board ship, we must have a numerous crew; the crew, is the engine, and this engine causes a consumption daily, whether in port or at sea, at anchor or under sail. On board a steamer, the engine which supplies the place of a number of hands, only consumes while at work, in proportion to the amount of power required, and which when compared with sailing admits of no comparison, as to rapidity and certainty of communication, while it constitutes an element of military power; in port this engine costs nothing.

This is why by giving a great development to steam power, it has been thought unnecessary to make in provision in the plan for vessels on commission de rade.

TABLE NO. 1.

List of Steam ships afloat.

1 *L'Asmodée* of 450 h. p.	23 *Le Papin* of 160 h. p.
2 *Le Gomer* idem.	24 *Le Phaëton* idem.
3 *L'Infernal* idem.	25 *Le Phare* idem.
4 *Le Cavier* of 320.	26 *Le Sphinx* idem.
5 *Le Gassendi* of 220.	27 *Le Styx* idem.
6 *Le Lavoisier* idem.	28 *Le Tartare* idem.
7 *Le Pluton* idem.	29 *Le Ténare* idem.
8 *Le Véloce* idem.	30 *Le Tonnerre* idem.
9 *Le Caméléon* idem.	31 *Le Vautour* idem.
10 *L' Archimède* idem.	32 *Le Ramier* of 150.
11 *L'Achéran* of 160.	33 *Le Castor* of 120.
12 *L'Ardent* idem.	34 *Le Brazier* idem.
13 *Le Cerbère* idem.	35 *Le N....* idem.
14 *La Chimère* idem.	36 *Le Flambeau* of 80.
15 *Le Cocyte* idem.	37 *Le Galibi* idem.
16 *Le Crocodile* idem.	38 *Le Voyageur* idem.
17 *L'Etna* idem.	39 *L'Erèbe* of 60.
18 *L'Euphrate* idem.	40 *L'Alecton* idem.
19 *Le Fulton* idem.	41 *L'Eridan* idem.
20 *Le Grégois* idem.	42 *Le Basilic* of 30.
21 *Le Grondeur* idem.	43 *Le Serpent* idem.
22 *Le Météore* idem.	

List of Steamers being built,

1 *Le Vauban* of 540 h. p.	10 *Le Cassini* of 220 h. p.
2 *Le Descartes* idem.	11 *Le Titan* idem.
3 *Le Sané* of 450.	12 *Le Coligny* idem.
4 *Le Mange* idem.	13 *N....* idem, iron.
5 *Le Colbert* 320.	14 *Le Chaptal* idem.
6 *Le Newton* idem.	15 *Le Brandon* of 160.
7 *Le Platon* idem.	16 *Le Solon* idem, iron.
8 *Le Socrate* idem.	17 *La Salamandre* of 80, iron.
9 *Le Roland* idem.	18 *L'Anacréon* idem.

[48] Some very good remarks will be found by Capt. Wheelwright on this subject, in his recently published correspondence on Pacific Steam Navigation.
[49] The should be 1 first rate, 1 second rate, and 1 third rate.

TABLE NO. 2.

Expences of maintenance per annum of each kind of vessel.

Ships of the Line.	Crew.	Pay.	Provisions.	Fuel.	Total.	
1st rate	1087	491,665 fr.	347,954 fr.		839,619 fr.	£33,584
2nd —	916	421,681	292,896		714,577	28,583
3rd —	860	392,977	275,290		668,267	26,730
4th —	677	327,672	216,711		544,383	21,775
Frigates.						
1st rate	513	254,623	164,213		418,836	16,753
2nd —	442	225,370	141,486		366,856	14,674
3rd —	311	177,971	99,552		277,524	11,101
Steamers.						
450 h. p.	303	166,088	96,991	94,608 fr.	357,688	14,307
320 —	191	107,946	61,140	67,276	236,362	9,454
220 —	100	69,081	32,010	46,252	147,344	5,893
160 —	74	50,771	23,687	33,638	108,097	4,324
120 —	50	41,102	16,005	25,228	82,336	3,293

The expense of fuel is calculated at the rate of 24s. per ton, and the consumption 9 lbs. (4 kilogrammes) per h. p. per hour, the number of days steam up being 1 in 5.

TABLE NO. 3.

Sailing vessels.

	Pay and Provisions.
3 liners { 1 first rate	839,619 fr.
1 second ditto	668,267
1 third ditto	544,383
22 frigates 1st class	9,214,392
5 20-gun brigs	517,453
5 gun boats	272,510
7 cutters, &c.	414,512
15	607,453
13 corvettes for transports	4,658,455
1 school ship	199,310
Bâtimens de servitude	282,653
71 — The expense of maintenance of 71 sailing vessels on the plan	15,219,107
Total allowed in budget of 1845 for sailing vessels	18,553,616
Difference less on the plan	3,334,509 fr.

STEAMERS.

		Pay, Provisions, and Fuel.
5 of 450 h. p.	Escadre.	1,788,440 fr.
5 of 320	Escadre.	1,181,815
10 of 220	Escadre.	1,473,446
1 of 450	Missions.	357,688
4 of 220	Missions.	589,376
5 of 160	Missions.	540,486
20 of 160 Algiers		2,161,954
10 of 120 Service of ports and colonies		823,360
60 — Maintenance of 60 steamers on the plan		8,916,565
Total allowed in the budget of 1845 for steamers		5,516,612
Difference more on the plan		3,399,953 fr.
Note. The 12 gun-boats, &c., on the plan, will cost		687,122 fr.
15 flotilla boats		607,453
Together		1,294,575
For the same expense 18 steamers might be kept up.		
8 of 120 h. p.		658,688 fr.
10 of 80		625,050
Together		1,283,738

The cost of the 10 steamers of 80 h. p. has been calculated with crews of 40 men.

TABLE NO. 4.

Extracts from the Navy Estimates (England) for 1844-45.

Funds voted specially for Steamers.

Coal for steamers	£109,559
Purchase of engines and repairs	230,000
Building iron steamers	36,623
Building wooden steamers, mixed up with the votes for the rest of the fleet	[677,783]
Woolwich.—Repairs of steam engines, construction of boilers, enlargement of the repairing factory, repairing dock for steamers, wages of men in the steam factory	80,000
Portsmouth.—New dock for steamers	30,000
Plymouth.—Ditto	30,000
Malta.—New basin; quay and coal depot	17,000
Allowances and grants to companies for mail service	432,541
Total	£937,047

PROFESSOR FARADAY ON HEAT.

A course of four Lectures delivered at the Royal Institute.

Lecture I., *April* 20, 1844.

(Specially reported for this Journal.)

The Professor commenced his lecture by remarking that he did not know which was the more delightful occupation, to receive and apply the laws of science as divulged by others, or by well-devised and carefully executed investigations to assist in searching out those immutable laws by which the universe is governed. It was the object of the present short course of lectures to consider the principal phenomena and general nature of that power commonly called heat; and although there has been but little that is new brought forward on this subject within the last year or two, yet it would not be without interest to pass again over the well-beaten path, and familiarly to reflect upon some of its most important truths, as met with in every day life. It will matter little in what order the subject is taken, so that by the end its most important points have been touched upon. It will be of no advantage to follow any particular pedantic arrangement, or rigid scientific order, as we do not find such in nature. The present lecture he proposed to devote to the consideration of the sources of heat.

By the sources of heat is merely meant those circumstances which cause the feeling of warmth to the hand, which communicate the same to other bodies, or ignite combustible substances. The common source of artificial heat is what is termed combustion, that is, heat generated by bodies at the moment they are combining by chemical affinity. As one instance of what is meant, a piece of phosphorus may be burned in a portion of air confined in a glass jar, and will continue to burn so long as the air within contains any oxygen for it to combine with, but when that is consumed it will go out. Just so is it with any other combustible, as a common fire; cut off air from it and it is extinguished. In these instances the heat is accompanied with light, which is the case in all ordinary combustions. The heat and light are momentary, but the effects are permanent. Certain substances are produced, in the case of phosphorus a solid, in that of the fire a gas, but in either case nothing is lost; no such thing as annihilation of either matter or force ever takes place; it may be transferred from one place to another, but in most cases it can be followed, and its presence proved. But this action can only once produce these phenomena, and therefore it is necessary in fires to keep up a continuous supply. The substance that we now use as fuel, namely coal, is perhaps of all others the best adapted for our wants. Wood is seldom now, at least in this country, thought of as fuel. A piece of charcoal and a bottle of hydrogen gas may be taken as representing the composition of all ordinary combustibles; whether coal, wood, oil, wax, or gas, it is for their carbon and hydrogen alone that they are valued. A piece of coal lighted and put in a jar of oxygen gas, will represent the ordinary circumstances of a coal fire, acting with more rapidity, certainly, but in every other circumstance the same. The miniature fire swells with heat, sends out gas, which burns with flame, causing heat enough to expel more gas, and leaving a red hot cinder, which, if there be gas enough, will burn entirely away, leaving a little ash. And now in the jar instead of oxygen is found carbonic acid gas and water, as the whole of the process consists merely in the carbon and hydrogen of the fuel combining with the oxygen to produce carbonic acid and water. The amount of heat produced is perfectly definite. From a given weight of combustible the same quantity of heat is evolved, whether it be burned slowly or quickly, whether under one circumstance or another. The amount of light produced must not be considered as at all indicating the amount of combustion or heat, as it is produced from a somewhat different cause. The flame of hydrogen is very faint, but produces great heat; the flame of hydrogen, to which has previously been added half of its bulk of oxygen, is scarcely perceptible, but its heat, with one exception, is the most intense that can be obtained. But bring into this non-luminous flame some solid substance, and it instantly becomes luminous. Not that the substance need consume, for lime, which is unaltered by heat, gives out a light so bright that the eye can scarcely bear it. Light in these cases, then, appears merely to arise from solid substances becoming intensely heated. Coal gas may be burned, and that to any amount, and in the most perfect manner, and yet very little light be evolved, by placing a piece of fine wire gauze on the top of the glass chimney, and lighting the gas after it has passed the gauze. The air is so intimately mixed with the gas that the carbon of the gas is consumed before it has been highly heated, and therefore little light is caused.

All things are combustible; everything around will burn; and yet they are all waiting till commanded, so obedient is nature to man's wishes. Why does the candle wait till lighted—why does gunpowder in the cannon wait? It is because they all want some little necessary condition to set them off: like a spring wound up to full tension, waiting but a touch. Sometimes the condition wanted is a little moisture, or electricity, or heat. A wax taper immersed in oxygen does not burn, though its wax is all ready to consume, and has ever been so, whether taken from the mummy or the bee of last year.

But when lighted and put into oxygen it falls in a stream of liquid fire. These are all cases of communication; the taper is lighted from the candle, and then can communicate to any number of combustibles. All combustions are similar; they are all successive; no such thing as instantaneous combustion is known. In a mass of gunpowder, which seems to give but one flash, the combustion travels from particle to particle, no one particle becoming ignited but by the flame of its neighbour; even in each grain the combustion is progressive, travelling from the outside to the inside. In a mixture of two gases, where the particles must be in intimate contact, there is the nearest approach to instantaneousness. Still, here, there is progression of flame. If a mixture of hydrogen and oxygen be fired, the explosion sounds instantaneous. So also does it if they be divided into bubbles by being made to pass through a solution of soap, though here it is evident the flame from one bubble must light the other. In a long narrow tube full of the same gases, the flame is seen to run from end to end, and scarcely any noise is produced. Still, in all this variety of circumstance, the amount of heat produced by the same amount of combustible is always the same. The ignition of the mixture of some other gases takes place more slowly; with olefiant gas and chlorine, the flame is seen to travel slowly along, marking its progress by a dense deposit of soot.

Many other substances are known, besides those commonly used, which burn in the air. A certain preparation of lead, for instance, becomes red-hot on exposure to air, and is called a pyrophorus. But a comparison of this with a piece of charcoal will show the beautiful fitness of common fuel for the purpose of heating. The charcoal continues to glow as long as it has air, and at length leaves nothing but a very little light ash; a mass of the pyrophorus, on the contrary, requires constant stirring to expose it to the air, and more ash remains than fuel used. This would be a serious inconvenience, for before the pot could boil, the grate would be full of ashes, preventing entirely the use of such powerful machines as steam engines.

But there are other sources of heat besides the chemical one of combustion, and none more astonishing than the heat caused by friction; there is nothing more puzzling to the philosopher, and he is obliged to acknowledge that it is entirely beyond his power of explanation. In other cases there is a limit to its extent, a cause for its production; but the heat from friction seems inexhaustible, its origin inexplicable. Here there is no case of affinity, nothing consumed. The Indian takes advantage of this source of heat, for he obtains a light to kindle his fire, by means of rubbing together two pieces of dry wood; and the school boy burns his fellow's hand by a button which he has rubbed on the form on which they sit. In nature, the chafing together of two branches of a tree frequently sets fire to a forest. Count Rumford kept water boiling for hours together by the heat arising from friction. The lecturer saw an ingenious carpenter melt a small portion of glue by placing it in the hollow of a gouge and rubbing it a few times backwards and forwards. The same may be done with a piece of jelly in a silver spoon. The fire from a flint and steel is a case of both friction and combustion; for the friction of the blow of the flint causes a piece of iron to fly off at such a heat that it burns in the air; and although the hand can bear it with impunity, it has heat enough to fire gunpowder, as is seen in the flint-lock of a gun. The miner, frequently surrounded by an atmosphere of gaseous gunpowder ready to blow him to pieces, cannot use a common flame; and before Davy's invention of the safety-lamp, a shower of sparks from a steel-mill, turned by a boy, was the only light by which he dare work. A dexterous smith avails himself of the heat of friction to light a match, for by a few blows of his hammer on a nail, turning it at the same time on the anvil, he will make the point of it red hot. This heat arises from the friction of the particles of iron against each other, and has nothing to do with any alteration of its capacity for heat. Lead becomes heated in the same manner.

From heat electricity can be obtained, and from electricity heat; and the heat from the latter source can be considered as heat from friction, for bodies evolve heat by the passage of electricity, just in proportion as they resist its progress, or are bad conductors. A powerful current of electricity from a galvanic battery may be made to develope great heat and light, by sending it through various substances. Between charcoal points they are most intense. Passed through wires the phenomena are different, accordingly as they are good or bad conductors. In a chain, the links of which are alternately silver and platinum, the platinum becomes red hot, whilst the silver is not so; and here, as in other cases of friction, there is no consumption of any thing to produce this heat, neither the electricity is lost nor the platinum consumed.

Evolution of heat takes place in animals to a very great extent. They are always giving heat off to the air from their bodies, losing it by evaporation of moisture from their surface, and giving it off by their breath, and yet, in the most frigid climate, the same temperature is maintained in their bodies, which in most animals is far above that of the air. And what, it may be asked, is the source of this heat. The answer is, combustion; for the burning of charcoal in the animal frame is supposed to be continually going on, giving out, in this case also, as much heat, though diffused over a longer time, as when it is burning more rapidly in a grate. No less than eight ounces of carbon, taken into the system in the food, is supposed to be consumed daily by a man, for the purpose of maintaining a proper temperature in his body, by being brought into contact with the oxygen of the air he breathes. He ought, consequently, to produce carbonic acid largely in his system, and he does so, throwing it off by breathing.

The Professor then brought forward two pieces of apparatus, to compare the effect produced on the air by breathing with that produced by burning charcoal; by means of one of which he passed the air from his lungs through lime water, and by the other the air which had passed over a piece of burning charcoal, in both cases the lime water was rendered turbid by a formation of carbonate of lime, proving in both a like formation of carbonic acid gas.

Lecture II.

The power of heat to expand bodies, to make them occupy a larger space than they did when cold, is most enormous, in solids, indeed, is almost irresistible. But it varies in degrees according to the substance. If two pieces of different metals be soldered together and heated, they will curve into a bow, that metal which expands the most forming the outer or convex side. Bad conducting substances act in a similar manner, and are frequently broken by heat. A thick piece of glass, as the bottom of a test glass, if heated suddenly, is broken, owing to unequal expansion in its various parts, as occurs, also, when boiling water is poured into a tumbler, especially in cold weather. Hence great care is requisite in the laboratory when applying heat to glass vessels. Owing to this it is that a thick glass rod which will bear hundreds of pounds weight of even pressure, is easily broken by heat. A piece of sulphur which is strong enough to bear a great deal of even pressure, flies asunder by the heat of the hand. By alternate expansions and contractions rocks are broken up, so as to form the soil for the plant to grow in. Solid metal inserted into pillars, frequently becomes the means of weakening instead of strengthening buildings, as may be seen at the Bank, Somerset House, the Custom House, and other public buildings. The linear expansion of some of the metals from the freezing to the boiling point of water, is given in the following table:—

Linear expansion of metals from 32° to 212°.

Zinc 1 part in	322	Gold 1 part in	682
Platinum ,,	351	Bismuth ,,	719
Tin, pure ,,	403	Iron ,,	812
Tin, impure ,,	500	Antimony ,,	923
Silver ,,	524	Palladium ,,	1000
Copper ,,	581	Platinum ,,	1100
Brass ,,	584	Flint glass ,,	1248

In fluid bodies the expansion is greater than in solid, as may be seen by heating water in a tube having a piston touching its surface. The rise of the piston shows the difference between the expansion of the glass and the water. When a solid is heated irregularly, it breaks, but not so with a liquid, because its particles are free to move. But other effects take place, such as the formation of a series of beautiful currents circulating through the mass of the fluid. These currents can be easily traced by placing at the bottom of the water some light particles of a coloured substance, which on the application of the heat from a lamp under the flask, are instantly set in motion, rising in the hottest part and descending in the coolest. The particles, becoming hot, increase in size; because they are large they are light, and because they are light they rise to the top, till, becoming cool again, they fall to the bottom. If hot water be carefully poured on to the top of a similar arrangement, so that the two liquids do not mix, it forms a strata into which the heated particles cannot rise until they have received the same temperature, and the lamp may be kept underneath for a considerable time, the two fluids remaining quite separate, the hotter colourless liquid floating on the top of the colder blue liquid. This shows the reason why it is not proper to heat liquids at the top. An arrangement such as the following shows the current in a very striking manner. Place a glass vessel full of water up high, and into the top and bottom of it fasten the ends of a long metallic pipe, in the upper part of which is a small chamber filled with a coloured fluid; heat the lower part of that side of the pipe where the small chamber is, and as soon as the water becomes a little warm, a current is established, which passing through the coloured fluid carries it with it, and pours into the water of the glass vessel a beautiful stream of coloured water. This arrangement will serve to illustrate one of the latest methods of warming buildings, by means of one long length of iron pipe filled with water carried through the various rooms of a building, the bottom part of the pipe being made to lie in a coil in a furnace. Thermometers, also, owe their utility to this property of expansion, the heat they indicate being calculated by the height to which the fluid in the tube has risen. All liquids expand by heat and contract on its withdrawal; but for a wise purpose water has been made to depart, in one portion of its course, from this general rule. When water cools down it contracts until it has arrived at a temperature of 40°, but on continuing to cool, it begins to expand till it arrives at a temperature of 32°, when it is solidified or freezes. Beginning at the temperature of 40°, therefore, water is expanded by either heat or cold. This is the case with no other known body, and the reason of it is obvious. If water. when near its freezing point, continued to contract and become heavier, as other liquids do, the colder parts, sinking through the warmer, would soon reduce the whole mass into a solid block of ice, which all the following summer's heat would not be sufficient to melt; the world would become ice-bound, and its inhabitants would perish; but owing to this benevolent exception to the general rule, when it has arrived at a temperature below 40°, it becomes lighter owing to the expansion which then begins, and the surface alone becomes frozen, protecting the water below from further effects of cold.

With gases and vapours, expansion takes place to much greater extent than with fluids. Immerse the beak of a retort in water, and apply heat; air will be expelled in large bubbles, which may be collected, and will serve as a measure of the expansion that has taken place. which is also shown by the quantity of water which flows in when all is cool again. The glass of the retort does not expand so much as the air within does, their comparative expansion being seen by reference to the following table, where is shown the increase of volume of solid, liquid, and gaseous bodies, from 32° to 212°.

At 32°		At 212°
1000 volumes of	Air become	1375 volumes
,,	Alcohol ,,	1110 ,,
,,	Ether ,,	1070 ,,
,,	Water ,,	1044 ,,
,,	Mercury ,,	1020 ,,
,,	Glass ,,	1002 ,,

The expansion of gases, though small in force, is great in bulk; but that it has force may be proved by heating a small portion of air contained in a bladder, when it will acquire power enough to burst the membrane with a considerable report. There are a great many airs and vapours, all differing from each other in their properties, but it has been found that the rate of expansion is the same with them all. A volume of hydrogen gas which weighs 1 ounce, the same volume of air which weighs 14 oz., or of the vapour of iodine which weighs 125 oz., all expand to the same extent by the same quantity of heat; they are all expanded about $\frac{1}{3}$ of their bulk, by an increase of heat from 32° to 212°. Water, when converted into steam loses the law of expansion of liquids, and acquires that of gases. When air is expanded by heat. it of course becomes lighter, and rises through the atmosphere, in a similar manner as water, though much more rapidly. Air enclosed in a light body and heated, would consequently carry it up with it, and hence the principle of the Montgolfier or fire balloon. In a crowded assembly, the air becoming heated by gas and otherwise, is continually becoming lighter, and exerting a pressure against the roof of the building. If from any cause it were suddenly heated from 32° to 212°, every 1000lb. weight of air would exert a force of 380° trying to lift off the roof; and there are some cases known where, from sudden changes of temperature, it is doubtful whether roofs have not yielded to this pressure. It is this expansion, this rising through the air of the heated particles, which causes bad air to be disseminated and carried to those places where it will be purified, thus preventing the accumulation of tainted air; by this means the air which we respire, and which our systems have just deprived of its oxygen, rises through the atmosphere and becomes dispersed. That the breath when expelled from the mouth rises in the air may be shown by suspending a bell glass filled with muriatic acid vapours over the head, placing a small vessel with ammonia in it in the mouth, and breathing under the jar; the breath carries with it the vapours of ammonia, which, rising into the glass vessel, combine with the acid, and a white cloud of sal-ammoniac is the result. Without this provision vitiated air would be breathed over and over again, and suffocation would frequently be the result.

REGISTER OF NEW PATENTS.

(Under this head we propose giving abstracts of the specifications of all the most important patents as they are enrolled. If any additional information be required as to any patent, the same may be obtained by applying to Mr. LAXTON at the Office of this JOURNAL.)

SHIP FASTENINGS.

Francis Higginson, of Rochester, Kent, Lieut. R. N., for "*certain improvements in fastenings for parts of ships and other vessels, which improvements are also applicable to other building purposes.*"—Granted November 21, 1843; Enrolled May 21, 1844.

This invention consists in a mode of fastening the decks or planking of ships to the beams or timbers, and also in joining together blocks of stone or wood, which improvements are also applicable to other building purposes.

Fig. 1, shows a mode of fastening the planking to the beams or timbers of ships and other buildings; A A is the deck or planking, and B the beam or timber; C is an iron bracket which is attached to the beam by means of "multi-threaded," or other screws hereinafter described; *d*, is a square-headed screw having a collar or shoulder, and is made to pass through a hole in the end of the bracket, and afterwards screwed into the underside of the

Fig. 1

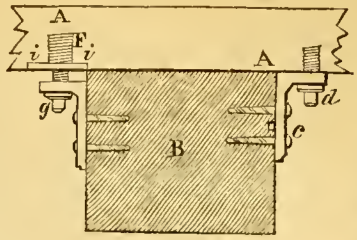
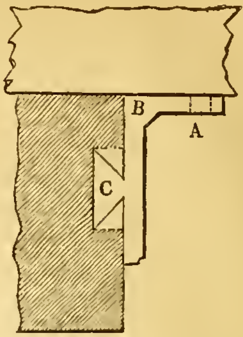


Fig. 2.



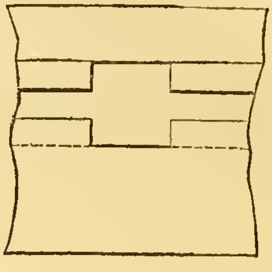


Fig. 3.

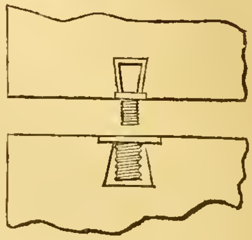


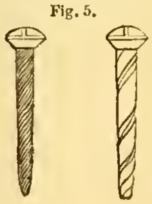
Fig. 4.

planking, thereby fixing the same firmly to the beam. Another mode of effecting the above is shown at the opposite side of the beam, this arrangement consists of a brass socket F, having a male or external screw cut upon it; this socket has also a female or internal screw which receives the screw *g*; this socket is also provided with a flange *i i*. through which there are three holes drilled which receive a key or spanner for the purpose of driving the socket into a hole previously made in the planking; the mode of fastening the planking to the beams as last described, differs from that first described in the application of a screw socket only as will be clearly seen.

Another mode of fixing planking to cast iron and other beams is seen at Fig. 2, which shows a transverse section of a beam having a longitudinal dovetailed groove cut through its entire length, B is a bracket having a projection C, which is made to fit the dovetailed groove, this bracket has also a hole drilled through it at A, which receives a screw for the purpose of fixing it to the planking as above described.

Fig. 3 is a front view of the beam, showing the mode of inserting the projection of the bracket into the longitudinal groove. There are several modifications of this last described mode of fixing the planking to beams, which it would be unnecessary here to detail. Fig. 4 shows a mode of fixing or joining together two blocks of stone or other matter, which is effected by means of a screw, and screw sockets fixed into each block of stone. Another

Fig. 5.



part of this invention consists in the peculiar formation of a "multi-threaded" screw, the general form of which is that of a cone, and is shown at fig. 5; these screws are so made that the lower face of the spiral curve or grooves are at right anges to the convex surface of the cone, and the upper face forming an oblique angle with the surface of the cone, the advantage of which is not stated in the specification.

DRESSING MINERAL ORES.

Alexander Vivian, of Gwennap, Cornwall, gentleman, for "*an improved apparatus for dressing ores.*"—Granted Nov. 25, 1843; Enrolled May 25, 1844.

This improvement consists in certain mechanical combinations, whereby the operation of dressing and washing ores may, in the opinion of the patentee, be carried on with less expence than with machines hitherto constructed and applied to that purpose. The machine described in the specification consists of a rectangular or oblong trough or "buddle," at one end of which there is an inclined plane, and at the top of this inclined plane there is a cistern, having stop cocks or plugs at intervals in its side for letting out the water during the operation of dressing the ores; just below the cistern there is a hopper, which extends from one side of the inclined plane to the other, into which the work or ore to be dressed is placed, at the bottom of the hopper there is a number of angular or "saddle back bars," placed transversely with regard to the hopper, and firmly fixed by their ends to a frame supported by anti-friction rollers; thus, by giving motion to the frame, which is effected by means of a lever, the "saddle back bars" will have the effect of dividing the ores contained in the hopper, the smaller portions of the ores, after passing through the bars, are delivered upon the inclined plane, and are carried from thence to the buddle by the streams of water running from the cistern at the bottom of the inclined plane; and before coming to the buddle there is a perforated plate or grate upon which the ores fall, the object of this plate is to arrest and more effectually separate the earthy matters from the ores. The ores after leaving the inclined plane as described, are received in the buddle, where they may be further washed with a broom or other convenient means.

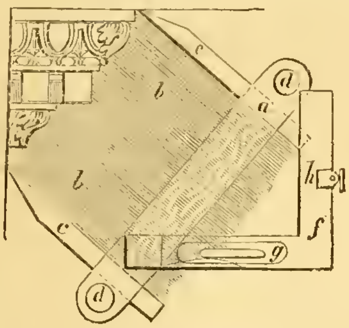
The slime and water produced from the washing and dressing of the ore passes through a perforated plate at the opposite end of the apparatus, and into a cistern, where it is allowed to settle, the water is then raised by means of a pump and is allowed to pass along a trough to a cistern, in which the slime and water are to be deposited, the residue being afterwards subjected to the process of trunking.

A PROFILE DELINEATOR.

Octavius Dellingham Mordaunt, of Clifford Street, Bond Street, in the county of Middlesex, gentleman, for "*Improvements in apparatus for obtaining the profile of various forms or figures.*" A communication.—Granted Nov. 21, 1843; Enrolled May 21, 1844.

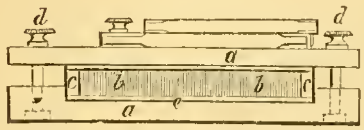
This invention consists in an apparatus for copying or taking the profile of a moulding, cornice, or other article of similar figure; a plan and edge view of which is represented in the accompanying drawing, fig. 1 being the plan,

Fig. 1.



and fig. 2 the edge view: *a a* are two bars of wood or other suitable material

Fig. 2.



which constitute the frame of the apparatus; *b b* represent a number of sliders, consisting of thin slips of wood, which slide between the bars, *a a*; *c c* are also two sliders of the same length and depth as the others, but considerably thicker, the object of these sliders being to keep the sliders, *b b*, together, and in close contact with each other, thereby serving as a support to the same.

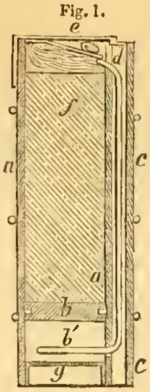
In using this apparatus, the ends of the sliders are placed against the cornice or moulding intended to be copied, then by pressing the apparatus against the same, the sliders will recede more or less according to the several projections of the moulding, and take the configuration of the same; the sliders being afterwards fixed by turning the binding screws, *d d*, which bring the two bars, *a a*, closer together, the insides of which are covered or lined with a thickness of leather, *e e*. The form of the moulding may now be taken by laying the apparatus upon a sheet of paper and moving a pencil thereon, observing to hold the point of the pencil against the end of the sliders. The apparatus is sometimes provided with a spirit level, *g*; a square, *f*; and slide, *h*, carrying a pencil, the object of which is to get a true horizontal and vertical line to work from. A similar apparatus on a larger scale may be used for taking the profile of a horse's back or a statue.

SIGNAL LIGHT.

Wm. John Hay, of Portsmouth, Operative Chemist, for "*Improvements in producing light by percussion for signals and for other purposes.*"—Granted Nov. 25, 1843; Enrolled May 25, 1844.

This invention consists in a mode of constructing the tube, and apparatus connected therewith, for containing the prepartion which is to form the signal light, the invention having no reference to the compounding or mixing of such pyrotechnic preparation, or giving the desired colour to the light, the nature of the invention being clearly shown by the accompanying drawing and following description; that is say, fig. 1 is a sectional elevation of a signal light constructed according to this invention, and fig. 2 an end view thereof. *a a* is a tube made of paper or other suitable material, *b* a disc of wood forming a bottom to the tube, *a*; *c c* is a small tube attached to the side of the tube, *a*, by folding and cementing a piece of paper round the two tubes, *a* and *c*, which may be further secured by tying a piece of cord round them at intervals; *d* is a piece of wire, which passes through the small tube, *c*, which piece of wire is bent at the top so as to pass through a slot formed in the tube, *a*, and in like manner at the bottom end, as at *b′*, which part is turned round in the form of a scroll; and in order to keep the wire, *d*, in its place a piece of paper is pasted over the slot at the lower part of the tube, which prevents the wire, *d*, from moving. *e* is a metallic plate fixed to the top of the tubes *a* and *b*; on the underside of this plate there is riveted a steel spring, the outer edge of which is made to rest upon the end of the wire, *d*; betwixt this spring and the metallic cover, *e*, is placed the percussion matter, which consists of a small globule of glass containing sulphuric acid, and covered on the outside with a mixture of chlorate of potassa and sugar, or other carbonaceous matter; between this spring and the composition (marked *f*) which is to form the signal light, there is placed a little cotton impregnated with gunpowder. *g* is a circular piece of paper or cardboard having a projecting edge similar to the lid of a pill-box, and cemented to the bottom end of the tube, *a*, the object of which is to secure the light from accidental firing.

Fig. 1.



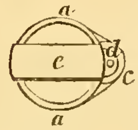


Fig. 2.

When it is required to ignite one of the signal lights, it is only necessary to hold it firmly in one hand, or fix it in any convenient situation, then by inserting a stick or other instrument in the lower end and forcing through the lid, *g*, the wire, *d*, will be forced upwards and by its raising the spring will burst the small glass globule containing the percussion matter, which will have the effect of igniting the composition forming the signal light.

IRON SAFES AND LOCKS.

Edward Tann, Sen., Edward Tann, Jun., and John Tann, of Minerva Terrace, Hackney Road, Middlesex, Iron Safe Manufacturers, for "*Improvements in locks and latches, and in iron rooms, doors, safes, chests, and other repositories.*"—Granted November 25, 1843; enrolled May 25, 1844.

The improvements in iron safes, rooms, doors, &c., consist in constructing the safes with two or more cases or chests, that is to say, with one or two internal cases and an external case, these cases being cast of such dimensions and so placed together as to leave a space between each case or box forming the iron safe, which spaces are afterwards to be filled with a chemical composition, which on the safes being subjected to fire is intended to melt and fill up the crevices, and also to be a bad or non-conductor of heat. The composition intended for this purpose consists of finely pounded alum and Austin's cement or gypsum, either of which are to be taken in equal quantities and placed in an iron vessel with the alum and then subjected to heat and ebullition, taking care to stir the mixture so as to have the alum and cement perfectly incorporated, after which it is to be poured out upon a flat iron tray and allowed to cool, when it will form a flat cake. This cake is afterwards to be reduced to a coarse powder. The cases or iron boxes intended for the safe are then to be put together so as to leave a space between each box forming the safe, which space or spaces are to be filled and tightly rammed with the pounded composition, and in like manner with the door of the safe, which is also constructed with a hollow space for the purpose above described.

It is stated that should a safe constructed as above be subjected to fire even to a white heat, the composition will melt and fill up the interstices formed by the fitting of the door and other parts, and thereby effectually preserve any deeds or other documents which may be contained therein from being scorched or in the slightest damaged by the fire.

The improvements in locks and latches consist in the application of a number of levers, or "tumblers," of peculiar shape and placed alternately upon two studs, upon which the bolt of the lock slides, and are acted upon by the various projections or wards of the key, on the lower edge of each tumbler, in such manner as to shoot the bolt of the lock backwards and forwards, but in what manner is not clearly described.

CONSTRUCTION OF PIERS, ETC.

Lawrence Holker Potts, of Greenwich, Kent, Doctor of Medicine, for "*Improvements in the construction of piers, embankments, breakwaters, and other similar structures.*"—Granted December 5, 1843; enrolled June 5, 1844.

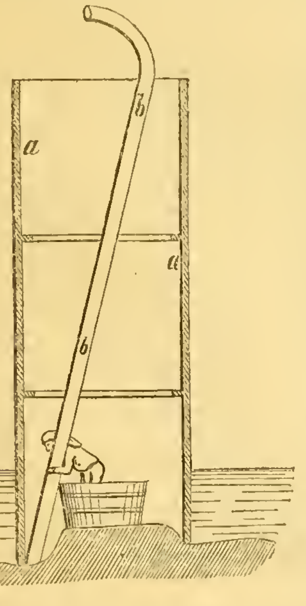
This invention is divided into four parts, and consists firstly in the application of hollow piles of iron in the construction of piers, embankments, breakwaters, &c., which piles may be of a circular or other convenient form, and are sunk by withdrawing from their interior the sand and other matter occupying the space upon which they sand. Secondly, in the application of skeleton frames or cases in connexion with hollow piles. Thirdly, in forcing or injecting by hydraulic pressure around the feet of the piles such chemical solutions as will solidify or consolidate the sand or other matter upon which they stand; and fourthly, in the application of cements in a state of dry powder, which cements are intended to solidify under water, and form an artificial rock.

The mode of driving hollow piles, as related in the first part of the specification, is as follows. A hollow pile is provided, open at both ends; presuming the place in which it is to be driven be of a sandy nature and covered with water, the pile is placed on one end in its destined place, such end being open, the upper end being closed by an air-tight lid or cover and connected by means of a pipe with a receiver. Another pipe also branches off from the receiver and is connected with a three-barrelled air pump, which on being set to work exhausts the air from the hollow pile and raises the sand and water from the bottom thereof, and thereby causes it to sink to the depth required, the sand and water passing through the pipe which is connected to the top of the pier or pile and into the receiver, which can be emptied as occasion may require.

In some descriptions of soil the inventor states that it will be found necessary to loosen the soil, which may be done by passing an instrument down the pile adopted for the purpose, and should it be required water may be applied in the same manner. When the piles meet with a hard substance the inventor proceeds to sink them by boring down the tube in the manner of boring Artesian wells.

When the piles to be driven are of large diameter the same mode of driving may be adopted, by the application of a moveable tube, which the inventor calls an "elephant or operating trunk," which will be seen in the annexed sketch, and marked Fig. 1, in which *a a*, is the pile intended to be driven, by removing in the manner above described, the sand and water as it accumulates. The sand and water being raised through the operating trunk *b b*, which is connected at its outer extremity by means of a flexible tube to a receiver, from which the air is exhausted by the air-pumps, the operating trunk being guided by a man, who, for the sake of security against the bursting-up of the loose sand, stands in a tub or "cobble," where he is enabled to move the operating trunk round the foot of the pile.

Fig. 1.



In order to secure the piles, which may be driven at any convenient distance from each other, the inventor employs what he terms skeleton frames, two of which are shown at Figs. 2 & 3; these frames are cast with holes to receive the ends of the piles, so that when applied they embrace and bend the whole together. After the piles have been sunk they may be wholly or partly filled up with rubble stones or concrete, but before doing so, should the soil be of a yielding nature, it will be necessary to consolidate it, which

Fig. 2.

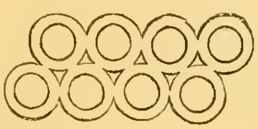
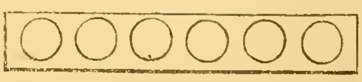


Fig. 3.



the inventor does by forcing or pouring down the hollow piles such chemical solutions as the nature of the soil may require, which may be ascertained by analysing a small portion of it, and according as silicious or calcarious matters predominate, it will be ascertained what chemical substances will be best calculated to consolidate and solidify the same.

Another mode of forming piers and such like structures is represented at Fig. 4, in which view *a a* represents the end view of a rectangular or oblong

Fig. 4.

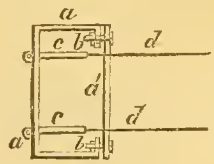
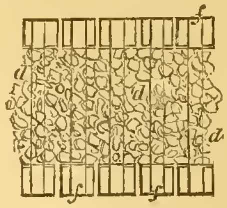


Fig. 5.



trunk, one side of which is attached by bolts *b b*; *c c* are bolts which screw on to the end of the tie bolts *d d*. In constructing a pier a number of these trunks are placed side by side as *f f f*, Fig. 5, and at a distance apart, depending upon the width of the pier, being bound together by the bolts *d d d*. The whole being firmly fixed, the space between the two rows of iron trunks is filled up with lime stones, and other matters, which are to be cemented together so as to form one mass of artificial rock. When the mass has become sufficiently set, the bolts *c c*, may be loosened, and the parts *a a*, of the trunks removed, leaving the plates *a'* and the tie bolts standing.

The cements to be used in a dry state, are those known as hydraulic cements, and may be used alone or mixed with stones, sand or shingle, and may be delivered at the foot of the pile or other structure by means of a hopper having a tube leading from it to the structure intended to be cemented, at which place the cement mixes with the water and consolidates the whole mass.

WOOD PAVING.

John Bishop, of Poland Street, Westminster, Jeweller, for "*Improvements in paving roads, streets, and other places.*"—Granted December 8, 1843; Enrolled June 8, 1844.

This invention consists in combining blocks of wood together so as to form a surface or covering for the streets, road or other way, in effecting which it will be necessary when using blocks of the description hereinafter mentioned, to have them all of the same size except at the edges of the street, at which place filling pieces in some cases will be required.

Fig. 7.

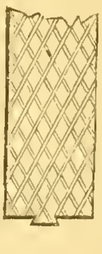


Fig. 1.

Fig. 2.

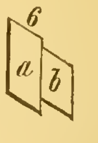


Fig. 3.

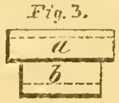


Fig. 8.

Fig. 4.

Fig. 1 shows a plan of one of these blocks, and figs. 2 and 3 two edge view of the same; each of the blocks consisting of two pieces *a* and *b*, which form an upper and under surface, and of equal sizes. These two pieces forming the upper and under surface are firmly fixed together so as to cross and overlap each other as shown in the plan view, the part overlapping being in all cases less than half the width of the block in the narrowest part. The severa blocks when constructed as above described, and represented in the drawing form a surface by partly joining side to side and partly side to end. Fig. 4 shows an edge view of five of the blocks, and a filling piece joined together, and overlapping each other. Instead of cutting the block square at the side or edges, as represented in the foregoing, the same may be formed with bevelled edges of any desired angle, as shown at figs. 6, 6'. Fig. 7 shows a plan view of a cast iron curb and gutter, which constitutes the second part of these improvements. Fig. 8 being an end view of the same, and shown as being joined up to the blocks, forming the wood pavement; the side or filling blocks being bevelled off as at *f*, in order to allow the water, &c. to pass freely into the gutter; the upper side of the curb is formed with a number of grooves in its surface, as shown in the plan view, to ensure better foothold.

ORNAMENTAL COVERING FOR FLOORS.

HENRY PURSER VAILE, of Blackfriars Road, Surrey, gentleman, for "*Improvements in manufacturing metal combined with other materials for covering of floors and other surfaces.*"—Granted Dec. 13, 1843; Enrolled June 12, 1844.

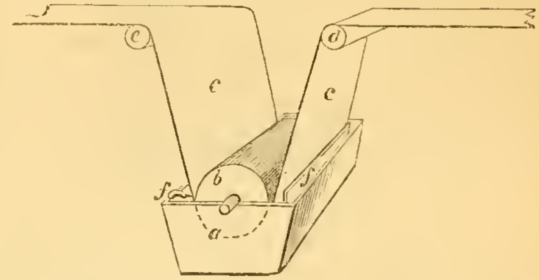
In carrying out this invention the patentee takes a sheet of lead or other suitable metal and perforates it with holes, which may be of a round, square, or other form and in right lines, leaving a narrow piece of metal between each hole, or the holes may be so arranged in the plate as to form some device or figure; but as the figure or device can be worked in the same manner as the Berlin goods, that is, by filling up the little squares on the pattern card or paper with various colours, the holes may be in right lines as will be hereafter described. A perforated metal plate being provided the holes are to be filled up with a plastic cement which may be applied in various colours, and in such manner as to form any desired pattern; the cement being of such a nature as to dry sufficiently hard to bear walking and treading upon, the invention not being confined to any particular composition, although Mr. Vaile mentions one which he has found to answer the purpose well, and consists of about two-thirds of pulverized glass with about one-third by weight of dry ground colouring matter, which ingredients are to be mixed up with copal varnish to about the consistency of putty. This cement being provided, the inventor proceeds by laying the perforated metal plate with its face downwards upon a flat table and then filling up the holes in the plate with any suitable instrument and with various coloured cements, so as to form the required design or pattern, after which the metal plate is to be turned over and the back side is to be covered with strong canvass or other suitable material cemented thereto. For this purpose the inventor employs a cement made from a matter known and sold by the name of mastic, mixed with one-fourteenth by weight of bees'-wax, melted together and reduced to a fluid state, or the consistency of oil paint by means of turpentine. This mixture is to be applied with a brush to the back side of the plate, and also to the canvass; the canvass is then to be placed upon the plate, and the same pressed together, after which the plate will be ready to be laid down upon the floor, any inequalities on the face side being removed with a pumice stone.

There is also another mode of filling the perforations in the plate with caoutchouc, or India rubber. For this purpose the patentee provides a sheet of India rubber somewhat thicker than the metallic plate, which in this case may be perforated so as to form various devices, which will be seen in consequence of the India rubber, on being exposed to the air, turning black and thereby forming a contrast with the metal plate. The plate being provided, a sheet of India rubber is to be laid upon one side thereof, after which the plate and India rubber are to be passed between a pair of pressure rollers, which will have the effect of pressing the India rubber into the holes or perforations of the plate, thereby filling the same, leaving a thin covering of India rubber on the back side of the plate, which when laid down will be next the floor. India rubber mixed with cork or colouring matter may also be used for the purpose above described.

DEPOSITION OF METALS.

JULIUS SCHOTTLAENOER, of Saint Swithin's Lane, in the City of London, Merchant, for certain "*Improvements in the deposition of metals upon various felted and other fabrics.*"—Granted December 8, 1843; Enrolled June 7, 1844.

The mode of effecting the deposition of metals upon felted and woven fabrics is as follows. A plate of copper is in the first place to be provided of the required dimensions, one side of which is to be covered with plumbago, and the other rendered inactive by covering it with varnish or other suitable material, the piece of cloth or linen fabric to be metallized is then to be stretched tightly over that face of the copper-plate which has received the plumbago, and secured by its edges in any convenient manner. The copper plate and piece of fabric to be metallized are then to be immersed in a solution of sulphate of copper, and the plate connected with the zinc end of the battery; another copper-plate is then to be immersed in the solution, and connected with the copper end of the battery, when the action of the battery will commence and the metal will be deposited upon the copper-plate between such plate, and the fabric to be coated, and by continuing the operation the metal will begin to penetrate the pores of the cloth, and will appear on the opposite or back side of the cloth in small globules. When the operation has been continued a sufficient length of time, the metal plate and cloth may be taken out of the solution, and the metallized cloth removed from the copper-plate, which will be very easily done, and should the plate employed have a smooth surface, the face of the metallized cloth will have a polished surface, but should the copper-plate have an engraved or embossed surface, the metallized cloth will also have an embossed surface, and be a fac-simile of such surface, the copper-plate forming the die or matrix. Ornamental designs may also be produced by drawing upon the copper-plate with some non-conducting substance, or portions of the plate may be cut away; by these means various ornamental designs may be produced, which may be afterwards silvered, gilt, or otherwise finished.



When it is required to metallize a piece of cloth of considerable length, the inventor employs an apparatus consisting of a vessel *a*, within which is put the sulphate of copper or other solution, *b* is a copper roller supported by the ends of the vessel, *a c* is the piece of cloth to be metallized, and which piece passes over the roller *d*, down and under the copper roller and up over the roller *e*, *f* is a copper-plate connected with the copper-pole of a galvanic battery, the copper roller *b* being connected with the zinc pole of the battery, the parts of the apparatus being connected to the battery by copper wires, and the vessel *a* filled with the solution of copper, a slow motion being imparted to the roller *b*, the deposition of metal takes place between the cloth and the roller in the manner above described, and should the roller be engraved with some ornamental design, a fac-simile will be obtained. It will be found of great advantage previously to operating upon woven or felted fabrics, to wash over the surface of the cloth with clay and water mixed to about the consistency of cream, and then allow it to dry, after which the cloth may be washed with water, which will leave some of the finer particles of clay in the cloth, and will thereby render it more porous and better adapted in other respects for the purpose above described.

When the surface to be metallized consists of glass or glazed earthenware, the surface is to be roughened by mechanical or other means, such as grinding. The parts to be deposited upon are then to be surrounded by a matrix of metal, which is to be connected with the zinc end of the battery, its inner surface being made conducting by means of plumbago. The article to be deposited upon is then to be immersed in the solution, and also a copper-plate, which latter is to be connected with the copper pole of the battery; the metal contained in the solution will then begin to fill up the parts between the matrix and the article to be deposited upon, and by these means any design may be copied and firmly fixed upon the glass or glazed surface of earthenware.

These are the improvements which consist in the arrangement of batteries for the purpose above described, one of which consists in arranging horse shoe magnets so as to form two circles, with their poles opposed to each other, the outer circle of magnets being wrapped with copper wire, covered with silk; a rotary motion being given to the inner circle of magnets, the electric fluid will pass from one wire to another throughout the whole, with a power depending upon the speed and size of the magnets.

BRINE APPARATUS.

JOHN SYLVESTER, of Great Russell Street, Engineer, for "*Improvements in applying heat to brine or other matters contained in vessels.*"—Granted December 13, 1843; enrolled June 13, 1844.

The object of this invention is to obtain and maintain a regular and uniform temperature above 212 degrees, Fahr., to brine or other liquid matters contained in vessels, which the inventor proposes to effect in the following manner.

In place of exposing the vessel containing the brine to the immediate action of the fire, such vessel is placed within another, which latter forms a jacket to the brine vessel, the outer vessel or jacket being of such dimensions as to leave a space of from 3 to 4 inches between the vessel containing the brine and the external vessel or case, which is made to form a water-tight junction with the brine vessel. The space between the two vessels is then filled with water, which fluid is to be subjected to a pressure which must be varied according to the temperature required to be maintained. The pressure transmitted to the fluid, contained in the space formed by the two vessels, is regulated by a pipe, which may be of small diameter and attached to some convenient part of the external vessel, and extending in a vertical direction to a height of 30 feet or upwards, and filled with water. This tube may be provided with a stop cock, at or near the bottom end, so as to regulate the pressure of the fluid contained in the space according to the temperature desired to be maintained and transmitted to the brine, which is effected through the medium of the water contained in the aforesaid space, the fire for heating the same being immediately below and in contact with the external vessel, the heat being transmitted to the brine through the medium of the intermediate fluid contained within the jacket.

Joseph Robinson, of Old Jewry, London, Solicitor, for certain "*Improvements in the construction and mode of working engines by the agency of air or gases for obtaining or producing motive power.*" Communication.—Granted December 5, 1843; Enrolled June, 5, 1844.

This invention consists in an improved inflammable gas, or vapour engine, by means of which power is obtained by expansion consequent upon the combustion of vapour of spirits of turpentine, or other evaporable and inflammable liquids, which are to be mixed with atmospheric air, and admitted into a cylinder similar to that used in the steam engine.

The cylinder of this engine is supported in a horizontal position, and is similar to that of a double acting steam engine. At one end of the cylinder and just below it there is a reservoir which contains the naphtha, spirits of turpentine or other evaporable liquid; but when resin or other matter is employed, from which the inflammable gas is to be obtained, the inventor employs a retort or evaporating vessel, which is placed below the cylinder and heated by a spirit lamp or other means, or the same may be placed in contact with the cylinder. This heating apparatus although necessary in the commencement of the action of the engine, may be dispensed with, after the engine has been set to work, by allowing the hot air from the cylinder (after having made its stroke) to pass into the retort, which is surrounded by chambers for that purpose. To the side of the cylinder there is a valve-box so constructed as to give a supply of the combustible gas or vapour, and atmospheric air to each end of the cylinder alternately, and in the same manner as in which steam is admitted or supplied to the cylinder of a steam engine.

The inventor here describes a cylindrical valve of peculiar construction, but sliding valves of the ordinary construction may be used, for governing the supply of inflammable gases. This engine is also provided with a double acting air pump, the air from which is made to pass through a tube into the retort, where it is made to commingle with the inflammable matter, which may be effected by means of an agitator, or the air may be admitted to the retort through a perforated plate, and in order to regulate the supply of air it is made to pass through a trunk, on the top of which there is an air regulator, its sides being made of leather or some other elastic material, and having at the top a valve through which the air escapes, when the pressure becomes too great; the whole apparatus being so constructed as to regulate with great precision the quantity of atmospheric air, and also combustible or inflammable gases.

At each end of the cylinder there is a valve contained in a circular valve box, which valve, as the piston moves backward and forward, is acted upon by means of the piston touching a small spring or projection, thereby allowing the ignition to take place, which is effected by means of a burning lamp, the flame of which comes in contact with the holes at each end of the cylinder, thereby effecting alternate action of the piston, the motion of which can be transmitted to the crank in any convenient manner. The inventor claims the mode of arranging the air pump, retort, and air regulator, which governs the admission of atmospheric air into the valve box and by which the supply of inflammable gas may be regulated so as to produce, within the cylinder, a pressure little exceeding that of the atmosphere, at the time of opening the valve for the admission of inflammable gas. Also the mode of heating the retort by placing it in contact with the cylinder; together with the mode of employing the heated air which passes from the cylinder through the eduction tube, thereby rendering such air effective in heating the retort for converting the combustible fluids into vapours, previously to admitting the same into the cylinder in the manner described.

Communication with France.—The Princess Mary steamer, which has been built for the South-Eastern Railway Company by Messrs. Ditchburn and Mare, and fitted with Messrs. Maudslay and Field's annular cylinder engines, made her trial trip on Wednesday, June 18. She left Blackwall at 43 minutes past 10 o'clock, and arrived off the east end of the Isle of Sheppy (a distance of 50 miles) at 7 minutes past 2, being at the rate of 16 miles an hour, against the tide the whole way. Everything that could be desired concurred to give her an opportunity of testing her power; the, till now, fastest steamer, the Prince of Wales, leaving Blackwall some minutes before her; the Isle of Thanet also preceded her by 20 minutes: they were, however, both passed in gallant style at the point above stated, the Princess Mary crossing their bows, making a circuit around them, and returning on her homeward voage. The Princess Mary, on the Boulogne station, must have immense influence in determining the continental traffic to the South-Eastern line. There can be no doubt, from the known energy and skill of the directors of the railway company, that this important branch of the service will be thoroughly well done. The influence of the railway is already telling well in this particular. Ostend has the Princess Alice. Dover the Magician, Folkestone the Princess Mary: and we shall be much surprised if the latter do not bear away the palm from its competitors. The Princess Maude, another iron steamer, built for and by the same parties, and of equal speed, is expected to be completed for the Folkestone station in a few weeks.—*Times.*

GREEK MASONRY.

Extract of a Letter from Walter Long Granville, Esq., *Associate R. I. B. A., to* Dr. Granville, *read at the Ordinary General Meeting of the Royal Inst. of B. A., June* 17, 1844.

"On a former occasion, I wrote you the impressions produced on me by the monuments of Athens, and you will remember that in one part of my letter I told you, how forcibly I was struck with the high and elaborate finish given to all the sculpture and architecture which surrounded me; a pleasure which was in such perfect unison with the other feelings their contemplation aroused, as to assure me that *perfection* is intimately connected with the qualities of *beauty;* although, assuredly, the latter may sometimes exist separately.

"'Smoothness,' says Burke, (Essay on Sublime and Beautiful, part 3, sect. 14,) 'is so essential to beauty, that I do not recollect anything beautiful that is not smooth.' Now the ancient Greeks were apparently impressed strongly with the same natural idea, as the extraordinary amount of attention and labour bestowed on their works of art testify.

When we consider the perfection to which Greek art attained—that it was arrived at, only after the experience of more than eleven centuries—and that its glorious improvement was chiefly owing to the united efforts of generations concentrated upon one particular object, namely the erection of temples to their protecting divinities; it becomes an interesting subject of enquiry to ascertain (from an examination of the structures themselves,) those principles and contrivances which, even in the most trifling or minutest matters, were the result of that improvement.

There are few books, that I am aware of, which treat fully of the methods employed by the ancient Greek masons in cutting and working marble or stone. Vitruvius, to whom we first look, is almost silent upon the point. We then turn, to supply the deficiency, to the living books themselves; and, fortunately, there are many points that can be gleaned from them, which would serve to compose a complete treatise.

I shall first observe that the ancient Greeks were as empirical in their rules upon the proportions of each stone they employed, as upon the proportions of the whole design. Thus it may be observed, for example, that the size of the stones in the *Erechtheum* and in the *Parthenon* differ in about the same ratio as the one building differs from the other. For the actual proportion of the stone itself no direct rule can be given, nevertheless I have found that the geometrical ratio of 1. 2. 4. is by no means unfrequently employed. Symmetry, also, was considered as necessary in the position of their joints, as in the composition of the plan, or the position of their triglyphs and mutules; and these may be observed as occupying the same place in nearly every similar construction.

The Greek joint, whether it be executed in marble or in stone is a thing really to marvel at. It is indeed scarcely visible. Great as is its perfection, which arises from the amount of skill and labour bestowed upon it, and from the peculiar method of working the two surfaces, which I shall presently describe to you,—I do not see why the same degree of perfection should not be attainable at the present day by following the same means. My attention was first drawn to the subject upon remarking the beds of the stones in the Temple of Minerva at Athens; and since my examination of other Hellenic works in Greece, Sicily, and elsewhere, I have grounds for believing that there was an universal system adopted in all ages by that nation; nor was it confined to the Greeks alone, it having been handed down to, and practised by the Romans also, as I observed but yesterday in the Coliseum and Arch of Sep. Severus. It, however, at length became either lost or disused in the series of revolutions and changes, which, with their other modes, the masonry of the middle ages experienced.

You well know of the predilection of the Greeks for constructing with large sized blocks of marble or stone. They were extracted from the λατομια, or quarries, in the following manner. In order to procure the square stones—after the top and front faces of a given mass of the rock in the quarry had been brought to a plain surface—incisions, usually from four to five inches wide, were made on the top surface, marking out the boundaries of the intended size of the block. These incisions being continued down to the required depth of the block, there remained nothing more to be done than to separate it from its lower bed, which operation was performed, as there is every reason to think, by the expansion of wooden wedges saturated with water.

The cylindrical courses for the shafts of the columns were extracted (as may be observed at the quarries of Selinus, in Sicily, a plan of which, as well as of its elevation, I herewith send you in confirmation of my statement) by means of a circular passage-way 2 ft. 8 in. in width, being hewn out of the rock, and taking the entasis of the in-

FIG. 1.

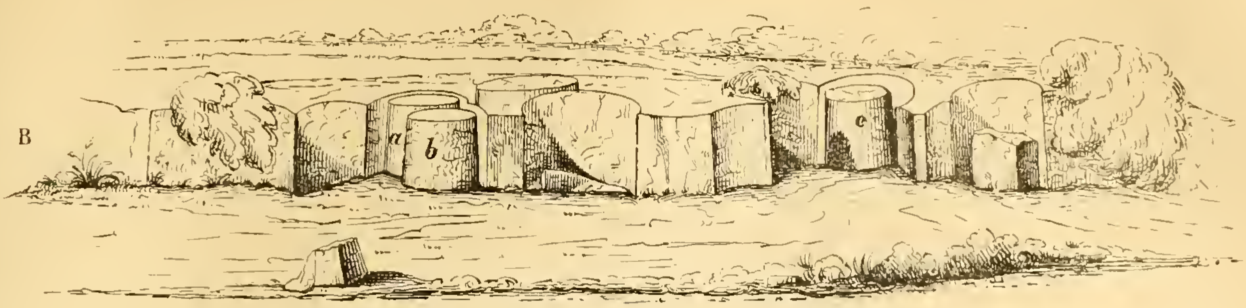
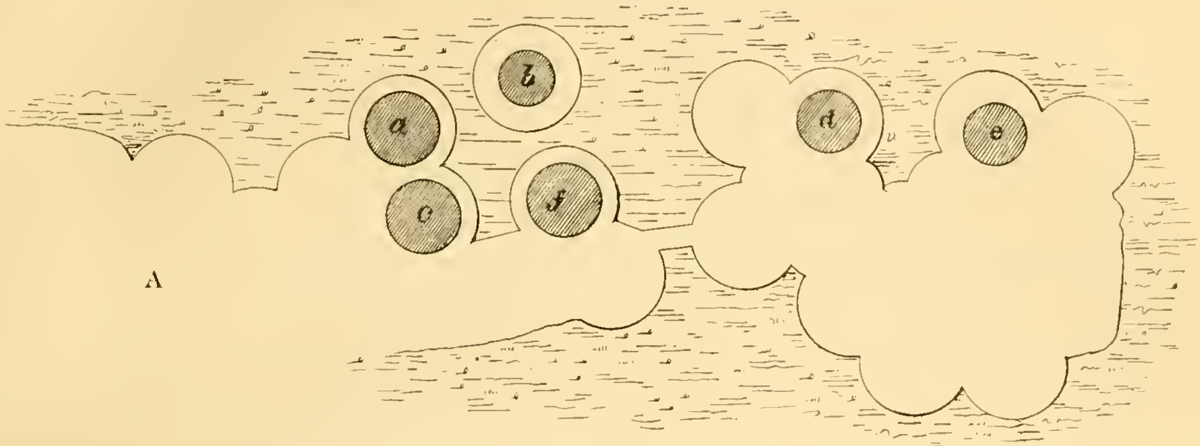


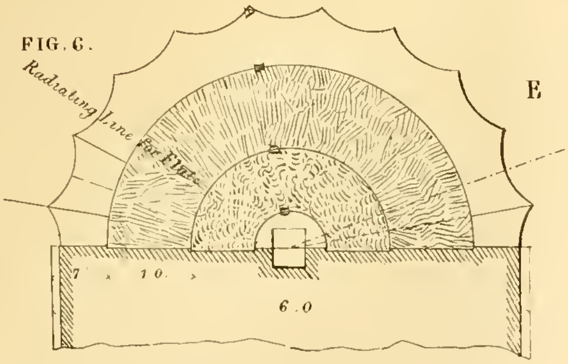
FIG. 2.



PLAN AND VIEW OF STONE QUARRIES AT SELINUNTUM

Plan & Section of Parthenon Column

FIG. 6.



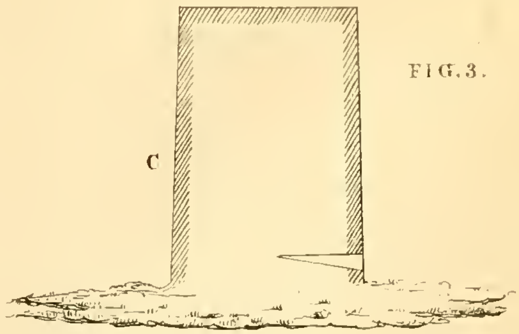
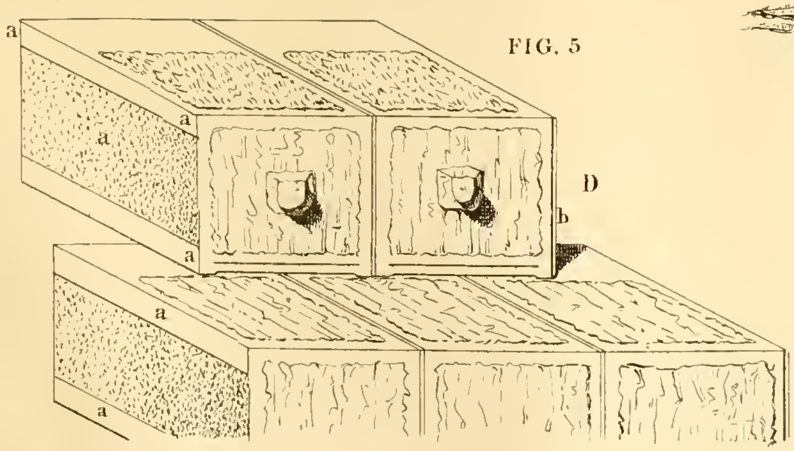


FIG. 3.

Blocks of Stone at SEGESTA.

FIG. 5



Plan & Section of Column with Wedge.

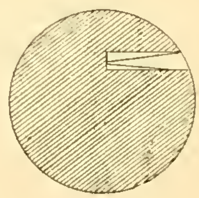


FIG. 4.

tended column: thus leaving an insulated mass of stone in the centre, the exact shape and size of the required shaft. (See fig. 1, *a*, *b*, *c*, *d*, *e*, and view fig. 2, *a*, *b*.) I should here add, that the stone columns of every temple occupy almost invariably the same relative position in the building which they occupied in the quarry. This circular mass of stone has now, like the square blocks, only to be lifted from its lower bed, and the method employed, which, from the examination of the quarries at Selinus, can be no longer doubted, bears me out in a conjecture I had previously made on the square blocks. A hole or deep incision, wedge-shaped (see shaft figs. 3 and 4, and fig. 1), was made in the lowest part of the insulated cylinder, in the direction of its centre, but considerably to one side, for reasons which will be obvious to you. Into this hole, I presume, a wooden wedge was inserted, which was saturated with water, and which being suffered to expand whilst in that position would, at no great distance of time, heave up the mass, on the same principle applied to the splitting of slate and millstones in France, and so separate it in the direction of its bed. Nothing, I think, appears more likely, from the consideration of the facts observed at Selinus, than that such was the method employed: and since I see from my memoranda, that I observed the branch of a shrub, not one inch in diameter, which by its growth in a crevice of the rock had split a mass of stone weighing about fifty tons,—I can readily conceive that the small orifice, as shown in the drawing, with its wooden wedge would have been sufficient to loosen the required mass. The mode by which these cylindrical masses or *courses* were transported to their places of destination is fully described by Vitruvius (Lib. x. cap. 6), where you will find it attributed to Ctesiphon, architect of the Temple of Ephesus, and his son Metagenes. In a flat country it might have succeeded well; but it is difficult to conceive how such masses could have been transported by those means only, over a rugged and mountainous district wholly destitute of roads.

We must regret that we have no farther elucidation of the subject, than that given us by Vitruvius, which is very limited, since—anterior to the building of the famous Ephesian Temple in the seventh century before Christ—monoliths were transported from place to place of proportions as large as those used in that temple. There are some cylindrical blocks of stone for columns near the quarries of Selinus in a field lying in a position which makes it highly probable that the method described by Vitruvius was adopted in regard to them. They have, moreover, the square hole already worked on the ends, which, independently of its use for other purposes, served as a means of fastening the wooden wheels.

It is interesting to remark, from the signs still remaining on the stone, the shape of the tool employed in working the material. The consecutive cuts which are seen in the steps of the Segesta Temple, show that the instrument used for rough work was 3½ inches in width, being slightly curved or hollowed like a gouge. The use of a saw to cut the stones is instanced in the 7th chap. of Kings, verse 7. "All these were of costly stones sawed with *saws*." Now these tools, I presume, were of iron, since iron was found in Crete by the Dactyli priests of Cybele, as far back as 1406 B.C., about which time Dædalus is said by Pliny (Nat. History VIII.) to have invented the axe, the saw, the wimble, the level, and many other mechanical instruments or tools. It is certain, however, that these tools were of iron 400 years after; for, in the description of Solomon's Temple, it is stated, that "the house when it was building was built of stone made ready before it was brought thither, so that there was neither *hammer*, nor *axe*, nor any tool of IRON, heard in the House of God while it was in building." (1 Kings vi. 7.) Now the examples of temples from which my notices were taken, were erected many years subsequent to the above date.

The next process of the Greek builder, after procuring the stones and columns, was the construction of the stylobate, or the sub-structure with its three steps, my remarks upon which are taken chiefly from the Propylæa at Athens, and the temple at Segesta in Sicily, both of which structures were never totally completed. Although the former structure is of marble and the latter of stone, and erected at a different period, still my remarks are applicable to both.

The stone steps around the temple are in large blocks, generally from five to seven feet long, placed, as usual, with the greatest regard to symmetrical arrangement, every joint coming over the centre of the bottom and top stone. The stones, therefore, are all precisely similar in size. Each block is, previously to its being set in its place, worked on four sides to a smooth face, the top surface being only worked on that part which has to receive the bed of the stone above. The remaining side, or front of the step is, like the top left rough, a small fillet or band only being worked all along the edges, to indicate the true surface to which the stone has afterwards to be finished. It is on this side that the small rough block used for heaving the stone is frequently found in the centre (see fig. 5). Every joint must necessarily be composed of two substances in contact; and it is the degree of contact which constitutes the amount of perfection in any joint. The two neighbour stones, whose surfaces together form the joint in Greek masonry, are worked differently from each other. One of the surfaces is tooled down to a very slight depth, (rarely visible to the eye, if the material be marble, though generally sensible to the touch,) until there is left only a third (I have seen it as little as a sixth,) portion of the surface of the stone for actual contact. The sole points of contact are a band along the two sides (see fig. 5, *a*,) in the direction of the stone's length, with, sometimes, another band in the centre. The surface of the other stone remains perfectly flat; as it would seem to be superfluous to work any off, although, as regards the case of columns, this extreme precaution has been deemed necessary. On that stone whose surface remains plain, the edges are sometimes chamfered off, as is the case at Segesta (see *b*, fig. 5). But this does not occur in every building.

I am unable to explain its use, unless it was a kind of distinguishing mark for the foreman, after the stone was placed, to detect inaccuracy of position; or for the slave who performed the laborious and heavy work of laying the stones. As their skill was of a subordinate kind, the position of the several square stones, columns, and other work were invariably marked out for them, by means of some sharp tool, with a thin line, as I have noticed in more than one instance which I could mention.

With respect to the columns, each course, of which the entire shaft is to be composed, being brought to the building, has then to be worked at the top and bottom in the following most elaborate manner, as an inspection of the drawing (see fig. 6) (taken from the Parthenon columns,) will fully show. After the two surfaces had been smoothed to a most exquisitely true plane, radiating lines marking out the division of the flutes were next indented by means of some sharp tool. Such lines may be especially noticed on the Propylæa columns. Next three concentric circles were drawn out, also with some sharp instrument, the common centre of them being the axis of the column. Now be pleased to refer to the drawing (fig. 6,) and its letters and figures to understand more readily my description. The area comprised between the external surface of the shaft, A, and the circle, B, is the smooth bed left untouched, and is to form the only surface of contact when the column is raised. That between B and C is made a degree lower than the surface of actual contact, by being very slightly tooled or scratched over. In the like manner, the surface of the ring, C D, is made lower than that of B C, by being tooled over very roughly. As to the remaining portion round the centre it is retained smooth, but is made as low as the surface B C. You will perceive from this what systematic fellows the Greek masons were, and what precautions they observed to ensure the accomplishment of their object.

Every one of the 11 courses which compose the shafts of the 58 exterior columns that belonged to the Parthenon, had the top and bottom surfaces worked in this manner, and with the same care and attention, which are so remarkable throughout the whole structure, whether the parts were to be covered or to remain visible. Each course had now to be lifted into its destined place; an operation which was accomplished, it is supposed, by means of a machine called the trochlea—an assemblage of pullies, fastened to a pair of sheers, or other scaffolding, and which, according to the number of such pullies, was denominated *τρισπαστος*, *πεντοσπαστος*, *πολυπαστος*, &c. At the end of the rope which passed through the pullies, were fastened the ψαλιδες, or *Forfices ferreo*, described by Vitruvius (Lib. X.), an instrument somewhat like a pair of large scissors, in use even at the present day. These forfices (for I believe there were more than one pair employed if the stone was very large,) were made to lay hold of the two or four rough masses[1] projecting from the block and left for the express purpose of raising the stone. When the circular stone or first course was lifted [it was set into that place which had been marked out for it, by a circle nearly the size of the column itself, on the stylobate. It was then, according to the evidence which innumerable concentric circles display on the stylobate of the Temple of Hercules at Agrigentum, turned round and round (on a pivot of wood as some suppose) and ground down to a fine surface.

I must doubt, however, if this operation of grinding was performed with each successive course, as I could find no other traces whatever

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[1] The rejected marble drums found in the Acropolis, and identified as those which were to have served for the Parthenon columns have four projecting masses round the stone. The shafts which still remain in the quarries at Selinus have, on the contrary, no masses whatever, and must therefore, have been lifted at the building in a different manner. I have before observed that the square hole left in the centre of the shaft, at top and bottom, was worked at the quarry; in some cases this square hole has two sinkings, as may be noticed in the Temple of Hercules at Agrigentum, and in no instance have I found that these cavities are in the slightest degree dovetailed, but rather the reverse. This circumstance renders it a matters of doubt, if not altogether, at least in the present case, whether the use of the Lewis was at all known to the Greeks.

of it in the same temple. The material of which the Temple of Hercules is built, is of an exceedingly coarse porous nature, and would leave, perhaps, but a few marks, which the weather might have obliterated. On the other hand, the Parthenon columns, respecting which I saw no traces of the grinding, are composed of a material supposed to be too *fine* to leave any such marks. Certainly none remain. With regard to the flutes, they were, as at the present day, considered with the finishing of the building and worked up wholly after it was erected, with the exception, in some cases where they are began, at top and bottom, as a guide. The method employed was this. After the vertical lines were drawn down from the points given by the radiating lines marked on the bed of each course, as previously described, the first stage was to work the column from top to bottom into a polygon—leaving a broad band where each arris of the flute is to come. The flutes themselves were next worked out to a curve, not their final ones, but very nearly to the required depth—still preserving untouched the band where arris is to come.

The final stage was to work away the band to a sharp arris, and bring the flutes to the desired depth and curve.

This description of the flutes is taken from the columns of the largest temple at Selinus, and of the Temple of Apollo Didymæus, near Miletus, which temples were never finished, and reveal several distinct stages of their execution.

I will not detain you any longer upon the shafts of the columns; but before proceeding upwards to the entablature, I will merely state the impression I, with many others, have had of the extreme likelihood of the capitals being worked in a lathe; for, as Mr. Cockerell observed in one of his lectures, Pliny tells us, that in the Labyrinth of Lemnos were 150 columns turned in a lathe; thus testifying to the Greeks' knowledge of such a machine as early as the 8th century before our Saviour.

Now as regards the architrave, my observations of its structure, in the several edifices I have had an opportunity of examining with the eye of a builder, in these parts, are recorded in my note books under the following memoranda. Generally speaking the architrave is composed in its thickness of *three* stones, though, sometimes, of *two* separate stones only. It is, however, always of *one* stone in height. The proportions of these stones, owing to the extent of bearing and height, are much thinner than in the ordinary square shaped stones. They are placed so that the laminæ, or lines of cleavage of the material, are in a vertical position, like a book standing on its front edge—the strongest position for a stone supported only at its extremities.

They do not touch one another,—having a space of about ¼ of an inch left between them, so that each performs its work independently of the other. Hence, should one of them fail in any part, it would not necessarily bring ruin on the others. On the outside and inside vertical joints, over the centre of the columns, there is, generally, a raised band left, which was not worked off till the finishing of the temple. The same occurs (in many cases I have observed) to the vertical joints of the mouldings. It is an excellent precaution, where the stone is very porous or fragile, as it preserves the edge from injury; and not being worked off until the last, a fair face at the joint is ensured.

The singular method employed in nearly all the temples at Agrigentum, for joining the stones together, in the entablature, has been well illustrated by Mr. Cockerell, and is too generally known to need any comments of mine. The same has been the case with the series of cramps and contrivances employed on the top of the Parthenon. To the person who beholds them for the first time, amidst the vast quarries of stone there, their sight independently of the effect which the scenery around him may produce, is truly bewildering. In fact, the mechanical construction of the Parthenon presents a series of studies and reflections to the architect which would fill volumes, and for which we look in vain elsewhere.

* * * * * * *

I pass now to another subject, connected more with the ornamenting than with the construction of temples.

It is well known that the Greeks, in a great many instances, constructed their temples of a very rough and intractable stone; especially is this the case in buildings of an early period, as at Corinth, Ægina, the old Hecatompedon at Athens, Pæstum, &c. This was owing to the natural character of the stone in the locality where they built—preferring the material at hand to a better kind the procuring of which would occasion difficulty. It is equally well ascertained that they covered the stone with a thin coating of stucco; whether for the express purpose of hiding the faultiness of the material, or for receiving the polychromic painting, which could hardly be executed on a rough surface, or for both those purposes, has not as yet been decided. For my own part, I am inclined to imagine, that it was for the express purpose of receiving the painting, since I have found instances where the buildings have been covered with a fine stucco, or other coating, even though the stone was of a smooth and excellent quality, and the workmanship of the most perfect kind. This is the case in the temples of Jupiter Panhellenius in Ægina, and Juno Lucina at Agrigentum. In works of a later period, the stucco itself, instead of being allowed to remain of its natural tint, was dyed before it was put on as an easier expedient than painting it afterwards. I have collected together several specimens which prove this to have been the case. Judging, then, from the universality of the employment of colour on temples, may we not suppose that it was a custom derived from practices which co-existed with the mode of worship at the time; it was first introduced into Attica by Cecrops' colony, from Egypt, and cherished from generation to generation, as if it had been a part of the prescribed ritual. It is, however, from Egypt that we must look in future for a better elucidation of this question.

In the middle of the 15th century before our era, Moses was commanded to build the Tabernacle, the materials for which, it was especially directed, were to be procured through the free-offering of a portion of those possessions and articles in general use, which the Israelites had brought with them from Egypt. By referring to chapters 25, 26, 28, and from 35 to 39, inclusive, of Exodus, we shall there find that an abundance of blue, purple, and scarlet linen, and rams' skins dyed red, were employed in its construction. So much of them, in fact, was then used for that purpose, that that structure must have presented almost altogether, at a little distance, an aspect of *blue*, *purple*, and *scarlet*. I do not wish to lay any particular stress upon this fact, but cite it only to evidence the very general use of those three colours among the Egyptians. The monuments of ancient Egypt themselves in the present day are witnesses to the truth of the text. Now, it was in 1556 B.C., or about the same epoch of the building of the Tabernacle, that Cecrops left *Saïs* for Greece, upon settling in which country, it is not at all improbable that he and his colony would adhere to the practices of the country they had left, in which case they would, as naturally, have followed the custom of decorating the temples with *colour* and other ornaments. If the origin of *colour* in Greece is to be referred to the East, we have next to inquire into the reasons of the Egyptians painting their own temples, and when once those are demonstrated the question will be set at rest.

Now people have never thought that *colour* spoiled the Egyptian temples, but the contrary; and they attribute the practice to a fancy only for decoration. But the moment that the discovery of polychromic painting on the Grecian buildings comes to show, that certain cherished notions, previously conceived respecting these buildings, were wrongly formed—and that in reality the Greeks, as well as the Egyptians, coloured their temples—these same individuals, rather than agree with such a notion, adopt another, which separates altogether the painting from the building of the temples, referring the practice of the former to a different period of that of the latter. Is it not much more natural to think that the motive which inspired the Greek was none other than the same which influenced the Egyptians? and that the custom was, as usual, moulded by the former into such definite principles, as not to be departed from even when a Parthenon was constructed. Mr. Hittorf's hypotheses on polychromic painting are exceedingly interesting, and I believe that very shortly the public will be made acquainted with them in a very elaborate work which that gentleman has been for many years preparing.

Your affectionate Son,

Rome, April 26, 1844. Walter L. Granville.

STEAM NAVIGATION IN THE EAST INDIES.

The introduction of steam boats into India was, in the first instance, attended with difficulties almost insurmountable, and scarcely to be accounted for by the common mode of reasoning upon political expediency, or upon the speculative habits of our then princely merchants of the East: its extension since its first introduction has been so trifling, so wholly inadequate to the rapidly increasing requirements of the local government in the time of war, and to the immense and widely disseminated commerce of that country, that it is a matter of still greater wonder, and naturally leads to a train of reflections, not in the highest degree favourable to the political sagacity of the one party, or to the enterprising spirit of the other.

The first introduction of steam into India, to be locally applied, was in 1818, when Captain Davidson, of the Bengal Engineers, brought to Calcutta an eight-horse power engine, purchased by Messrs. I. and W. Gladstone, of Liverpool, and designed for a river boat. From some unexplained cause or other it remained neglected in a Godown, until Major Schalch purchased it for a dredging boat, which Messrs. Kyd

& Co. were employed to build for government in 1822. This boat (the Plato) was built, being furnished with a double set of buckets to dredge on both sides; but, on the breaking out of the Burmese war, these buckets were taken off, and she was fitted up as a floating battery, and sent with the expedition to Aracan, where she rendered services the most important, passing the troops over the creeks and estuaries of that coast. The original form was that of a barge, flat bottomed, and square at both ends; but when fitted up as above described, a false bow was attached to her and other alterations were made.

The boat built at Lucknow, by Mr. Wm. Tuckett, for the Nawaub, was the first vessel in India propelled by steam; the plan and engine were brought out by Mr. W. Jessop, in 1819. The engine was eight-horse power, giving the boat a speed of 7 or 8 miles per hour; the total cost, including freight, was about £7000 when landed in China. This boat, originating in the caprice of the late king, was soon laid aside and suffered to go to ruin.

The Diana, one of the steam boats still in active service, was originally sent out on a speculation of Mr. Robarts, a member of the Factory at Canton: the Directors, on the unfounded representations of some individuals, declining to employ it. Mr. Robarts obtained a pair of 16-horse engines, boiler, and other requisites, of Messrs. Maudslays, and having fitted it out employed it on his own account. The vessel, 110 tons burthen, found its way to Calcutta, and after remaining there some time it was purchased by subscription, and entirely altered and enlarged at a cost of 75,000 rupees. This vessel was also purchased by the Indian government for the expedition to Rangoon, and employed as a transport, rendering the most important service and being mainly instrumental to the success of that expedition; the novelty of this engine of war producing, says Mr. William Prinsep, an effect analagous to that of the Spanish horses in Mexico. During nearly the whole time she depended almost entirely upon wood fuel which was found to answer very well.

The Enterprize, launched in 1825, cost 43,000 rupees, was considered a failure, disappointing public expectation; the Burmese war relieved the proprietors of, to them, a bad speculation, and after performing important services at Rangoon she was consigned to the Bombay government.

The Comet and Firefly, two vessels still in active service, were launched separately in 1826; these vessels were built by native carpenters, the engines and fittings being supplied by Messrs. Maudlays; the engines 10 horse power have a stroke of 2 feet, and make 32 to 36 revolutions per minute, consuming 480 lbs of coal per hour; the vessels draw from 4 to 5 feet, and have capacity for nearly 11 tons of coal. These vessels are competent to ascend the river in the rains and during a great part of the dry season. A short time after this a steamer on a smaller scale was constructed at the Fort Gloucester Mills (below Calcutta) for the use of that establishment, and furnished with a single four horse high pressure engine, made at that factory, and this was followed up with another boat 50 ft. in length, with 6 horse power engines working upon a pressure of 45 lb. to the square inch, draught 17 inches, with a speed of 0 miles per hour, and carrying fuel for 13 days.

The next vessels built in the country were the Hooghly and Burhampootur, carrying engines of 25 horse power, the latter having her service assigned to her in the Assam Valley; the former, after her experimental trips, was found so wholly insufficient for the navigation inland as to be laid aside, a new vessel having been built on a plan better adapted to encounter the shoals and shallows of the navigable river. It had also been discovered that the draught should in no instance exceed four feet, and it was therefore necessary to construct vessels accordingly, and which experience has proved enables them to navigate in the upper provinces during the whole period of the dry season. The necessity of having vessels of small draught led to the idea of employing iron steam boats, and the material of two boats was sent from England to be put up in that country. These vessels have since been serviceably employed on the river.

The Indus is a much less navigable river than the Ganges, its shoals are more numerous, and are said to be more often shifting their position, and the currents in many parts are exceedingly rapid. On the other hand, it intersects a country occupied by barbarian tribes, who are more desirous to gratify their love of plunder, than to aid in the extension of commerce; but this latter circumstance is a very powerful reason for steam navigation on the river, as the best and most effectual check to those unruly people, and a sure and certain source of power, to which the Indian government can apply, should disturbances break out, or should operations in some future day be directed against the Punjaub. It is along this river the cotton districts spread, and it is from the want of speedy conveyance to Surat or Bombay, that the cotton, by undue and protracted exposure to the atmosphere, becomes depreciated in value, and sometimes totally spoiled. The annexation of Scinde to the territorial government of India will also be productive of immense benefit, by insuring greater safety to our commercial intercourse with the upper country; and by becoming, under European superintendence, the productive fount of great agricultural wealth, the whole country being wonderfully fertile and productive, and the inhabitants relieved from the tyranny of their rulers, will soon gladly exchange their feudal thraldom for the more profitable and lasting benefits derivable from their hitherto neglected lands.

Of the extent to which navigation may be carried in Bengal, by the powerful agency of steam, some judgment may be formed, when we state, in the words of Mr. Prinsep, that it is not the Ganges only, as a single stream, that confers these benefits which are derived from commerce, but all the large rivers that bring down the waters of the northern hills are navigable more or less throughout the year, and almost to the foot of the first range; these, too, are sufficiently numerous to sweep the commercial produce of all that track, without its needing any land transportation, except the Ghauts were it is embarked. Taking the limits of the Ganges and Jumma to the West and South in Hindostan and the Burhampootur and Megna to the East, the country completely intersected with navigable canals, and within which both trade and travel are mainly carried on by water, may be computed to cover an area of not less than forty square degrees.

With an extent of available water communication like this, intersecting in all directions a variety of rich and fertile soils, influenced in their produce by a variety of climate, passing through lands occupied by nearly one hundred millions of people, the greater part of whom are industriously inclined, and only await British capital to produce the staple commodities to any extent, to compete with America with her cottons, the Brazils and other slave states with their sugars, to re-open the now closed silk factories, and to grow the thousand necessary requirements of life; is it not wonderful that steam navigation should here labour under such disadvantages in its extension; and that advantages tested and approved by experience, should be suffered to escape those whose individual or conjoint interest it is to embrace them.

The late Burmese war is a practical illustration of the political advantages derivable from small river steamers in the time of war, and the still more recent military operations on the banks of the Indus, demonstrate, in the strongest manner, the necessity there exists of the Indian government having an effective steam force always at their disposal, in order to overawe the turbulent, protect the navigation of their rivers, facilitate communication, and open new sources of commerce, and consequently of revenue. The appeal to the mercantile community is equally strong, and in fact much stronger, it is to their vast individual advantage that a further extension of river steam navigation takes place; the merchants of the upper provinces, as formerly, know nothing of the trade of the lower provinces; the merchants of the lower provinces know nothing of what is passing above Merzapore; the goods transmitted by the common country boats, whether up or down, are liable to so many accidents that the rates of insurance are much higher than between India and Great Britain; and these dangers, arising from their being continually exposed to eddies, sudden and violent gusts of wind, shifting sands, sunken trees, and fallen banks, are necessarily encountered by the present system of tracking, and prolonged by this tedious and uncertain mode of travelling; added to this is the continual danger of robbery, and the impossibility of guarding against it, from the circumstance of being compelled to bring to every evening close in shore, and the increased expences entailed and constant damage done to the goods.

It is surprising to us at home that the lesson set by the Americans has not been followed by the merchants of the East. India, like the Western country, is the land of lakes and rivers. The American boats somewhat resembling the floating baths at Paris, and differ little from the first class budgerow of Calcutta, other than having an upper deck for the accommodation of passengers, the funnel being placed in the fore part of the boat; a description and drawing of one of these boats is given in Mrs. Trollope's work on America. There is a striking analogy between the rivers of the two countries, and although the American maintain a greater depth of water all the year round, the difficulties of navigation arising from natural causes are common to both. Captain Hall, speaking of the steam boats which ply up and down the Mississippi, observes—"Thirteen vessels of this description were lying along the banks of the river. One of them, called the Amazon, was just setting off for Louisville, in Kentucky, upwards of 1,400 miles distant, in the heart of the continent, which they hoped to reach in ten or eleven days, though they had to go in the very teeth of the current."

"These boats are employed exclusively upon the river, where the water is always smooth, and where, also, they are well sheltered by the woods. These circumstances allow of their accommodation being raised to the height of 20, and sometimes 30 feet above the water. They have two complete and distinct tiers of apartments. The upper one is appropriated to what are called deck passengers, who pay a very small sum of money, have no very luxurious accommodations, and provide themselvhs with food. The cabin passengers, or those who live in the apartments, fare differently, and are, of course, required to pay a higher sum for their passage."

These are the very boats best adapted for our Indian rivers, modified by giving them greater length, so as to ensure the smallest draught of water, they would more immediately suit the wealthier classes of the Indian community, and the conveyance of high priced or perishable articles, or those which are liable to spoil in the common sailing boats.

Objection has been made to the use of high pressure steam engines; and the many accidents on the American rivers have been quoted to show the impolicy, if not inhumanity, of employing them; but we think these fears over-rated, as they have been with railway steam engines; and certainly since steam has become so universal in its application, vast improvements have taken place in the machinery, so much so, that it is now of rare occurrence to hear of the blowing up of a river boat, and when this is the case it is generally found to be more the fault of the parties managing the engine than from any defect in her construction. It is true that steam tugs answer the purpose, but this to a limited extent only, and they are totally unfit for the more extended purposes of commerce. The results of experience show that extended accommodation is required; that under the present system, the benefits of steam power, while they answer all the purposes of the government in times of peace in carrying bullion, stores, &c., to and from the presidency, the mercantile community and the multitudes of Europeans and natives continually travelling to and fro, are either wholly debarred from sharing in these advantages, or, otherwise, they are made to pay those exorbitant rates of freight which are always the accompaniments of monopoly.

The Select Committee recommended tugs of low pressure, in order to decrease the draught and furnish more space in regular built boats; but had steam tugs answered the purpose in America, on the Missisipi, better than the boats, they would assuredly have adopted them. On the Missisipi, river boats are propelled, against a strong current, at between eight and nine miles per hour, averaging the voyage from New Orleans to Louisville, which is 1580 miles, and which has been performed in eight days. In India, up to the present day, they have attained nothing like that speed, although it is certain that the current of the Ganges is of much less force than the Mississipi.

The Reports of Select Committees have invariably recommended the employment of steam boats in our Indian rivers: the advantages, says one of them, given in so far back as 1829, are self evident; first for expedition, secondly their power of moving up and down the rivers at a greater draught of water than at present; thirdly, less risk of grounding, and they might have added, the application of their power to back them off the shoal when grounded; fourthly, a saving in anchors and cables. Again, it is maintained by them that the Indian government will themselves be the greatest gainers by it, and recent events have testified to the correctness of these calculations. The heavy losses sustained by disaster and plunder by the native vessels of every class are wholly unknown to steamers in the present day. We know of no instance where they have been plundered, and for this ten years past of any vessel of this kind having been lost. On the other hand, in common with the sea steamers, they have laid the foundation of a vast moral revolution in the commercial, agricultural, and political state of society, bringing all parts of this vast empire into one narrow circle of communication, and the country itself within a few days pleasurable sail of Great Britain.

Two manifest causes exist for the non-adoption of river steam navigation in India. The first is the Indian government having as many steamers as they desire under existing circumstances, they are indisposed to add to the load of debt with which they are already overwhelmed by any considerable outlay beyond that which they have gone to advance steam navigation viâ the Red Sea: the other is, the European merchants have so many calls for their capital, as merchants, bankers, agriculturists, brokers, and agents, that with them it is impossible, individually or collectively, to speculate to any extent in this way, and the natives are either too poor or too timid to embark in anything requiring a large expenditure, when the returns are not directly manifest to them according to their strict rules of mathematics. It is, therefore, left to the capitalists of this country to unite and subscribe the necessary funds; and attempts have been made time after time to get up a company for this purpose, but the temporary derangement of commercial affairs, and the little encouragement given by the East India Company, who were content to enjoy their monopoly, proved insurmountable barriers to success. Times, however, are altered, money is superabundant, and the direction of East India affairs is beginning to distinguish itself by a more liberal line of policy than has been displayed in bygone times; it is, therfore, to be hoped that British capital will not only be employed largely in the extension of steam navigation in the rivers of India, but also in developing those vast resources which India is known to possess to a far greater extent than those lands upon which we are now dependent for our cotton, sugar, tobacco, indigo, and other staple commodities, which, to the millions at home, have become, from long usage, absolute necessaries.

The following rates of hire for the large boats will give an idea of the expence of travelling on the Ganges. Assuming a voyage to Allahabad to last 2½ months, the charge would be for a Dacca pinnace, 1st class, at 18 to 20 rupees per diem, or for the trip 1,200 to 1,400 rupees, about £140; ditto, of the lowest class, at 12 or 14 rupees per diem, or for the trip, 900 to 1,000 rupees; Budgerow, of the 1st class, for the trip 650 rupees; ditto, of lowest ditto, 450 rupees; Patella, of 500 maunds (about 18 tons), 150 rupees; Oolak, of ditto, 150 rupees; Pulwar, of ditto, 150 rupees.

Of the distance to be traversed from Calcutta to Allahabad, we have 232 miles from Calcutta to the mouth of the Moorshedabad river Bhagratta, 248 from thence to Patna, 127 to Ghazeepore, and 200 to Allahabad. The extreme rise of the Ganges at Allahabad is 45 feet, by the 15th of October it usually falls to 6 feet.

A plan has been suggested for a canal communicntion, by which a vast distance, and consequently loss of time, would be saved; but the stupendous nature of the undertaking and the expence attending it precludes the necessity of discussing this subject, which probably in some future day will be carried into effect, if railroads do not render such an undertaking unnecessary. It is certain that the want of good roads is most sensibly felt in India. In the Madras presidency there are no roads beyond that city; around Calcutta the roads are few and very indifferent, and many of the roads in the interior are no other than water courses, laid dry for a greater portion of the year.

NUNHEAD CEMETERY.

The first stone of the Chapel to be erected in the Cemetery of All Saints, Nunhead, near Peckham, was laid on Monday, the 17th of June, by the Rev. Dr. Russell, the chairman of the London Cemetery Company, assisted by B. Hawes, Esq., the deputy chairman, and the other Directors. This extensive cemetery containing above 50 acres was enclosed and laid out in the year 1838, since which time the service has been read in temporary buildings, but the company having resolved to erect chapels suitable to the extent of the ground, and the increasing accommodation required by the populousness of the vicinity, which includes Peckham, Camberwell, Deptford, Lewisham, &c., selected the designs submitted by Mr. Thomas Little, architect, under whose direction they are now in progress. Both chapels are in the style of architecture prevalent in England about the middle of the 14th century, known as decorated English. The principal chapel is an octagon with a high pitched roof, and groined ceiling, modelled after the Chapter House at York; the exterior is to be built of Kentish Rag and Bath stone. Mr. Winsland is the contractor.

With regard to these chapels, considerable interest was excited in the early part of this year among the architectural profession for the result of the competition, which the Directors of the London Cemetery Company had instituted, by offering premiums of 100*l*. for the best, and 50*l*. for the second approved design, limiting the expenditure to 6,000*l*. Sixty-five sets of designs were sent in.

Architectural competitions have almost become a bye word for jobbing of all sorts; there has been too often "a foregone conclusion." Intrigue and interest have been set to work, and advertisements have so often been issued for designs, merely to cover a premeditated job, or favour a previously selected architect, that competitions are "caviare to the general." It is highly gratifying, however, in this instance, to record the good faith with which the Directors acted; deeming themselves incompetent from unprofessional experience, to decide upon plans and designs, where it was evident great taste and talent had been displayed, they referred the selection, and submitted all the drawings to Sir Robert Smirke. The report which he made to the Directors was as follows:—

TO THE ARTISTS.

15, Bridge Street, Blackfriars.

The Directors of the London Cemetery Company feel it due to the artists who have favoured them with designs for the Chapels at Nunhead to express their thanks for the exertions made on their behalf, and their appreciation of the taste and talent conspicuously displayed. They have much pleasure in presenting to each artist a copy of the letter in which Sir Robert Smirke conveys to them the results of his most disinterested and patient examination of the several drawings.

(Copy.) *52, Queen Anne Street, February 16th*, 1844.

Gentlemen,—I have felt great difficulty in fulfilling the promise made at your request to point out to your notice those designs given for the intended Chapels at the Nunhead Cemetery which are, in my judgment best entitled to the two premiums proposed to be awarded; but I have examined them carefully, and with an earnest desire to make a just selection.

Sixty-five artists have employed themselves upon this competition for your favour, and have submitted to you more than four hundred drawings prepared for the occasion; a very large proportion of this number shewing a high degree of talent, and made with great care and labour. I hope I have given to each of these drawings the consideration that was due to them, and after weighing every circumstance connected with the designs and the objects of the Directors in regard to the work, I beg leave to say, that I am of opinion the author of the design numbered 16, (comprising thirteen drawings) is entitled to the first premium, and the author of that numbered 55, (comprising fifteen drawings) to the second premium.

Your Secretary informed me that you were desirous I should also select for your notice any three other designs which might appear to me specially deserving of your approbation; I trust, however, you will excuse me in declining to do this, for there are so many others which are excellent and well-considered designs, that I should feel much reluctance in offering any farther opinion upon the comparatve merits of the artists who made them.

I regret exceedingly to know that so much talent, zeal, and industry can have no other reward upon this occasion than the well-deserved expression of your sense of their merits, with which I am persuaded you will favour them.

I remain, Gentlemen,
Your very faithful Servant,
(Signed) Robert Smirke.

To the Directors of
The London Cemetery Company.

The architect of the design No. 16, was Mr. Thomas Little, of Northumberland Street, New Road.

The architect of the design No. 55, was Mr. Brakspeare, a gentleman brought up in Mr. Barry's office.

The Directors, in order to test still further the impartiality of the decision, formed an exhibition of the designs, in their office at Bridge Street, which was open to general inspection for two days, and gave much satisfaction to the competing artists.

Mr. Little was instructed to take the necessary steps for carrying his design into execution, provided the amount did not exceed the estimate which he had reported, and we are gratified to hear that the amount of the accepted tender by Mr. Winsland, is below his estimate, and that the works are proceeding.

We have given the above details, as we consider it a fair example of the manner in which competition designs should be treated.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTE OF CIVIL ENGINEERS.

THE PRESIDENT'S CONVERSAZIONE.

The annual *conversazione* given by Mr. Walker, the president, took place on Friday and Saturday, June 7th and 8th, and when the attendance was even more numerous than on former occasions. About 300 gentlemen were present on Friday, but on Saturday the assemblage was much more brilliant, comprising the most distinguished persons for rank in science or the fine arts in this country. The worthy host, attended by Mr. Manby, the secretary of the institution, received the visitors on their arrival, and directed their attention to the objects most worthy of notice. Our limits will not permit us to enumerate all the very beautiful and curious things exhibited at this *reunion;* we, however, particularly noticed some very good busts by Mr. S. E. Jones, one of Major Blakeney, the other of Mr. Manby, the secretary, both of which were remarkable for their spirit, their good taste, and their striking similitude to the originals; there were some busts of much merit by the same rising artist in the different rooms; as also a very beautiful, and at the same time simple sketch, made at Strathfieldsaye, of his Grace the Duke of Wellington, on horseback, by E. H. Bailey, which was much admired; some bronzes from the collections of Mr. F. Hodgson, M.P., Mr. Deville, and Mr. Grissell, were in the rooms, as also wood carvings from Rogers, Pratt, and Vincent; a very beautiful engraving of the Duke of Beaufort's dog, by T. Landseer, from a recent picture of his brother Edwin's, and a Maltese dog by the same clever artists. Scanlan had several excellent sketches of scenes in domestic life; the best was an episode from the history of the White-boy in Ireland, an affecting picture now being engraved by Brown. A collection of rings intended to illustrate the most remarkable events in Grecian history, formed of beautifully carved heads of the ancient Greek philosophers and poets, attracted much attention, as did also some natural flowers coated with metal by the electro-deposit, after Elkington and Co.'s process, and some by the simple electrotype itself from Captain Ibbetson. The principal saloon was illuminated by an elegantly cut-glass chandelier from Apsley Pellatt's. The *chefs d'œuvre* of the evening, however, were a bust of Lorenzo de Medici, by Michael Angelo, belonging to Mr. Dennys, remarkable for the stern expression of the countenance, and the bold freedom of its style, and a choice painting by Demier, supposed to be a likeness of his mother, the most exquisite thing in its way that we have ever seen; some very good models of animals, &c., in *terra cotta*, were exhibited by B. Sangiovanni, the Neapolitan, of whose works we have often had occasion to speak favourably; Mr. Dunn, of the Chinese Museum, contributed some very beautiful things, one of them being a cameo, presented to him when in China, by Howqua, and other Hong merchants, valued in that country at 4,000*l.* Advancing further in the rooms, we found some chronometers from Dent and Frodsham; and also a machine for tracing ellipses, by Mr. Farey, a gentleman well known in the scientific world.

In the model-room, which was lighted by two gas chandeliers, on Faraday's principle, were various models of steam-engines, by the Earl of Dundonald, G. Rennie, Maudslay and Field, Boulton and Watt, and Borrie, and in the centre of the room was a full sized model of Greener's harpoon gun. Around the room were arranged models of various light-houses; a Russian camel for lifting large vessels over sand-banks; and some interesting models from the Admiralty; Bremner's apparatus for building harbours in deep and rough water; models of various forms of screw propellers (from Rennie, Smith, Galloway, and Grantham); Mitchell's screw-pile lighthouse and battery, proposed for the Goodwin-sands; Bush's caisson, and a compass of his, intended for the Royal yacht; a model to show the principle of the atmospheric railway from Mr. Vignoles; Prosser's timber railway, carriage, and locomotive, with guide-wheels for traversing very sharp curves; Barlow's hollow iron keys for fastening the rails in the chairs; Wood's soft metal bearings for railway axles; agricultural implements from Cottam; models of London-bridge with its cofferdams, and part of the centering of Stoneleigh Abbey-bridge, and of Scotney Castle, the latter by Mr. Dighton; a model of the Dover terminus, by Mr. Salter; a pair of finely turned candelabra, made of slate from Mr. G. K. Pollock's pant-draining quarries near Bangor, North Wales; curious specimens of what can be done with that material. The walls of this room had a very beautiful appearance given to them by some specimens from Mr. Ponsonby, of Regent Circus, Piccadilly, of Mr. Albano's patent Cannabic architectural ornaments, highly gilt and burnished; they were very much admired.

In the lower rooms were the heavier models of machinery, consisting of Bunnett and Corpe's concentric ring engine, Bodmer's breaks for preventing injury to heavy machinery, and many other interesting and ingenious specimens, which want of space alone prevents us from noticing.

The rooms were exceedingly crowded, but among the distinguished visitors present we particularly recognized the Marquis of Northampton; the Earls of Lincoln, Devon, Dundonald, and Lovelace; Lords Blayney and Courteney; Mr. Baron Parke and Mr. Baron Rolfe; the Bishop of Lichfield; his Excellency Ali Effendi, the Turkish Ambassador, and suite; Sirs R. Peel, G. Murray, H. Douglas, G. Clerk, and B. Martin; Major-Generals Monteith and Pasley; Colonels Maberly, Sykes, Jackson, Herbert, and Sloane; Lieutenant-Colonels Spottiswoode, Sabine, Alderton and Wells; the Lord Mayor and Mr. Sherriff Moon: and among the distinguished foreign visitors Meer Jaffir Ali Khan, Hoof Oolah Khan, Mohammed Allee, from Surat; Counts Lopez, Gola, and de Rosen; Barons de Linden and de Gerlache; Messieurs Horace Vernet, Bauguiet, Godesharle, Siemens, Strateneus, Bindewalde, Vanzeller, Mex, and Hebeler; Professors Brand, Wheatstone, Hosking, Ansted, Faraday, Willis, and Barlow; and almost every eminent artist, architect, and man of science now in London.

PORTUMNA BRIDGE.—SHANNON.

"*Description of a Bridge across the river Shannon at Portumna.*" *From the Minutes of Proceedings of the Institution of Civil Engineers, Feb.* 27, 1844." By Thomas Rhodes, M. Inst. C. E.

This paper describes a bridge which has been erected across the river

Shannon at Portumna, to form a communication between the counties of Galway and Tipperary, at the spot where a timber bridge formerly stood. The present structure is composed of straight cast iron girders, resting upon piers formed of timber piles, leaving thirteen openings of 18 feet 6 inches span each, between the Tipperary shore and Hayes Island, and twelve openings of the same span, between the island and the outer pier of the swivel-bridge, which is 40 feet 6 inches span, and is close to the Galway shore. The total length of the bridge is 558 feet 6 inches, exclusive of the width of Hayes Island, upon the centre of which are placed the toll-house, and a stone obelisk, commemorative of the building of the bridge, under the direction of the Commissioners of the Public Works for Ireland. The width between the balustrades is 17 feet. The ashlar work and rubble masonry of the abutments, the pier of the swivel-bridge, the toll-house, and the retaining walls, are of Portumna limestone, and are built with hydraulic mortar, the lime of which was burnt from the same description of stone as that used in the building. In the foundations, the sheeting piles are of red pine; the bearing piles of beech and larch; and the main piles and waling pieces for supporting the roadway girders are of Memel timber. The earth having been excavated down to the solid strata, of sufficient space for the abutments, retaining walls, counterforts, and the foundations for the swivel bridge (the latter being done by means of two coffer-dams); the foundation or bearing piles 8 feet long and 10 inches in diameter, were driven 4 feet apart, from centre to centre, along the foot of the abutment walls, and a capping of Dantzic timber 12 inches by 6 inches was spiked to them; the whole area of the foundation under the walls and counterforts, was covered with a thickness of 12 inches of concrete, composed of six parts of clean gravel and sand, and one of lime. A course of flag-stones 7 inches thick, was then laid and the walls were built, being backed with well pounded clay from the excavations, as the masonry proceeded; the space between the retaining walls was then filled to the underside of the roadway, and levelled to receive the broken stone or metalling. The ashlar work and backing, were laid flush in their respective kinds of mortar, and every course was well grouted, so that the whole might become one solid mass. The mortar was made of Portumna lime, in the proportion of two parts of sand to one of lime, fine sifted and wrought in a pug-mill. The main piles, 14 inches square, (after being Kyanized,) were driven at least 9 feet into the solid ground, at distances of 20 feet apart from centre to centre, and were cut off level, at the height of 9 feet 6 inches from the surface of the summer water-level. The caps were then tenoned upon them, all the joints having in them a sheet of patent felt saturated with boiled tar. The cast iron girders are 20 feet long, 17 inches deep, and $1\frac{1}{2}$ inch thick, with a flanch at the top 8 inches wide, to receive the roadway plates, and another at the bottom of 4 inches in width. They are supported by chairs cast in the caps, and are secured by distance pieces. The roadway plates are $\frac{3}{4}$ inch thick, secured by bolts and nuts, and the joints made with iron cement. Cast iron fascia plates are screwed to the outside girders, to carry the wrought iron balustrade.

Previously to leaving the manufactory of Messrs. J. and R. Mallet (Dublin), where they were cast, all the girders were proved, by placing them on supports 20 feet apart, and suspending from the upper edge a weight of 12 tons, which was made to traverse from end to end of the girder, in order to subject each part to the same test.

The swivel-bridge is composed of two leaves, with a clear opening of 40 feet for the navigable channel. The ribs forming the arched part of the bridge, from the abutment to the centre, are each cast in one piece, with flanches at the radiating line, to which the cross tie-plate is bolted; a continuation of each rib is carried across the upper frame, to the circular tie-plate at the end; these have also flanches to correspond with those of the arched ribs, and are bolted together; the flanches on the upper edge of the ribs, receive the roadway planking, which is of British oak $2\frac{1}{2}$ inches thick. The leaves turn on case-hardened iron rollers, and require about 15 tons of ballast, to balance them. The construction is minutely described, with the quantity of materials of all kinds employed, the dimensions of the several parts of the masonry, the timber work, and the cast and wrought iron work.

The specifications, the form of tender, and the prices of the various portions, are given, and it is stated that the total cost of the bridge, including the extra work, superintendence, law expenses, &c., was £24,131 8*s.* 1*d.*

Extracts from the journal of Mr. Smith, the superintendent of the works, give the dates of the commencement and termination of the several parts, from which it appears, that the first stone of the abutments was laid on the 13th September, 1838, and that the whole structure was finished on the 13th January, 1842.

WELLINGTON BRIDGE, NEAR AIRE.

"*Account of the building of the 'Wellington' Bridge, over the river Aire, at Leeds.*"[1] *March* 5, 1844. By JOHN TIMPERLEY.

This bridge was erected from the designs, and under the direction of the late John Rennie; it is situated on the line of road leading from Leeds towards Wortley and Armley, and spans the river Aire at a spot where it is 100 feet wide, and about 6 feet in depth; the banks rising to between 7 feet and 8 feet above the surface of the water. The borings, which were made to the depth of 30 feet, on each shore, to prove the ground, previously to commencing the construction, showed the strata to consist of fine sand, and then sand and gravel, with thin layers of what was supposed to be stone, but was probably, hard concreted gravel, such as was afterwards found in excavating for the foundations. That on the south bank, was commenced in the middle of September, 1817. The upper part, for 6 or 7 feet in depth, was through fine soft sand; then came a bed of alluvial gravel, containing, at about 12 feet from the surface, black rotten wood, roots of trees, shells, bones, and horns of animals. The upper part of this gravel was coarse and open, but it gradually became finer and more compact, until it assumed the hardness of a concreted mass, resembling agglomerate, very like (except in colour) the Blackwall rock, which was taken up about forty years since, in deepening the entrance from the Thames to the East and West India Docks. Upon this stratum Mr. Rennie ordered the foundation to be placed, although it was not so deep by 4 feet, as he had originally intended.

The coffer-dam, which was formed of a double row of piles of half timbers, from 15 feet to 18 feet in length, was then completed; the best earth that could be procured for the puddle, was of so light a nature, that in high freshes the leakage became so considerable, as to render it advisable to allow the dam to fill with water, to prevent its blowing up. The details of the construction of this coffer-dam are given. It was kept dry by a steam-engine of 6 horses' power, which was fixed on the shore, and worked the pumps by an endless chain. The quantity of water was such as to keep the pumps constantly at work, night and day. The coffer-dam for the north bank was constructed after the foundations on the south shore were finished. The details are then given of the sheet piling and wales, &c., in front of the abutments, which are each 30 feet long, by 28 feet wide, at the bottom, diminishing by offsets to 27 feet in length, by 21 feet in width, at the springing of the arch.

The abutments are built in radiating courses within, but on the faces they are horizontal; the stones were from 14 inches to 18 inches thick, cut correctly from templates, made to suit the respective courses. The lowest foundation courses were of large blocks, laid dry, and the joints well grouted; but the other courses, up to the ordinary water line, were laid in mortar, made from magnesian limestone, got on the banks of the Aire, a few miles above Ferry Bridge: the proportions were, one part of lime, one part of clean sharp river-sand, and one part of forge scale, the whole well mixed and tempered, and used quite hot. The grout was made from the same lime, and was used for all the courses, except the lowest, where Parker's cement was employed, which was also used for pointing all the face joints up as high as the water-level. In the other parts of the structure, the mortar was composed of one part of lime to two parts of sand, but that for the arch was made of equal proportions of lime and sand. Great care is stated to have been taken with the joints, as no under-pinning was allowed, the beds of the stones being all dressed to coincide accurately. The ordinary allowance was $\frac{1}{8}$th inch for each joint, but on trying the first fourteen courses, from the springing, it was found, that 1 inch only was taken up by the joints, which gave $\frac{1}{14}$th inch for each. The stones were laid on the south side by a moveable crane, and on the north side from the end of the two-wheeled truck (somewhat resembling a timber carriage) by which they were brought from the stone-yard on the south bank, along a wooden tramway and temporary bridge, extending from the south to the north shore, using either a simple sling, or sheave-blocks, for placing the stones, according to their dimensions and weight. The construction, dimensions, and cost of this truck and of the crane are given in detail.

The abutments being finished, the piles were driven, to support the centres, which were fixed so high as to be above the freshes. The lagging was laid 5 inches higher than the proposed arch, to allow for it settlement. The six centres were framed of Memel pine, each rib containing about 370 cubic feet of timber. The striking-wedges were of seasoned oak, well greased; they were 6 inches wide and 9 inches in height altogether, the middle one, which was the largest, being the striking wedge. They were, however, found to be too narrow, for they were squeezed upwards of an inch into the timber, by the weight of the centres and the masonry. Prior to framing the centres, one-half of the arch, which is a segment of a circle of 91 feet radius, with a versed sine of 15 feet, was laid down, full size, upon a platform, from which templates were made, for dressing the voussoirs and arch-stones; the front voussoirs were 7 feet on the bed, at the springing, diminishing to 4 feet at the crown; but the interior arch-stones, near the springing, were much wider. The arch-stones were, on an average, 3 feet long, by 18 inches thick. It was customary, in setting the stones, to saturate them with water; a thin coat of mortar was laid on the under stone, the upper one was lowered, and well beaten down while the mortar was soft; the surfaces were thus brought closely in contact with each other, and any interstices that remained, were grouted, after the vertical joints had been pointed with cement.

When the arch was turned to the extent of one-third from each side, about 20 tons of stone were piled on the crown, as an equipoise for the centres, and the haunches were not loaded until the key-stones were placed. The turning of the arch occupied four weeks; when that was finished, the haunches were completed, and the centres were eased; but it was found that the weight, which before the arch was keyed was equal to 1000 tons, had forced the wedges into the timber, so as to render it necessary to cut some of them out, which occupied three days for the first easing. A second easing took place two days after, and after a third easing the centres were removed. During the progress of the work, the arch squeezed down about $2\frac{1}{2}$ inches; in a few days after the centres were struck, it settled $1\frac{1}{2}$ inch, which increased slowly to $2\frac{1}{2}$ inches, after which no further subsidence was observed.

[1] The discussion of this paper was extended through part of the meetings of March 5th and 12th.

The arch had thus arrived at the exact dimensions which were proposed by Mr. Rennie.

An account is then given of the progress of the remainder of the structure the forming of the parapet, the roadway, the approaches, &c., the whole of which were finished on the 18th of June, 1819, having occupied thirty-three months in construction. The stone used in the bridge, is a brown coarse sandstone, or mill-stone grit, of great durability, from the quarries at Bramley-fall, about four miles from the bridge; they were brought down by water to within 120 yards of the work. The price of the stone in the vessel alongside the work, scappled ready for dressing, was 9*d.* per cubic foot; the dressing and setting, exclusive of the cornice and the parapet, cost $4\frac{1}{2}$*d.* per cubic foot, which, with conveyance and mortar, made in the whole 15*d.* per cubic foot; the cost of the cornice and parapet walls was about 4*d* per cubic foot extra.

The total quantity of masonry was 80,000 cubic feet, and the entire cost of the bridge, including the toll-house, was £7,530.

Remarks.—Mr. Rennie concurred in the accuracy of the description of the 'Wellington' Bridge; it presented an excellent example of theory and practice, not only on account of its strict conformity with the principles of equilibrium, but from the correctness with which the works had been executed, as was evinced by the small subsidence of the arch after the centres were struck. Respecting the theory of the arch, writers were nearly agreed upon the principle established by De la Hire, upon the equilibrium of a loaded chain, or of a series of voussoirs, or wedges, with polished touching surfaces, as shown in his 'Traité de Mécanique,' in 1695.[2] The subject had been variously demonstrated by writers, but with little effect; architects were forced to select examples at random, for which no precise rules existed; but any persons on examining the actual state of an equilibrated arch of solid materials, or of a substantial chain suspended at its extremities by points, would immediately perceive the difference in the curves, or loads on the extrados, arising from the want of sensibility in the arch, or in other words, from friction and adhesion. Hitherto theory had been unable to comprehend these retarding forces, which had actually been so serviceable to the architect: Perronet was perhaps the first to throw any real light upon the subject; the experiments that he undertook, on the absolute strength of materials, in the year 1758, previously to the commencement of the celebrated bridge of Neuilly,[3] and subsequently, those by Gauthey, on the failure of the piers of the church of St. Geneviève,[4] at Paris, were very instrumental in the advancement of the art. It was, however, chiefly owing to the good quality of the material, that Perronnet was enabled to surmount the difficulties which arose from the unusual subsidence of the arches, in the bridge of Neuilly. The splaying of the arches, by which a double curvature was given to them, and which had been injudiciously copied in this country, was neither justified by science nor practice. The results of the French experiments were much too slow in reaching this country, and the strength of building materials was but little attended to, until within a recent period.

In the year 1824, the late Dr. Thomas Young having engaged to contribute the article 'Bridge,' to the Supplement of the sixth edition of the 'Encyclopædia Britannica,' applied to Mr. Rennie, to furnish the particulars of the Waterloo and Southwark bridges, then just completed; when, finding the data insufficient, Mr. Rennie undertook a series of experiments on the absolute and relative strength of materials, part of which he communicated to Dr. Young, and he subsequently published the whole in the 'Philosophical Transactions,' for 1818.[4] The results were then applied to the calculations, on the lateral thrust of the arches of those bridges, perhaps for the first time in this country, and which were more amply applied afterwards to bridges in general by Mr. Ware, and his tables of the relative boldness of brick, stone, and iron bridges, were valuable accessions to our knowledge on this subject.[5] As regarded the friction of arches, Mr. Rennie found that the arch stones of Waterloo and New London bridges commenced gliding, or pressing upon the centres, at angles of from 33° to 34°; he believed that soon after the adhesion of the mortar commenced, the centres would have very little pressure on them, even from stones at an angle of 45°. As to the gliding of the arch stones at the haunches, from the pressure of the upper voussoirs, he had never seen an instance of it; but he had seen the haunches so much eased from the centres, by the lateral action, exerted in driving the stones into the vertex of the arch, as to allow the lagging, or cross bearers above the ribs, to be taken out. This proved the correctness of the rotative system of voussoirs, as shown by experiment. With respect to adhesion, Mr. Rennie had seen its effect on broken arches of considerable magnitude, among the buildings of Rome, and also in the bridge of Alcantara over the Tagus, where the centre arch, of nearly 100 feet span, had been blown up by the French, leaving the adjoining arches and piers, which were upwards of 90 feet in height, standing perfectly undisturbed. With respect to the magnitude of arches, M. Perronet expressed himself confident that arches of 500 feet span could be safely executed. The bridge which he proposed to construct, over a branch of the Seine, at Melun, consisted of a segment of a circle of 400 feet. The experience he had derived from the length of the primitive radii of the the arches of the bridge of Neuilly, and his experiments on the strength of materials, would appear to justify so bold an experiment.

Mr. Rennie was of opinion, that with our strong magnesian limestones and hard granites, arches of larger span than any hitherto built, might be safely constructed. There were numerous examples, both in ancient and modern times, of very large arches. The bridge of Narni, in Italy, of Vielle Brioude, in France,[6] and of Alcantara, in Spain, by the ancients; and those of Gignac, and of Castel Vecchio, by the middle ages; but the most remarkable example of cylindrical vaulting (the remains of which still existed), was the bridge of Trezzo, over the Addu, in the Milanese.[7] The span was 251 feet over the chord, and 266 feet over the semicircle. The stone beams in the church of the Jesuits at Nismes, and those between the towers of Lincoln Cathedral, the former equal to the segment of an arch of 565 feet span, and the latter to one of 262 feet span, proved how much could be done with materials of small dimensions.[8] In modern times there were examples of bold vaulting in France, in the bridges of Neuilly, Mantes, St. Maixence, and Jena; in Italy, in the Ponte Sta. Trinita, Turin; in England and Wales, in the bridges of Llanrwst, of Pont-y-tu-Prydd, of Gloucester, of Chester, and those of London and Waterloo over the Thames; independently of numerous arches and viaducts, more recently erected for the use of railways. The radii of curvature of the centre arch of New London bridge, taken near the vertex, would equal in boldness an arch of 333 feet; and the length of the key-stone, at 4 feet 9 inches, would make the depth only $\frac{1}{70}$th of the whole span.

The origin of the arch had occasioned much controversy. The subject had been learnedly investigated by Dutens, Le Roy, King, and others, but apparently to little purpose, as the invention of the arch would now appear to be, with more justice, attributed to the Egyptians, as they seemed to have used it, many centuries before the Christian era. The researches of modern travellers, particularly those of Sir Gardiner Wilkinson,[9] proved that the brick arch was known in Egypt in the reign of Amenoiph I., 1540 years B.C., and the stone arch in the time of Psamaticus II., 600 years B.C. "The most remarkable," says Sir Gardiner Wilkinson, "are the door-ways surrounding the tanks of Assassief, which are composed of two or more concentric semicircles of brick, as well constructed as at the present day, and all the bricks radiate to a common centre." Mr. Hoskins was of opinion that arches were constructed long anterior to the time of the Ptolemies; for in the pyramids of Ghebel Birkel and Dunkalie, which were of more ancient date, both round and pointed stone arches were discovered. Mr. Perring stated that he found at Thebes some remarkably well-formed arches of 12 feet to 14 feet span, built in concentric half-brick rings, the bricks of which were marked with the name of Sesostris; consequently they were upwards of 3180 years old.[10] A representation of the tomb of Saqqura and its arched vault of stone, was given in the vignette of the 10 chapter of the third volume of Sir Gardiner Wilkinson's "Manners and Customs of the Ancient Egyptians." The arch seemed to have been known to the Etruscans; and from the representations of their palaces and their sea-ports, the arch appeared generally to have been employed for moles and jetties. With reference to the knowledge of the arch among the Greeks, opinions were very contradictory. The researches of modern travellers had brought to light many curious remains of Cyclopean or Pelasgic architecture; but in confirming the descriptions of the ancient cities of Mycenæ and Orchomenos, they had left us still in ignorance as to their actual knowledge of the arch.

Mr. Rennie exhibited a series of lithographic prints, from drawings made by the late Mr. Dodwell during his travels in Greece. They displayed the various doorways of Pelasgic fortifications, from the lintel of single stones resting on upright jambs, to the overlapping of the stones until they reached each other, in the form of a triangle, as in the gate of the lions, the entrance into the treasury of Atræus, &c. But the most remarkable monument was the subterranean chamber, of which Mr. Dodwell's lithographic plate gave an imperfect idea; complete plans and sections of that extraordinary building were given by Mr. Donaldson in the supplement to the "Antiquities of Athens,"[11] from which it appeared, to have been constructed in the form of a parabolic cone, of 48 feet in diameter at the base and 44 feet 6 inches in height, by means of rings of regular masonry, overlapping each other until they reached the apex, where the aperture was closed by a flat stone. From this and other buildings of a similar kind, there was reason to infer that the ancient Greeks had very imperfect notions of the arch. Mr. Kinnaird, in his

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2 'Traité de Mécanique.' De la Hire. 12mo. Paris, 1695.

3 'Decription des projets et de la construction des Ponts de Neuilli, de Nantes, d'Orlèans, &c.' Perronnet. 4to. Paris, 1788.

4 'Construction desPonts.' Gauthey. 4to. Paris, 1809.

4 Vide 'Phil. Trans.,' 1818, p. 118.

5 Vide 'A treatise on Arches and their abutment piers.' By Samuel Ware. 8vo. London, 1809.

6 The following dimensions of the Pont de Brionde are given in a letter from M Seguin to Mr. Rennie (dated Feb. 27, 1827). "The ancient bridge was constructed by the Romans for the use of foot-passengers, pack-mules, and small carts drawn by oxen.

	Metres.		English feet.
Length of the arch . . .	56	=	183·73
Breadth " . . .	5	=	16·005
Height " . . .	18 to 19	=	59·058 to 61·339

"The arch was a segment of a circle, formed of volcanic stone, of little consistence. The bridge gave way in the course of time, but was upheld for fifteen years, by means of buttress walls, 6 metres (= 21·68 English feet) in thickness, and 10 metrea (= 32·8 English feet) in height; and also by bars of iron, fixed in the wing wall, and through several courses of the arch-stones. The structure finally fell, and a new stone bridge has been erected upon the same site, of which the following are the dimensions:—"

	English feet.
Opening of the arch, (which is a semicircle) .	150·9
Breadth of ditto	24·7
Height from the stream to the pavement . .	83·7

7 A section of this arch is shown in Part 1 of the "Theory, practice, and architecture of Bridges." Hann and Hosking. 8vo. Weale. London, 1839.

8 Robinson, in his "Travels in Palestine," mentions the remains of an arch over the valley of Kedron, at Jerusalem, supposed to have been 350 feet span.

9 "Manners and Customs of the Ancient Egyptians." Wilkinson. 3 vols. 8vo. London, 1837.

10 Vide Minutes of Proceedings, Inst. C. E., for 1843, page 170.

11 "Antiquities of Athens," &c. Stewart and Revett, Supplement, Folio, London, 1830.

"Description of the Antiquities of Delos,"[12] gave a representation of a portal or gateway on the ascent of Mount Cynthus, formed to support the wall of the ancient fortifications. The entrance was constructed with ten large stones inclined to each other, like those at the aperture into the great Egyptian pyramid. It was perhaps the earliest specimen of Pelasgic architecture in Greece, displaying the first step towards the principle of the arch. That it was known by the Etruscans seemed evident, from the remains of arches and bridges, now existing in the country of the Volsci in Italy; and the researches of travellers in that country, within the last few years, had brought to light many curious examples, anterior to the period of the Cloacæ of Rome, and the tunnel of Albano by Ancus Martius. Mr. Rennie was of opinion, from his examination of the subject, that there existed no sufficient evidence, to establish the knowledge, or use of the arch among the Greeks.

Mr. Page presented two sketches made by him of two arches at Cape Crio (Cnidus, Rhodes). These arches were semicircular, built of large stones regularly radiating from a centre, without any mortar in the joints, and stood among Cyclopæan remains, of which they apparently formed a part. He was of opinion, that the Greeks were aware of the properties of the arch. They evidently appreciated its form, for it must have been noticed by all travellers, how frequently the flat lintels were cut out on the under side; several specimens of this existed in the sepulchral remains now in the British Museum. At Athens, he had noticed a very considerable excavation of a regular arched form through solid marble.

Mr. Rennie observed, that as more useful lessons were given by failures in construction, than by records of successful undertakings, he had caused a large drawing to be made, of the bridge of Boverie at Liège, showing its state at the time of the report upon it, by the commissioners appointed by the Belgian Government, when it was condemned, and was ordered to be reconstructed, at the cost of the contractor, which however had not yet been done. The bridge, which was built of hard, compact, magnesian limestone, consisted of five arches of 78 feet span each, with a versed sine of 8 feet, which was between $\frac{1}{9}$th and $\frac{1}{10}$th of the span. The form of the arch was that of a segment of a circle of 100 feet radius, the angle of the springing was therefore 46° 45′. The abutments at either extremity were of rubble masonry, and were very deficient in weight and dimensions. The obvious consequnce of this want of due proportion was, that the abutments gave way, all the arches sunk at their centres, many of the stones nearly falling out, several of them were fractured in both directions, serious dislocations occurred in each pier, above the springings of the arches, and also down upon the cutwaters, and in spite of all attempts to remedy the defects, the bridge was condemned and was taken down, although it had cost upwards of £25,000. It was evident that these flat arches were not well proportioned, and that the abutments were insufficient to support their thrust. It appeared also, from the report of the Commission (of which he presented an abstract, No. 672), that sufficient attention had not been paid to the quality of the workmanship, or in the selection of the materials employed.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

June 3.—T. B. Papworth, V.P., in the Chair.—Mr. C. H. Smith resumed the subject commenced on the 29th April, (see *Journal*, p. 200), "*On the Magnesian Limestones, especially with reference to those employed in the New Houses of Parliament*."—Previously to the Commission appointed to investigate the choice of a material for the Houses of Parliament, the proper selection of stone for building purposes with regard to its quality had been strangely neglected. Public attention was first called to this subject by Sir H. De la Beche in 1835, and the inquiries, originated by that gentleman, resulted in the establishment of the Museum of Economic Geology and the Commission, of which Mr. Smith was a member. On the first preparations for rebuilding the Houses of Parliament, efforts were made by our neighbours in Normandy for the introduction of Caen stone, and a great number of specimens were sent, comprising stone of every quality, from the best to the worst, all passing under the same name. In selecting the stone for the Houses of Parliament, the Commissioners had to take into consideration a variety of circumstances, independent of the mere quality; as the situation of the quarries, the facility of water-carriage, and the assurance that the supply of stone would not fail during the progress of the work, and that the cost of labour upon it should not greatly differ from that upon the building stones in general use. Upon comparing the produce of many quarries, the Bolsover Moor stone appeared to the Commission to be the best adapted; and as beds of stone of nearly the same quality extend over a tract of about fifteen miles from north to south, the quarries of North Anston were finally selected, as uniting in the greatest degree all the conditions demanded. In this locality an ample supply of stone lies at a depth of from ten to fifteen feet. Eight beds of stone of the best quality, are found lying nearly level, the uppermost affording blocks of four feet thick, and the remainder from two feet and a half to eighteen inches. The quantity of stone supplied from the Norfol Quarry at North Anston, between February 1840 and April 1844, amounted to 726,893 cubic feet. Mr. Smith made some remarks on the effect of lichen on the surface of stone, which has been supposed favourable to its preservation. His own observation had led him to a different conclusion, as he had found stone covered with lichen reduced to powder to the depth of a sixteenth of an inch on its removal; and he suggested that the lichen had had the effect of absorbing some of the elements of the stone. In some specimens of magnesian limestone the lichen appeared to have taken up the lime and left the magnesian.

June 7.—Right Hon. Sturges Bourne, V.P. in the Chair, Mr. Faraday "*On recent Improvements in the Manufacture and Silvering of Mirrors*."—Mr. Faraday's subjects were: 1. The manufacture of plate-glass. 2. The *ordinary* mode of silvering mirrors. 3. The *new* method of producing this result, lately invented and patented by Mr. Draytoo.—1. Mirrors are made with plate glass. Mr. Faraday described glass generally as being essentially a combination of silica with an alkaline oxide. The combination, however, presents the character of a solution rather than of a definite chemical compound, only it is difficult to affirm whether it is the silica or the oxide which is the solvent or the body dissolved. From this mutual condition of the ingredients, it follows that their product is held together by very feeble affinities, and hence, as was afterwards shown, chemical reagents will act upon these ingredients with a power which they would not have were glass a definite compound. Mr. Faraday noticed, that as glass is not the result of definite proportionals, there are many combinations of materials capable of producing a more or less perfect result. Each manufacturer, therefore, has his own recipe and process, which he considers the most valuable secret of his trade. It is, however, well known, that the flint-glass maker uses the oxides of lead and of sodium, the bottle-glass maker lime, (an oxide of calcium) and the plate-glass maker, in addition to soda, has recourse to arsenic. Mr. Faraday then adverted to the corrosions which take place in the inferior qualities of glass, owing to the feeble affinity with which their ingredients are held together. He stated, that from the surface of flint glass a very thin film of soluble alkali was washed off by the first contact of liquid, leaving a fine lamina of silica, the hard dissoluble quality of which protected the substance which it covered. If, however, this crust of silica chanced to be mechanically removed, the whole of the glass became liable to corrosion, as in ancient lachrymatories and other glass vessels. Mr. Faraday illustrated this by the corroded surfaces of two bottles, one obtained from a cellar in Threadneedle Street, where it had probably remained from the period of the great fire of London, another from the wreck of the *Royal George*. A still more striking instance of the instability of glass as a compound was exhibited by formations in the interior of a champagne bottle, which had been filled with diluted sulphuric acid. In this case the acid had separated the silica from the inner surface of the glass, and formed a sulphate with its ingredient, lime. The result was, that the bottle became incrusted internally with cones of silica and sulphate of lime, the bases of which, extending from within outwards, had perforated the sides of the bottle so as to cause the escape of the liquor it contained. Mr. Faraday referred to the long period of annealing (gradual cooling) which glass had to undergo as a necessary consequence of glass wanting the fixity of a definite compound. He concluded this part of his subject by describing the mode of casting plates, and the successive processes which gradually produce the perfect polish of their surface. 2. Mr. Faraday next exhibited to the audience the mode of silvering glass plates as commonly practised. He bade them observe that a surface of tinfoil was first bathed with mercury, and then flooded with it. That on this tinfoil the plate of glass, having been previously cleansed with extreme care, was so floated as to exclude all dust or dirt; that this was accomplished by the intervention of ½ in. of mercury (afterwards pressed out by heavy weights) between the reflecting surface of the amalgam of the mercury and the glass; and that when the glass and amalgam are closely brought together by the exclusion of the intervening fluid metal, the operation is completed. 3. The great subject of the evening was the invention of Mr. Drayton, which entirely dispenses with the mercury and the tin. (See last month's *Journal*, p. 206). By that gentleman's process, the mirror is, for the first time, literally speaking, *silvered*, inasmuch as silver is precipitated on it from its nitrate (lunar caustic) in the form of a brilliant lamina. The process is this: on a plate of glass, surrounded with an edge of putty, is poured a solution of nitrate of silver in water and spirit, mixed with ammonia and the oils of cassia and of cloves. These oils precipitate the metal in somewhat the same manner as vegetable fibre does in the case of marking ink—the quantity of oil influencing the rapidity of the precipitation. Mr. Faraday here referred to Dr. Wollaston's method of precipitating the phosphate of ammonia and magnesia on the surface of a vessel containing its solution, in order to make intelligible how the deposit of silver was determined on the surface of clean glass, not (as in Dr. W.'s experiment) by mechanical causes, but by a sort of electric affinity. This part of Mr. Faraday's discourse was illustrated by three highly striking adaptations of Mr. Drayton's process. He first silvered a glass plate, the surface of which was cut in a ray-like pattern. 2nd. A bottle was filled with Mr. Drayton's transparent solution, which afterwards exhibited a cylindrical reflecting surface. And 3rd. A large cell, made of two glass plates, was placed erect on the table, and filled with the same clear solution. This, though perfectly translucent in the first instance, gradually became opaque and reflecting; so that, before Mr. Faraday concluded, those of his auditors who were placed within view of it, saw their own faces, or that of their near neighbours, gradually substituted for the faces of those who were seated opposite to them.

The INSTITUTE have resolved to award the following medals next year, to the Authors of the best Essays on the following subjects:—

1. On the system and principles pursued by the Gothic architects from the

[12] "Antiquities of Athens," &c. Stewart and Revett. Supplement. Folio. London, 1830.

11th to the 15th centuries inclusive, in the embellishment, by colour, of the architectural members and other parts of their religious and civil edifices.

2. On the various species and qualities of slates, with an analysis of their component parts,—their relative value and applicability for building purposes, and the best chemical tests for ascertaining their durability.

N.B. Each Essay to be written in a clear and distinct hand, on alternate pages, and to be distinguished by a mark, or motto, without any name attached thereto.

The Soane Medallion to be awarded to be awarded to the best design for a College in an University, of Roman or Italian architecture, adapted for twenty fellows and four hundred scholars, with chapel, hall, retiring rooms, library, lecture rooms, and a theatre capable of containing one thousand persons. There must be provided a residence for the principal, a suite of four rooms for each fellow, and two rooms for each scholar, with suitable accommodation for the several inferior officers; likewise kitchen, scullery, buttery, and other requisite domestic offices.

The building to be placed in an Area of about ten acres;—the portion not occupied by the buildings to be laid out in gardens, courts, or terraces.

The Council expect a design, the principal buildings of which shall be composed in a noble and imposing style, with the subordinate features forming an appropriate group.

N.B. The general plan of the buildings is to be as large as a sheet of antiquarian paper will admit, with two elevations and a section of the entire composition, to the same scale as the plan; together with such other drawings to a larger scale, as the candidate may consider necessary for the perfect development of his design. The block plan may be to a smaller scale. The plans, elevations, and sections, to be tinted in India ink or sepia.

The competition is not confined to members of the Institute.

DIRECTIONS FOR CANDIDATES.

Each Essay and set of Drawings is to be accompanied by a sealed letter, containing the name of the writer within, and on the outside the same motto as that attached to the Essay or Drawings; this is to be enclosed in a sealed envelope, containing an address, to which a communication may be sent of the decision of the Institute, and directed—

To the Honorary Secretaries of the Royal Institute of British Architects.

Essay for Medal (or) Drawings for Medal (Motto).

The Packet, so prepared and directed, is to be delivered at the Rooms of the Institute, on or before the 31st of December, 1844, by Twelve o'clock at noon.

The Council will not consider themselves called upon to adjudge a Premium, unless the Essays or Drawings be of sufficient merit to deserve that distinction; and, if the best drawings should be by a candidate who has been successful on a former occasion, the Institute reserve to themselves the power of adjudging such other adequate reward as they may think fit, and of awarding the Medals offered to the second in merit. The Essays and Drawings, to which Premiums are awarded, become the property of the Institute, to be published by them if thought fit. In case of the papers not being published within eighteen months after receiving the Medals, the authors will be at liberty to publish them.

THE ROYAL SCOTTISH SOCIETY OF ARTS.

June 10, 1844.—Mungo Ponton, Esq., F.R.S.E., V. P., in the Chair.

The following communications were made:—

1. "*On the Uses and Adaptation of Iron as a material for Building;*" with Drawings and explanation of the construction of the first iron-house built in Great Britain. By William Fairbairn, Esq., Hon. Member, R.S.S.A., Engineer, Manchester. In this paper Mr. Fairbairn gave a detailed account of an iron-house constructed by him for the Seraskier Halil Pasha at Constantinople, to be used as a corn-mill. It was 36 feet long by 24 broad, and contained 48 tons of iron—was completely fire-proof—and, taking advantage of Mr. Hodgkinson's experiments on the strength of iron, he has given the different parts the greatest strength combined with lightness of metal. Excellent drawings, plan, section, and elevation were also given. Mr. Fairbairn introduces an inner coating of plaster upon coarse wire gauze, leaving four inches of space betwixt the iron exterior and the inner chambers, which guards against the extremes of heat and cold. Mr. Fairbairn also viewed the adaptation of cast-iron to architectural ornament, especially where enriched forms have to be frequently repeated—which affords great facility for the introduction of ornament at a moderate cost, and where but for this it would be unattainable, he, therefore, called the attention of architects and engineers to the subject, and shewed that as iron is now extensively used in ship building, so it is well adapted in many situations, particularly where stone is scarce, to architectural purposes, and even where stone may be had in abundance, iron is well adapted for decorative purposes.—The thanks of the Society were voted to Mr. Fairbairn, and his communication was referred to a Committee.

2. "*Observations on the Railways, and the Flax and Cotton Manufactures of Belgium.*" With Drawings. By John Anderson, Esq., Cupar-Fife, F.R.S.S.A. Mr. Anderson's paper was the result of a tour lately made in Belgium. After a few introductory remarks, he described the Belgian system of railroads, and gave the estimated cost of the different lines, and the anticipated cost of the whole establishment when the Government project shall have been fully completed. He enumerated the principal works of art, and stated the radii of the most important curves, and also the principal gradients. From this paper it appeared that the fares on the Belgian lines were considerably lower than those in this country, and that in 1839, when they were for a time raised, a great diminution of passengers was the result. The accidents that have taken place upon the different lines throughout the country are comparatively few, and when the number of passengers is compared with an equal number who travelled by the common diligence, the calamities by railway communication are found to be fewer, and the safety of the passengers in general much greater. The concluding part of the paper described the present state of the flax and cotton manufactures in Belgium, and compared them with those in this country. Mr. Anderson believed that the Belgians had made great improvement in some of the manufacturing arts; and he had no doubt that if they continued to show the same spirit of improvement which they had done for these two or three years past, they would soon rank among the most important manufacturing nations of Europe.—Thanks voted, and referred so a committee.

3. Description, with a Drawing, of a new Arrangement of *a Canal Lock.* By William Galbraith, M.A., teacher of mathematics, Edinburgh.—Mr. Galbraith proposed a plan which had occurred to him some years ago, for the more speedily filling and emptying of Canal Locks. He proposes two side chambers, the one in connection with the upper, and the other with the lower reach, with sluices upon them, the effect of which is, that when the one is opened the water flows into the lock through numerous pipes of large diameter, along the whole length of the lock; and when the other sluice is opened, and the former shut, the water in the lock is speedily emptied into the lower reach, by which a great saving of time is effected, and the great agitation of the water in the lock prevented.—It was remarked by the Secretary, that he understood that a lock on this principle had been introduced by Mr. Walker, civil engineer; and this was an instance which frequently occurred, where two ingenious men hit upon the same idea unknown to each other.—Thanks voted, and referred to a committee.

4. *An Elliptograph,* on the trammel principle, was exhibited, by which an Ellipse may be formed of any given proportion and size, from half an inch to 18 inches radius. Invented by Mr. D. R. Hay. Communicated by Mr. Alexander Bryson.—Mr. Hay exhibited the Elliptograph, and described it verbally, showing at the same time its mode of operation. It consists of a plane table of iron, having a trammel cut on the under side, into which two studs work, and these studs can be brought close together, or separated from each other, by right and left handed screws, while at the same time the arm bearing the pencil for describing the Ellipse is pushed outwards or drawn inwards by another screw. A wooden table is fitted to the iron table, on which the paper is fastened; and after adjusting the studs and pencil to the required Ellipse, the table is turned round by the hand, and the pencil traces the Ellipse. Mr. Hay promised to give a written description and drawing of the machine.—Thanks voted, and referred to a committee.

ON LOUD BEATS OF CLOCKS USED IN OBSERVATORIES.

A paper by J. S. Eiffe, Esq., lately read at the Astronomical Society explains a simple and easily applied method of obtaining very loud beats for the astronomical clock. The mode of constructing the apparatus is as follows:—Two pieces of thin brass are placed at the sides of the frame-work of the clock, in length the same as the space between the pillars; in width, about two inches or more at pleasure; the pieces are placed horizontally, at about the same altitude from the base as the axis of the escape-wheel pinion, and at right angles to it or nearly so. They should be made of such a size as would insure a sound, distinct, sharp, and short. The little tables can be made to any size. Upon these tables or plates two hammers ply, supported by arbors at the same elevation as all the others. The pivots should be made small for easy motion. The hammers are intended to beat upon the middle of each brass table simultaneously with the drop proper of the escape wheel; through the agency of the pendulum, they are lifted alternately by the heels of the anchors of the pallets, assisted by a passing spring similar to that used in the chronometer escapement. It has just been observed, that the arbors which support those little hammers are placed at the same elevation from the base of the brass frame-work of the clock as the escape-wheel arbor, but at the sides, and as near to the edge as possible. About the centre, or midway between them, are affixed brass collets, about $\frac{1}{8}$ of an inch in thickness, and $\frac{1}{4}$ of an inch in diameter. Two slender pieces of spring are secured to the collets by screws passing through square holes formed longitudinally, to secure power of adjustment for bringing the arms into proper contact with the anchor of the pallets. The little hammers beat upon the plates or tables at one end, and at the other the lifting action takes place, assisted by the passing spring. The strokes upon these brass tables have a peculiar sharpness of tone, which can be accounted for in some measure, when it is considered that they are very different from the sounds produced by the teeth of the wheel itself; in the dead-beat escapement, the teeth have a sliding motion in the moment of drop, but not impulse, for it is well known that that is subsequent to the sound. By such application it is proposed to obtain sound, so loud as to be *distinct in the stormiest night;* but as the constant connexion of such apparatus would neither be desirable as concerns the action of the clock, nor pleasant to the ear as a companion, a mode has been introduced of readily detaching it altogether. By a certain method, which shall be explained, the hammers are raised from the tables at one end, and the arms at the other entirely disengaged from the anchor at the pallets, without inconvenience or disturbing action to the clock itself. The apparatus within is immediately, and at pleasure, acted upon through the agency of a bolt, which is placed vertically, immediately over the 60 minutes, or about two inches back, sufficiently long to reach a spring of hard brass, which is about half an inch wide, and which passes transversely over the frame-work of the clock, and is fixed securely to the backboard of the clock-case. Now the mode in which the spring unites its action with the rest of the apparatus is by slight cross-bars, which extend to the extremities of the sides of the frame, so that the ends are immediately over the hammers, with which they are connected by silk threads. Therefore, by pressing down the bolt before named, the hammers are allowed to fall into action, and do their duty simultaneously with the teeth of the wheel upon the pallets. While the little hammers are in action, the teeth of the wheel are no longer heard. The Astronomer Royal has examined the plan, and says that it answers completely for its proposed purpose; and that it appears likely to be very useful. Moreover, that the rate of the clock will not necessarily be disturbed during the time of its connexion—though that will greatly depend on certain conditions.

ENERGIATYPE. A NEW PHOTOGRAPHIC PROCESS.

Mr. Hunt of Falmouth, has communicated to the *Athenæum* the following notice. While pursuing some investigations, with a view to determine the influence of the solar rays upon precipitation, I have been led to the discovery of a new photographic agent which can be employed in the preparation of paper, with a facility which no other sensitive process possesses. Being desirous of affording all the information I possibly can to those who are anxious to avail themselves of the advantages offered by Photography, I solicit a little space in your columns for the purpose of publishing the particulars of this new process. All the Photographic processes with which we are at present acquainted, sufficiently sensitive for the fixation of the images of the camera obscura, require the most careful and precise manipulation; consequently, those who not accustomed to the niceties of experimental pursuits are frequently annoyed by failures. The following statement will at once show the exceeding simplicity of the new discovery.

Good letter-paper is first washed over with the following solution—

A saturated solution of succinic acid .	2	drachms.
Mucilage of gum arabic	½	"
Water	1½	"

When the paper is dry, it is washed over once with an argentine solution, consisting of one drachm of nitrate of silver to one ounce of distilled water. The paper is allowed to dry in the dark, and it is fit for use; it can be preserved in a portfolio, and at any time employed in the camera. This paper is a pure white, and it retains its colour, which is a great advantage. At present,, I find it necessary to expose this prepared paper in the camera obscura for periods, varying with the quantity of sunshine, from two to eight minutes, although from some results which I have obtained, I am satisfied that by a nice adjustment of the proportions of the materials, a much shorter exposure will suffice. When the paper is removed from the camera, no trace of a picture is visible. We have then to mix together one drachm of a saturated solution of *sulphate of iron*, and two or three drachms of the *mucilage of gum arabic*. A wide flat brush saturated with this solution is now swept over the face of the paper rapidly and evenly. In a few seconds, the dormant images are seen to develope themselves, and with great rapidity a pleasing *negative* photographic picture is produced. The iron solution is to be washed off as soon as the best effect appears, this being done with a soft sponge and clean water. The drawing is then soaked for a short time in water, and may be permanently fixed, by being washed over with ammonia—or perhaps better, with a solution of the hyposulphate of soda, care being taken that the salt is afterwards well washed out of the paper. From the pictures thus produced, any number of others correct in position, and in light and shadow, may be produced, by using the same succinated papers in the ordinary way; from five to ten minutes in sunshine producing the desired effect.

The advantages which this process possesses over every other, must be, I think, appa.ent. The papers are prepared in the most simple manner, and may be kept ready by the tourist until required for use: they require no preparation previously to their being being placed in the camera, and they can be preserved until a convenient opportunity offers for bringing out the picture, which is done in the most simple manner, with a material which can be anywhere procured.

Anxious to give the public the advantage of this process during the beautiful weather of the present season, I have not waited to perfect the manipulatory details which are necessary for the production of portraits. It is sufficient, however, to say, that experiment has satisfied me of its applicability for this purpose.

Prismatic examination has proved that the rays effecting this chemical change are those which I have elsewhere shown to be perfectly independent of solar light or heat. I therefore propose to distinguish this process by a name which has a general rather than a particular application. Regarding all photographic phenomena as due to the principle Energia, I would nevertheless wish to distinguish this very interesting process as the Energiatype.

I inclose you a few specimens of the results already obtained. The exceeding sensibility of the Energiatype is best shown by an attempt to copy engravings or leaves by it. The three specimens I inclose were produced by an exposure of considerably less than one second.

REDCLIFFE CHURCH.

It will be seen by public advertisement, that the vestry of the parish of St. Mary Redcliffe again appeal to the public on behalf of the beautiful fabric of which they are the present custodians. They do not feel justified in entering upon so great an undertaking as the substantial repair of the church, until they have obtained a sum sufficient to insure the satisfactory execution of that portion of the work absolutely essential to the stability of the building; and this sum they have fixed at £7,000. The amount already raised we understand to be about £5,000, and latterly subscriptions have come in but slowly. We believe the public are not fully aware of the nature of the demand made upon them. They do not know that this magnificent fabric is crumbling away with a rapidity that must soon reduce it to ruin, if steps are not speedily taken to check the progress of decay, and support its declining masses. We can speak from observation, having carefully inspected the building; and we are sorry to say that the architects Messrs. Britton and Hosking, whose report has been published, have not exaggerated the dangerous condition in which it stands. The rotten state of the external stone-work is an evil only of second magnitude, yet one not to be fully appreciated without close inspection. The Crockets, Finials, Ball-flowers and other ornamental works are crumbling away; but, however, much we might regret their loss, as the stability of the fabric is little dependent upon them, there would be no imperative necessity for repairs on that account; though it should be known that these do not wear away by imperceptible degrees, but are constantly falling in fragments of considerable size. Almost the whole of the exterior surface of the stone-work consists of a loose crust of soot and sand, the disintegration of the stone having taken place to a depth of from one to three or four inches. But an evil of a much more formidable nature exists in the declension of the walls themselves from the perpendicular, in their unstable foundations, and the thrust constantly exerted by the roof to push them outwards. The parts where this is most observable are the Choir, with its South Aisle, and the South Transept. The walls of the Choir (or what is called its *clerestory*) are supported on the piers and arches that separate it from its aisles, and its heavy groined roof has, of course, a tendency to thrust them outwards; to this thrust of the roof the architect had applied the usual counteracting forces, pinnacles placed over those parts of the wall against which the ribs of the groining converge, to give the outward thrust a more downward tendency, and flying buttresses supporting the clerestory wall from that of the aisle, which in its turn was strengthened by strong buttresses, in stages. We doubt whether sufficient support was originally given to the clerestory; but probably little injury would have resulted, if the stability of the outer walls and buttresses had not materially suffered from the reprehensible practice of digging graves close to their bases. This practice has destroyed the resisting power the walls would derive from foundations firmly set in the earth; and the outward pressure of the flying buttresses, which convey the thrust of the roof from the walls of the clerestory to that of the aisle, has thrown the wall of the aisle, likewise, and its buttresses, out of the perpendicular. The clerestory, as we have already explained, was originally supported from the wall of the aisle; but as this can now scarcely support itself, it may be supposed it has become incapable of affording sufficient support to the other. Some bungler has been employed to remedy this evil, and has endeavoured to uphold the outer wall by connecting it by iron bars with the inner one; thus each has now the office assigned it of supporting the other, which, as they both lean in the same direction, and not towards each other, it is impossible for them to do. The transept is in a similarly unstable state, but in that *both* the walls have an inclination to the westward. The mullions and tracery of most of the windows are so much decayed that it is with difficulty they have been held together.

On going up the tower and upon the roof of the church, the manner in which the masonry is crumbling away becomes more apparent than from below. We observed one mass of stone, weighing fifty or sixty pounds, which had fallen very lately from the pinnacle at the South West corner of the Church, upon the Leads of the South Aisle; it was part of a Finial, and the Iron Bar in its centre, which had been used to connect it with the rest of the stonework, had made, in its fall, a hole through the leads of the size of a hens' egg. Within the parapet at the top of the tower was a still larger fragment, which had likewise fallen within the last few weeks. A member of the vestry, who obligingly accompanied us in our examination of the building, stated that it had fallen since he was last up the tower, which was not long since. In another place we observed a split down the centre of a pinnacle, a large portion of which can scarcely fail to be detached by the first frost occuring after rain, and it will fall on the west side of the tower towards the street.

It will be seen from what we have said that the question of the Restoration of Redcliffe Church, is not merely one of what would be well in an æsthetical point of view, but it is a question of whether the building is to stand or fall. And this being understood, we cannot entertain any doubt as to the liberality with which the dwellers in the west will come forward to support the vestry in the exertions they are so creditably making. Very unjust aspersions have lately been cast upon Bristol for its alleged illiberality, merely from the thoughtlessness of a clever writer, who considered that she could not be wrong in abusing a city with a bad name. Bristol *has* a bad name, and though very causelessly, the sooner it is retrieved the better. A Bristol merchant built Redcliffe Church; another rebuilt it when decayed; by another the beautiful Church of St. Stephen's was erected; by another that of St. John; St. Werburgh by a fifth; the church and convent of St. James too were built by private munificence; and the names of Colston, and Spencer, and Forster, and many others, might be adduced to show what has been the liberality of the wealthy merchants of Bristowe, in times past; whilst to this day no town is more ready in its support of all pious and charitable purposes, though it may, as yet, be behind some others in its patronage of the tasteful arts. We cannot believe that any real difficulty will be experienced, in repairing, in the nineteenth century, when the wealth of Bristol has increased twenty fold, a church, which was erected in the fifteenth by the munificence of *one* of her sons,—

"The mornyinge starre of Radcleve's rysinge raie,
A true manne, good of mynde, and Canynge hight."

The object is one in which the pious, and the useful, and the ornamental are all united; the church has claims every way upon the people of Bristol; but its claim as a temple worthy of the holy purpose to which it is consecrated, will be sufficient, it may be hoped, to insure it against being allowed to perish through neglect.—*Great Western Advertiser*.

MONUMENT IN ST. STEPHEN'S CHURCH, BRISTOL.

This Monument is a very pretty subject for antiquarian discussion. It is older by a century than the church;—it has been built into the wall probably after the erection of the church, and it is composed of parts that do not appear to have been originally conjoined.

Costume is not always an infallible guide in determining the period of the erection of an ancient monument, as it was not uncommon for persons to be represented in the dress they wore, though the fashion of that dress had passed away at the time the monument was erected. It is possible, therefore, that the effigies now lying side by side, were originally so placed; though several reasons would lead to the conclusion that the male figure formed no part of the original monument; there may be a difference of 50 years in the date of their costume, as well as in that of different portions of the architectural work.

From the manner in which this monument is built up,—the figures being on separate slabs, and the table-face of the tomb being without sides or back, and disjoined from the jamb mouldings of the arch under which it is placed: it is certain that we do not see the parts in their original connection.

The male effigy is one of the few specimens of a figure not attired in armour. Such cumbent effigies have been hitherto considered as belonging only to Royal personages, with the exception of ecclesiastics who have their proper costume: but as this figure appears to be of about the year 1400, it may represent some wealthy burgess of Bristol. Wealthy he must have been, as sumptuary laws in Edward III.'s reign imposed restrictions upon such luxuries as armour and monumental effigies.

The female figure is habited in the Costume of Edward III.'s reign, about the year 1350. The architecture of the monument has the usual outline of that period—broad and low. It consists of a flat ogee arch, tri-cusped in the middle, with two smaller hanging cusps on each side—the moulding a simple fillet and hollow with square flowers at intervals. It had a crocketted ogee canopy, and a low crowned buttress on each side, probably similar to the Berkeley monuments in our cathedral. The base is either cut away or sunk under the surface, yet unopened, which is about 18 inches beneath the floor of the church. There seems no reason to think that the floor of the present church has been much raised.

Under this monumental arch is no tomb, but only the face of an altar tomb. This face is separated by square buttresses into six very shallow compartments, which contain mourning figures about 18 inches high—two are male, three female, in ordinary dress, the sixth is much mutilated, but may represent a knight by the canonical head dress. The square buttresses terminate in plain shields, and at the junction of these spring trefoiled ogee arches with crockets and finials, forming canopies to the figures.

We have described the arch and the altar tomb as far as their imperfect state will permit, and have only to add that they have been charged with colour as well as the figures recumbent on the tomb.

As the effigies of two sons of Edward III., one in York Cathedral the other in Westminster Abbey, are the only published specimens of figures of the 14th century not in armour, this male effigy deserves enquiry as to the personage it may represent. For the present we can only describe the figures. They are, as was the custom in the middle ages, in the attitued of prayer; the hands have been placed together palm to palm, but those of the male figure have been broken off above the wrists. The female effigy, which is on the inside, is partly built into the masonry of the wall, under a rough arch of later date than the front arch of the monument. This is the longer figure, and appears to be that for which the monument was erected.

The head of the male effigy is uncovered—the hair is parted in the middle and falls down in a single curl over the ears—the face is not that of a young man, though without whiskers, and having the moustache and beard but slightly marked. The dress consists of a doublet, buttoned down in front, fitting close to the body and reaching to the middle of the thighs; round about the hips is an ornamental bawdrick, from which a dagger has been suspended on the right side. This doublet has a small cape over the shoulder, and leaves the neck to be covered by a loose collar; the sleeves reach below the elbow, and beneath them appears a covering for the lower arm, towards the wrist closely buttoned. The legs wear close fitting hose, and the feet have pointed sandals of similar material. This costume belongs to the latter end of the 14th century. The feet rest upon a lion, and the head upon a diamond shaped cushion with tassels.

The head of the female effigy rests upon a square tasselled cushion, and the feet, which are scarcely visible, against a dog.

The head dress consists of a netted drapery of square form, beneath which appears the hair, braided each side the cheek. The hood, or veil, falls from the back of the head, and a wimple of linen encloses the chin and covers the whole of the neck and shoulders, except some strips in front of the neck. The body is habited in a surcote; the sleeves are tight and close, up to the wrist; the hands are without gloves or ornaments. The surcote as far as the hips, fits closely to the shape, but below enlarges in numerous folds; the dress is not buttoned or laced in front, but two buckles of large size are placed low down the waist in front. The mantle or cloak is short, and stretches round the back and shoulders, being fastened by a cordon across the breast. This costume properly belongs to the date 1350, whereas the costume of the male figure appears to be later. The different sizes of the figures and other things above mentioned, leave little doubt in the mind of the writer that the monument is compiled of two separate ones, which have been put together in their present situation since the time of Henry VIII.

Great Western Advertiser. S. C. F.

IMPROVEMENTS IN SUBMARIME BLASTING AT SPITHEAD.

Lieut. Barlow, the present executive engineer officer, at Spithead, who conducts the operations with no less zeal, intelligence, and activity, than his able predecessors, has tried numerous experiments in the firing of gunpowder by the voltaic battery, partly with the service charges used in breaking up the timbers of the wreck, in tin cans not usually exceeding from 44 lb. to 55 lb. of gunpowder, and partly with small experimental charges of a few ounces, by desire of General Pasley, who wished to carry out Lieut. Hutchinson's ingenious plan of firing submarine charges by one conducting wire only, instead of two, (See *Journal*, vol. vi. p. 337,) using the water of the sea to complete the electric circuit. In these experiments Lieut. Barlow first found that it was unnecessary to let down a piece of wire with zinc plates attached to it from the voltaic battery into the water, as had been done by Lieut. Hutchinson, for the circuit was equally good when the wire alone was used; and on repeating those experiments in General Pasley's presence, the correctness of this principle was sufficiently proved, but a difficulty occurred, which had not been experienced before—viz., that it required two plate batteries of ten cells each, to fire a charge at a distance of 200 feet, with the single wire, whereas one of Prof. Daniell's batteries of eight cells only, which is inferior in power to a plate battery of ten cells, had always fired submarine charges instantaneously in former years by the double wire, which circumstance had not been adverted to by Lieut. Barlow, as this was his first season. General Pasley, therefore, concluded that the firing charges with one conducting wire, instead of two, might diminish the power of voltaic electricity more than had been suspected last year, when this change was introduced so very late in the season, that there was not time to investigate the result of it in all its bearings; and, consequently, he directed that two conducting wires on reels, the same that had failed in igniting a charge when attached singly to less than a twenty cell plate battery, should be attached to one plate battery of ten cells, on the original principle used at Chatham and Spithead, from 1838 to the middle of 1843 inclusive, so that these two wires, well insulated, connected that battery and a charge at the bottom, without trusting to the water. On adopting this arrangement, instantaneous explosion took place, as soon as the circuit was completed. Thus the double metallic circuit was proved to be the best for firing gunpowder, whether underground or under water, and will as such be exclusively used in all future explosions; though for the purposes of an electric telegraph, which requires wires to be laid for many miles, and which needs infinitely less power than is necessary for the firing of gunpowder, water or moist earth, especially the former, may be used to advantage for completing the circuit, in combination with one wire only, extending the whole length of the telegraphic line.

Launch of the Gipsy Queen.—The launch of this elegant iron steam-vessel took place on Monday, June 17, from the yard of Messrs. Samuda, at Orchard-place, Blackwall. The vessel was announced to be launched at 3 o'clock, but the tide rose so fast that it became necessary to let her go at a quarter before 3, by which means a vast number of persons were disappointed in not being in time to see her enter the water. She went off in very gallant style, amidst the usual demonstrations of satisfaction. This vessel is, we believe, the largest iron steamer ever built on the river Thames. Her length from the figure-head to the taffrail is 197 feet 6 inches, and between perpendiculars, 175 feet; her breadth between the paddle-boxes is 24 feet. Her burden is 496 tons. Previously to the launch we had an opportunity of examining the engines with which the Gipsy Queen is to be fitted. They were constructed at Messrs. Samuda's works at Southwork, and are made in conformity with the patent obtained by those gentlemen; they are of 240 h. p. These engines will be placed fore and aft, and not, as the engines of most steam-vessels are, on each side of the keel; the cylinders will be directly over the keel, and being in one frame-work, all strain will be avoided on any part of the vessel; their total weight, including boilers, &c., which are tubular, water and paddle-wheels, is only 87 tons, being little more than half the weight of the engines, &c., in common use. This saving of weight is a great advantage, and is greatly to the credit of the patentee. The form of the steamer is calculated for great speed. She has a considerable rise of floor, and for a sea-going vessel (she is built for the Waterford Steam-packet Company, and will travel between London and Waterford) her lines are remarkably fine. She was much admired by several scientific and practical men, who were present, and who examined her very carefully.

New Mode of Tracking on Canals.—It will be interesting to our scientific readers to learn that steam-tugs, with screw propellers, have now been successfully introduced on the Union Canal. An experiment with one of these steamers took place a few days ago, under the superintendance of the Company's able manager R. Ellis, Esq., in the presence of their chairman, Col. M'Donald, Messrs. Maxwell, M'Lagan, Burns, L'Amy, and Tennant, directors; Mr. Shaw, manager for the Duke of Hamilton; Mr. Crichton, manager of the Forth and Clyde Canal; Mr. Glennie, manager of Monkland Canal; Capt. Yuill, R.N.; together with a number of other gentlemen interested in the result. The boats are the first of the kind introduced into Scotland. They are built of iron by Messrs. John Reid and Co., Port-Glasgow; and the engines, screw-propellors, &c., are fitted up by Mr. William Napier, sen., engineer, Glasgow. The engines which were much admired, are on the upright principle. They communicate their power to the screws placed on each side of the bow; and by a very nice arrangement of wheels with wooden and iron teeth (in order to prevent noise and vibration), they are driven at a great speed without creating any of that surge or wash on the banks which has hitherto formed the chief objection to the use of steamers on canals. The result of the experiment gave great satisfaction to all present; and, independently of the gain in point of speed, it is calculated that there will be a considerable saving in expense, compared with the ordinary mode of tracking by horses. The steam-boat had attached to her six very large scows deeply laden, but it is capable of towing double the number without any material diminution of speed. The scows to be tracked are connected together by rods having a parallel movement, and all under the control of the steersman on board the steamer, so that the necessity of a separate rudder and steersman for each scow is avoided—the whole train moving along with a steady and uniform motion. After the company had been thoroughly satisfied as to the practicability and success of the scheme, which there is every prospect of being very generally adopted, they adjourned to the Star and Garter Inn at Linlithgow, where the Directors handsomely entertained them at dinner. The evening was spent in a rational and agreeable manner, the various scientific gentlemen present expressing themselves highly delighted with the experiment they had witnessed.—Glasgow Citizen.

Safety Beacon for the Goodwin Sands.—Dover, June 19. This day the Trinity Buoy steam yacht towed off to its station on the Goodwin sands a stupendous safety beacon, designed and executed, we believe, by Mr. James Walker, C.E., under the auspices of the Trinity Board. The beacon is intended not only to be a guide to mariners but also a place of refuge for the crews of vessels cast away on the fatal Goodwin. It will be recollected that a safety beacon, the invention of Captain Bullock, R.N., was placed on the Goodwin Sands some years since, and still braves the storm. The one that has been towed out to-day is of larger dimensions, and will be placed on a different part of the sands. This beacon is an experiment, and we understand, should it succeed, it is the intention of the Trinity Board that similar fixed erections shall supersede floatings buoys. Mr. Walker's beacon consists of a strong iron column, about 40 feet high, based on a circular platform of solid masonry, the latter being upwards of 20 feet in diameter. The foot of the pillar is bell-shaped, and tapers upwards to the extent of some six or eight feet. About the middle of the column there is a convenience, resembling a vessel's top, surrounded with an iron railing, capable of receiving, we should say, half a-dozen men, and on the summit is placed an iron basket, shaped like a balloon, which is also constructed to contain about a like number of persons, should they be enabled to reach it, in the case of shipwreck. The column is tied down to the the stone-work by iron stays, and on it are fixed steps by which it may be ascended. The whole of the unwieldy machine is incased in a huge timber vessel, resembling a brewer's vat, in which it was built, for the purpose of floating it to its station on the sands. The sides of this wooden building are constructed in such a way as to admit of their being removed on the beacon settling down in the sand. The bottom, on which the masonry rests, will, however, remain under the beacon.

Daguerreotype Improvement.—At the Academie des Sciences a communication was made by M. Daguerre, relative to some improvements in the Daguerréotype process, chiefly for the purpose of taking portraits, the ordinary mode of preparing the plates not being found sufficient to enable the operator to obtain good impressions. The improvement made by M. Daguerre requires a rather complicated process, but it is a very regular one, and has one decided advantage, for the artist is now enabled to have a good stock of plates on hand, as the new preparation will remain for a very long time in a perfectly fit state for use. The new substances of which M. Daguerre makes use are an aqueous solution of bi-chlorure of mercury, an aqueous solution of cyanure of mercury, oil of white petroleum, acidulated with nitric acid, and a solution of platina and chlorure of gold. The process is as follows:—the plate is polished with sublimate and tripoli, and then red oxide of iron, until a fine black be obtained; it is now placed in the horizontal plane, and the solution of cyanure previously made hot by the lamp is poured over it. The mercury deposits itself, and forms a white coating. The plate is allowed to cool a little, and after having poured off the liquid, it is dried by the usual process of cotton and rouge. The white coating deposited by the mercury is now to be polished. With a ball (tampon) of cotton saturated with oil and rouge, this coating is rubbed just sufficiently for the plate to be of a fine black. This being done, the plate is again placed upon the horizontal plane, and the solution of gold and platina is poured over it. The plate is to be heated, and then left to cool, and the liquid having been poured off, the plate is dried by means of cotton and rouge. In doing this, care must be had that the plate be merely dried, not polished. On this metallic varnish, M. Daguerre has succeeded in taking some very fine impressions of the human figure, which were exhibited.

The Centurion, 80, was launched at Pembroke on the 2nd of May, and was docked on the following morning, and will be ready for sea within the present month. She is a noble ship. The following are her dimensions:—

	Feet.	Inches.
Length between perpendiculars	190	0
Length of keel for tonnage	155	3
Extreme breadth	56	9
Breadth for tonnage	56	0
Depth in hold	23	4
Burden in tons, 2,589	—	—
Light water draught forward	15	3
Light water draught aft	10	9

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM MAY 25, TO JUNE 26, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

William Augustus Guy, of Bloomsbury-square, bachelor of medicine, for "certain Improvements in ventilation."—Sealed May 25.

Charles Low, of Robinson's Row, Kingsland, for "certain Improvements in the making or manufacturing of iron and steel."—May 25.

Charles Anthony Deane, of Poplar, for "Improvements in the constructing, propelling and steering vessels.—May 30.

Robert Hazard, of Clifton, near Bristol, confectioner, for "Improvements in baths."—May 30.

John Lee, of Newcastle-upon-Tyne, Esq., for "Improvements in obtaining products from sulphurets and other compounds containing sulphur."—May 30.

James Fenton, of Manchester, engineer, for "an Improved combination or alloy, or improved combinations or alloys of metals applicable to various purposes, for which brass and copper are usually employed in the construction of machinery."—May 30.

Walter Noak, of West Bromwich, Stafford, colliery agent, and John Noak, of the same place, engineer, for "Improvements in the manufacture of salt, and in the apparatus to be used therein."—June 1.

Edward Massey, of King Street, Clerkenwell, watchmaker, for "Improvements in apparatus for ascertaining the rate at which vessels are passing through the water, also applicable in ascertaining the rate at which streams or currents are running."—June 1.

James Murdoch, of Staple Inn, Middlesex, mechanical draftsman, for "certain Improvements in the manufacture of gas, and in the apparatus employed therein." (Being a communication.)—June 4.

William Henry Phillips, of Bloomsbury Square, Middlesex, engineer, for "certain Improvements in the means and apparatus for subduing and extinguishing fire and saving life and property, and in obtaining and applying motive power, and improvements in propelling."—June 4.

George Chapman, of Claremont Terrace, Strangeways, Manchester, engineer, for "certain Improvements in steam engines."—June 4.

Henry Boden, of Derby, lace manufacturer, for "an Improvement in the manufacture of bobbin net, or twist lace."—June 4.

Joseph Cowen, of Blaydon Burn, near Newcastle-upon-Tyne, merchant, "for certain Improvements in making retorts for generating gas for illumination."—June 4.

William Ward, of Leicester, hosier, and David Winfield Grocock, of the same place, framesmith, for "Improvements in machinery for manufacturing framework, knitted or netted work."—June 4.

William Elliott, of Birmingham, button manufacturer, for "Improvements in the manufacture of covered buttons."—June 4.

Paul Griffiths, of Holywell, in the county of Flint, millwright, for "Improvements in washing the products evolved from furnaces."—June 4.

Joseph Woods, of Bucklersbury, London, civil engineer, for "Improvements in producing designs and copies, and in multiplying impressions, either of printed or written surfaces." (Being a communication.)—June 6.

David Cheetham, of Rochdale, Lancaster, cotton spinner, and Edward Briggs of the same place, hat manufacturer, for "certain Improvements in the manufacture of bats, and in machinery or apparatus connected with such or similar manufacture."—June 6.

William Higham, of Nottyash, near Liverpool, and David Bellhouse, of Liverpool, aforesaid, merchant, for "Improved constructions of boilers for evaporating saline and other solutions, for the purposes of crystallization."—June 5.

Edmund Morewood, of Thornbridge, Derby, merchant, and George Rogers, of Stearndale, same county, gent., for "Improvements in coating iron with other metals."—June 8.

Elijah Galloway, of Nelson Square, Blackfriars' Road, Surrey, for "Machinery, for connecting axles or shafts, whereby when in motion they revolve at different relative velocities."—June 12.

Thomas Farmer, of Birmingham, manufacturer, for "certain Improvements in the ornamenting of papier mâche, and in manufacturing and ornamenting japanned goods generally."—June 12.

George Kent, of Constitution Row, Gray's Inn Road, blind-maker, for "Improvements in machinery for cleaning, polishing, and sharpening knives, forks and other articles."—June 12.

Moses Poole, of Serle Street, Middlesex, gent, for "Improvements in wheels and axles." (Being a communication.)—June 12.

John Swindells, of Manchester, manufacturing chemist, for "several Improvements in the preparation of various substances for the purpose of dyeing and producing colour, also improvements in the application and use of several chemical compounds for the purpose of dyeing and producing colour not hitherto made use of."—June 12.

Alexander Simon Wilcott, of Manchester, machinist, for "Improvements in roving and spinning cotton, wool, and other fibrous substances."—June 18.

Charles William Graham, of Kings Arms Yard, London, merchant, for "Improvements in manufacturing pathological, anatomical, zoological, geological, botanical and mineralogical representations in relief, and in arranging them for use."—June 18.

George Wilson, of Saint Martin's Court, Saint Martin's Lane, stationer, for "Improvements in the cutting of paper for the manufacture of envelopes, and for other purposes."—June 18.

William Sutcliffe, of Bradford, York, manufacturer, for "Improvements in preparing, dyeing, sizing or dressing, drying and winding yarns and manufactured fabrics of wool, flax, cotton, silk and other fibrous materials."—June 19.

Pierre Armand Lecomte de Fontainemoreau, of Skinner's Place, Size Lane, London, for "A new mode of Locomotion applicable to railroad and other ways." (Being a communication.)—June 21.

Thomas Lever Rushton, of Bolton Le Moors, Lancaster, iron manufacturer, for "certain Improvements in the manufacture of iron."—June 21.

Christopher Phipps, of River, near Dover, paper manufacturer, for "An Improvement or improvements in the manufacturing of paper, and in marking, writing, and other papers, or in the machinery employed for those purposes." (Being partly a communication.)—June 21.

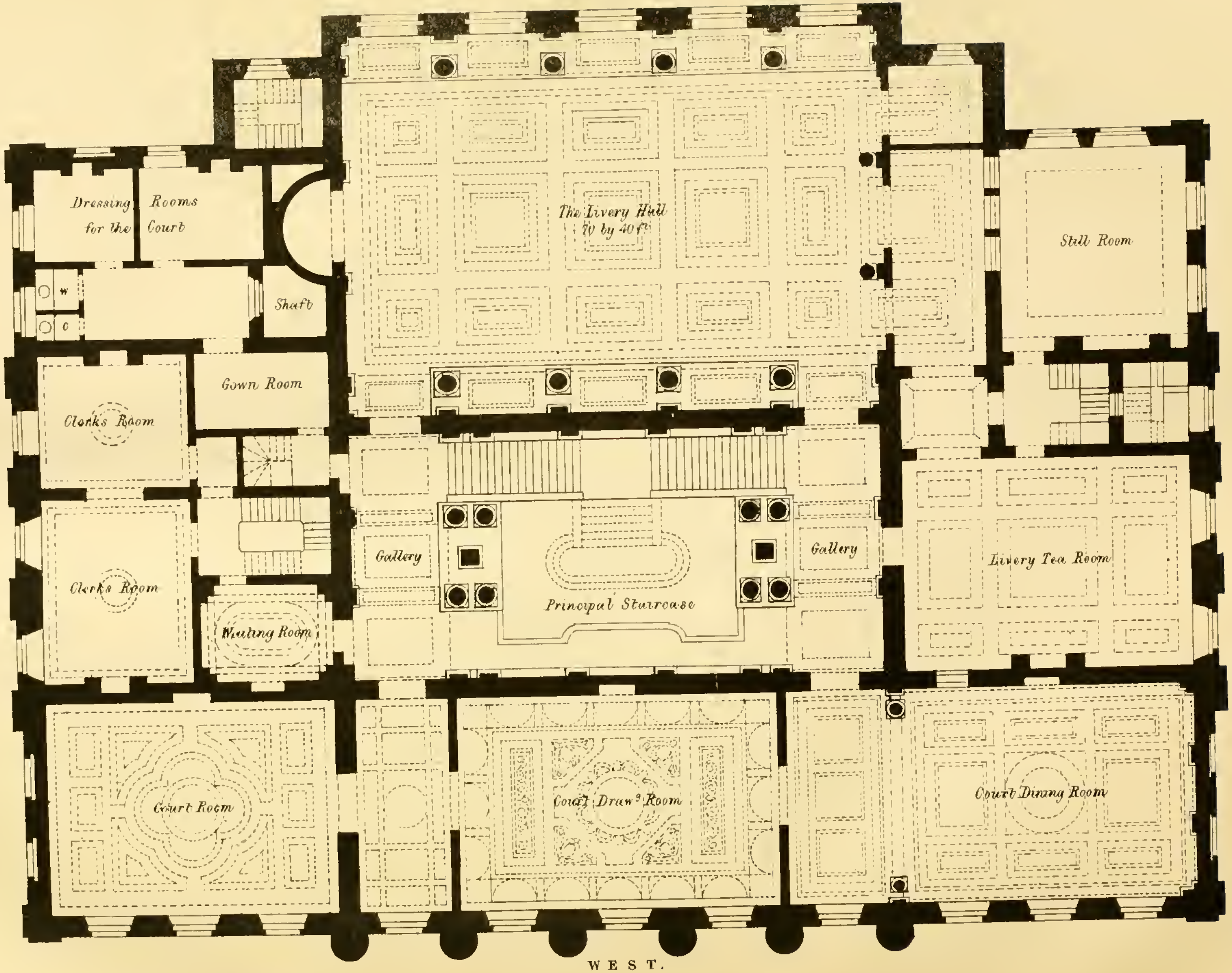
James Sharp, of Sheffield, manufacturer of Britannia metal articles, for "Improvements in the manufacture of metal dish covers and metal dishes."—June 24.

Rees Davis, of Ystradgunlais, Brecon, gent., for "Improvements in the manufacture of iron."—June 24.

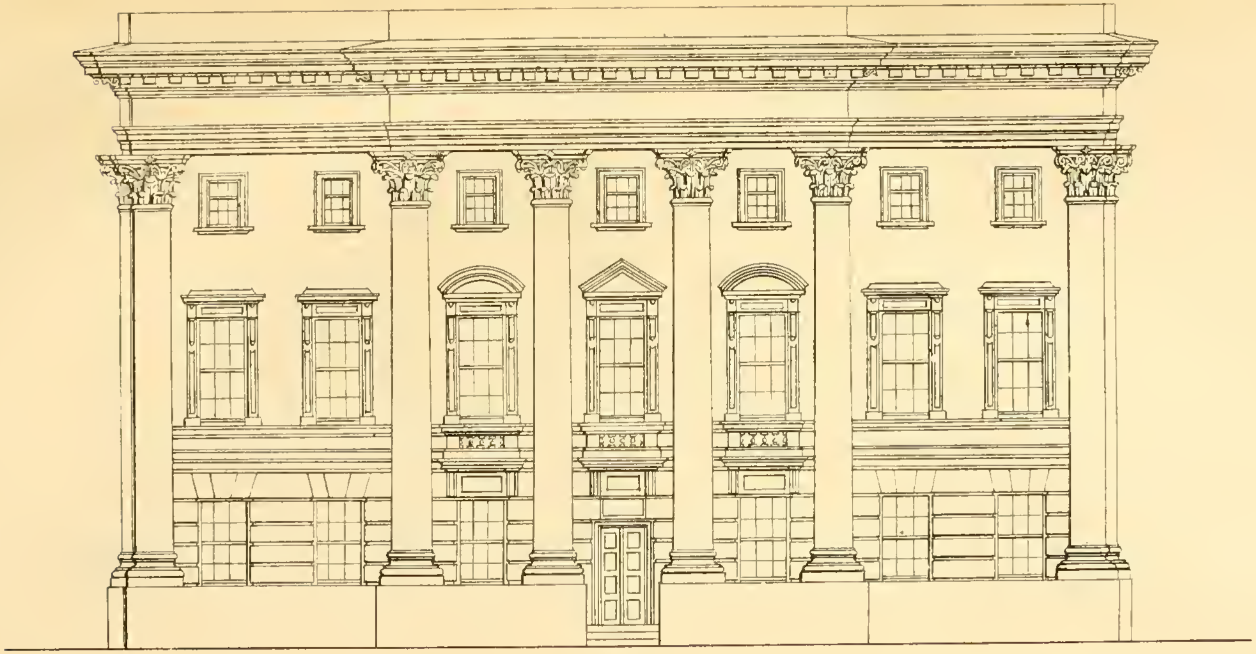
William Worby, of Ipswich, for "Improvements in the manufacture of bricks, tiles and other articles from plastic materials."—June 24.

Charles Maurice Elizee Sautter, of Austin Friars, gent., for "Improvements in piano-fortes."—June 26.

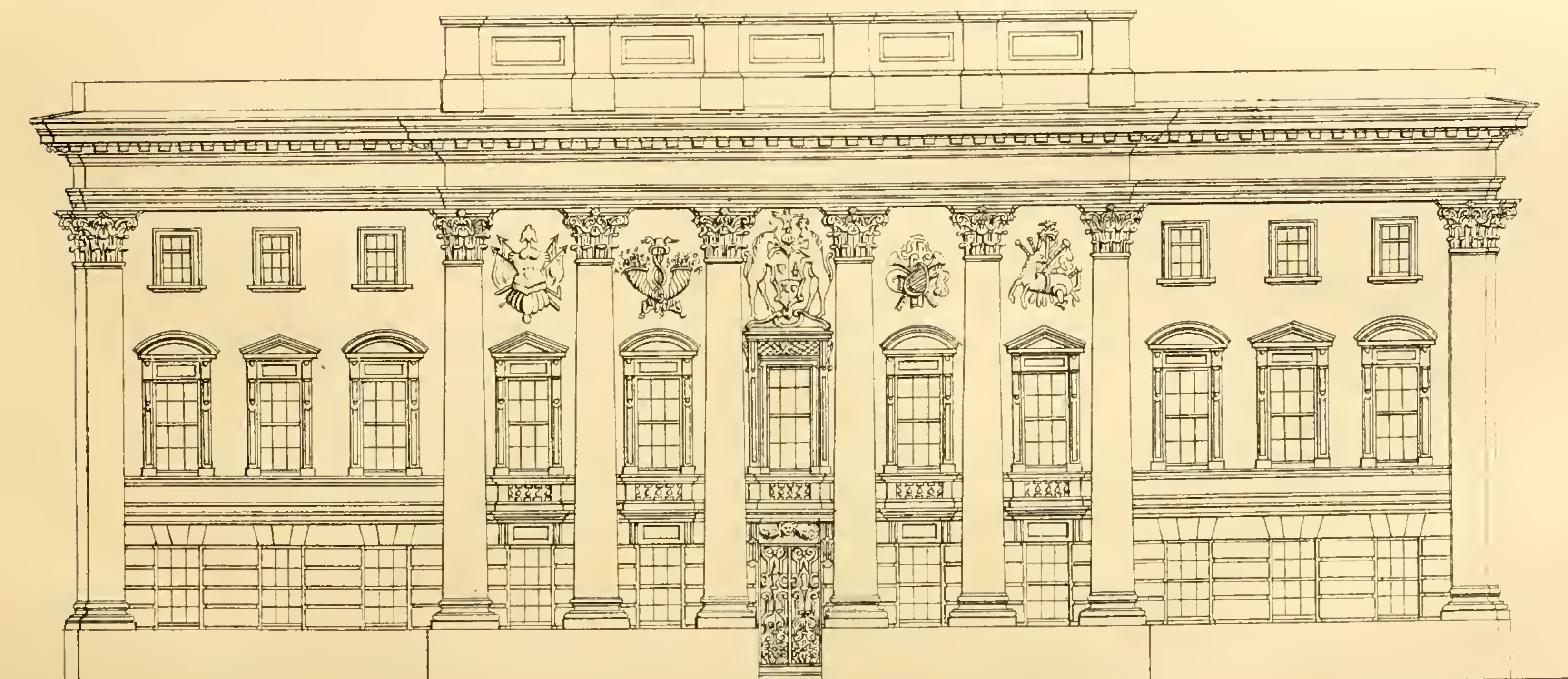
EAST.



WEST.
PRINCIPAL FLOOR



NORTH FRONT



WEST FRONT.

J. R. Jobbins, 3, Warwick C[t].

GOLDSMITHS' HALL.

(With Two Engravings, Plates X. XI.)

TAKEN in general, the Halls of the Civic Companies contribute very little to the architectural appearance of the City, notwithstanding that they are tolerably numerous, and that the bodies to whom they belong could very well afford to indulge their taste if they had any. Several of these buildings are so situated—fortunately perhaps, as it happens, rather than the contrary—that it matters very little what they are—externally at least,—they being quite concealed from public view,—buried in courts, lanes, and narrow back streets. It is only an old-fashioned portal or gateway, with columns and a "crinkum-crankum" pediment and scrolls, that in many cases, gives any indication of any building of the kind being at hand.

Old Goldsmiths' Hall, which so long as it existed, was buried in the labyrinthine intricacies of a mass of lanes, was of very frowzy appearance, and marked by a sort of quaint and picturesque ugliness. To give any description of it would not be easy, so exceedingly fantastic and outré was it in design—if such an architectural medley could be called design.

[1] "As soon, however, as the Post Office was erected, and the houses at its rear taken down, Goldsmiths' Hall made a somewhat forlorn appearance, and looked as if, after being so long pent up in an alley, it did not care to have the sun shine upon it. What share—if any—this circumstance had in determining the Company to erect a new 'Hall,' we are unable to say, but their former building was taken down in 1829, and the present structure forthwith commenced, from the designs of Mr. Hardwick, who has here produced a very noble piece of architecture,—imposing, both by the solidity of its construction, and the dimensions of its order; dignified in aspect, and remarkably rich in character, as regards the sculptured trophies introduced over the five centre windows of the West front. It has indeed been objected, that the ground floor is too plain and too tame to accord with the richness and boldness of the rest of the design; a defect, however, capable of being easily remedied at any time, should it be thought worth while to do so. As to the building being so badly situated, as some would have us believe, we do not see any reason for particular dissatisfaction in that respect. Although it does not stand in a main street, it is by no means shut out of sight, a view being caught of it from St. Martin's Le Grand; and although it certainly comes behind the Post Office, it cannot be said to be concealed or crowded up by that building, there being quite sufficient space to view it in front, nor is it at all a disadvantage that there is not *too much*. It is more to be regretted that the 'Hall' could not be placed parallel to the Post Office, at least, the degree of obliquity between them rendered less apparent."

We fully—or even more than fully agree with what is said in regard to the lower part of the design of the exterior: even had the ground-floor been made a mere basement to the upper one, it would still have been quite out of keeping with the latter, had there not been some kind of dressings to the windows; but actually *incorporated* as it is with the rest by being included within the order, its excessive nakedness causes the upper windows, &c., to look as much too heavy and overloaded as the lower ones are insignificant and mean. We are here struck by a strange incongruity and perverseness of taste—modern cockney or quaker-like no-style mixed up with the bold manner and richness affected in the Roman palaces of the 17th century. Even the most uneducated eye must, we think, be offended at the very glaring discrepancy of parts here manifested. Accordingly we do not give the elevations of Goldsmiths' Hall, that is the exterior, as affording a study of design which may be safely taken as an example by others, but merely to show what it is, and by pointing out its defects to warn and caution against them.

In the interior of his building, the architect has acquitted himself infinitely better, since that deserves almost unqualified praise, not only on account of the general magnificence and sumptuousness of its state apartments, but also for an unusual degree of picturesque effect. As far as we are aware, the Grand Staircase has no rival in the metropolis, either in any of the Clubhouses, or any other buildings public or private—certainly not in the British Museum, where—if anywhere at all something approaching to it, at least, might be expected. From the plan alone, of course but an imperfect idea can be formed of its beauty, but without a plan even careful description, and that aided by a view, is not sufficiently explanatory.—And for description we will here again have recourse to the writer in the "London Interiors."

"The entrance hall itself makes no great architectural show, it being treated merely as an outer vestibule, as which it is sufficiently spacious and handsome; still even here we have something to excite curiosity—a sort of promise of, and prelude to, still greater magnificence to come, as we catch imperfect glimpses of a splendid back-ground, showing itself—we will hazard the bull—in lustrous dimness through the glazed oak screen which separates, yet without entirely disuniting, the Hall and Grand Staircase. Nothing can be better managed than this arrangement, whether as regards effect or convenience; without being altogether shut out of view even at first, the staircase does not come into view too soon; and the vestibule having first to be passed, gives an idea of greater extent than if that and the Staircase formed a single open space. By being enclosed, the latter is rendered infinitely more comfortable: not only draughts of air, but the noise attending the arrival of carriages and the setting down company, is cut off, and visitors can linger on the staircase in their ascent, without being exposed to the gaze of attendants in the hall. It certainly is a scene to linger in: most striking as is the *coup d'œil*, on first entering, and it is one of almost magical effect, a fresh architectural picture—a new combination, presents itself at every turn of the ascent; and as you advance, the space shews itself greater; nor is the full climax of effect gained until you have reached one of the side colonnades, and thence survey the full extent of the staircase from end to end, across the four ranks of columns."

"Standing on this spot," viz, at the bottom of the staircase, the writer goes on to remark, "there is a striking degree both of expanse and loftiness over-head; to the first of these the depth of the colonnades and upper loggias contributes in no small degree, for had the design been in all other respects just the same, but with only a single line of columns on each side, the effect would have been considerably less—different, in fact, as to kind, as well as to degree, and of by no means so striking and unusual character. The scenic effect thus produced is considerably enhanced by the mode in which the light is admitted entirely from above—over the centre division, through three large arched windows beneath the dome, on the south, west, and north sides, and over each of the loggias behind the columns, through three compartments in the flat ceiling, filled in with diapered and stained glass, and therefore highly ornamental in themselves, and also tasteful novelties in design."

This is by no means all which is said in the way of either description or comment on the subject of the Staircase, but we do not consider it necessary to quote more, for were we to help ourselves to what would suit our purpose, we should reprint all that is said in the publication. Still we cannot refrain from taking, if not the whole, a considerable portion of what is said of the Banquetting Hall, and do with the less scruple, because we think that we are rather serving the publication which we thus make use of, by making many of our readers now first aware of its existence.

"On the west side, or that facing the windows, the two extreme intercolumns are occupied by the doors communicating with the loggias of the staircase, consequently the stylobate is there of necessity interrupted: in the three other intercolumns are as many full-length portraits, viz., that in the centre of William IV., by Sir Martin Archer Shee; to the right of him Queen Adelaide by the same artist, and the other, that of her present Majesty, by Sir George Hayter. The north end of the room, which is that shown in our view, presents what is both a novel and characteristic feature, as well as a striking one in the general coup d'œil, as seen on first entering from the opposite end—namely, the large niche serving as a beaufet. This is hung with scarlet drapery in folds, on which the light falls from above through a glazed semi-dome; yet, although happy in idea, this last does not produce in the day-time all the effect which it might have done, had that opening been filled with warm amber-coloured glass. The appearance, however, is most superb of an evening when, on the occasion of a banquet, this recess is decked out with what has been called 'the very best edition of Goldsmith's Works'—the Company's magnificent array of plate, rendered still more dazzlingly splendid by the intense lustre poured full upon it, by lights which themselves are not seen by the spectator.

"Turning now in the opposite direction, to the south end of the room, our admiration abates very considerably, for that is so different in design and character from all the rest, as not to seem to belong to it. Here we behold an oak screen, with Corinthian columns and pilasters, over which is an open gallery: the order, indeed, is the same, but of very different material and colour, and being of one uniform colour throughout, this screen contrasts far more strongly than agreeably with the scagliola columns along the sides of the room. The general design or *ordonance* of the room is, besides, disturbed by it, as its order is upon a smaller scale, and quite unconnected with the larger one. This screen carries a quaint old-fashioned look, expressive enough of olden times and civic customs, yet ill assorting with the more refined and elaborate splendour of the room. We do not, however, at all attribute it to the architect's own taste, but suppose that it was forced upon him as a point of etiquette."

It must be confessed that the oak screen mars the general design of this noble room. Far better would it have been had the order, and the screen formed by filling up the lower part of the intercolumns to the same height as the present screen, leaving the upper parts and the capitals of the columns, insulated, which while it would not have been attended with any inconvenience as regards the music gallery over the screen, would have been a decided and very great improvement in respect to uniformity and beauty of ensemble. At present the screen has too much the look of not belonging to the rest, but of being built up into the room; and the gallery over it, too much like an awkward and unsightly gap in the design.

[1] We borrow this and some other extracts from the letter-press to Part XXVIII. of the "London Interiors," which contains views of the Grand Staircase, and the Banquetting or Livery Hall, the latter from a drawing by Mackenzie. Those views, therefore, and our elevations and plan mutually aid each other in affording an adequate idea of the structure, both externally and internally; and hardly need we recommend the "London Interiors" for the manner in which the literary part—if not, indeed uniformly from the first, in all the later parts, because our extracting so much sufficiently attests our good opinion.

OBSERVATIONS ON ARCHITECTS AND ARCHITECTURE.

By Henry Fulton, M.D.

No. II.

It must be stated, although it is with grief I do so, yet without the fear of contradiction, that the state of architecture is far behind that of all the other branches of science and art. With us, its character, without possessing anything noble, is almost degraded into the mere art or trade of building. Some architects, fearful it may be of exposing their own ignorance, discourage the attempts of amateurs to raise the character of the art, when these latter endeavour to do so by urging the necessity for a more extensive knowledge of its principles, and a closer adherence to the best examples of antiquity; but, instead of their being hailed as auxiliaries, they are stigmatised, or at least treated, as intermeddlers and idlers. To prove that a lamentable state of ignorance with respect to useful knowledge prevails, we need only refer to Professor Donaldson's exposé of the circumstances attending the election of an assistant surveyor for the Westminster Commission of Sewers: out of thirty-three candidates who were to be submitted to an examination, six only were selected as competent to go to the election, all of whom were engineers; indeed, it would almost appear that the architects feeling their own incapacity had bolted on reading the paper containing the proposed questions. The publicity of such a circumstance as this, ought to excite the laudable emulation of the profession; and although it would be unfair to judge of a whole profession from the deficiency of a few individuals, yet unhappily it may be brought in aid to support a generally received opinion that the architectural profession is behind most others in the acquirements of both general and the higher walks of professional knowledge. Of course, it must be admitted, even by those inimical to the art, (if such indeed there be,) that to this observation there are some bright exceptions—to such I would now address myself, and beg of them to put their shoulders to the wheel and extricate the good machine out of the mire, into which the incapacity of some, and the apathy of others, have suffered it to sink.

That the acquirements of our modern architects, in the merely mechanical branches of the art, are respectable, I fully admit; the pressure from the builders sufficiently secures that; and if the latter class saw, or could persuade others to see, that those who assumed the station of directors had no superior qualification to fit them for the office, they would soon throw off all subjection: of this propensity there is a striking example in another profession, which in many instances has been too successful. Then to mend matters, Mr. Gwilt (of whom more anon) has made an attack on amateurs, who would naturally be your allies, a force by no means so contemptible as he supposes, a force though small in number they may be, yet possessed of some of the material requisite for such a contest; that amateurs can write, and write well, I may mention Dallaway, Hope, Willis, Whewell, and other "literary idlers of both Universities;"—that amateurs can design, I may mention Lord Burlington, and the Noble President of the British Institute, although, from what I have seen of the former, and have heard of the latter, I cannot mention either with much pride, but within these few days I have seen a composition of a non-professional, which I much doubt if there be many architects amongst us who could equal it for the chasteness, simplicity and harmony which an ornate design should possess. Go to the Hall of Commerce and see what I mean, it is in the immediate vicinity of the Bank of England and the Royal Exchange, both of which buildings probably cost thousands for the hundreds expended on the former, and yet we have in it what we may in vain look for in the others. It is true Mr. Moxhay has hung a solitary effigy of a cocked hat above the door, apparently in compliance with the Palladian predilections of the profession; if he will take this away, he will remove all that mars a very creditable design. I understand that the Noble President's design, before alluded to, is a Louis Quatorze castle, if so, his Lordship shews great good sense in resisting the solicitations of those friends (?) who have recommended its publication.

Architects should be more communicative, they must not be so shy in writing, but let them in every way support their own journal, and through it, as the best medium of communication, improve, guide and direct the public taste, so as to enable the uninitiated to discriminate. It is a thing much to be wished for that the profession would avail themselves of such a vehicle more than they appear to do. A subject most useful and improving in itself, may not admit of being elongated into a book, yet may make a good paper in a scientific journal, and in such a form be more extensively read and canvassed. Perhaps it may be said that architecture is not a liberal profession, if so, the sooner it ecomes one the better, otherwise it must be a mere trade. I do not want books or papers written with the title of "Every Man his own Architect," I only want treatises to direct the taste of the public, not their trowels; if architects will do this, then their own acquirements must keep pace with the improvement they desire to effect in others, which in itself must lead to an advancement of the art far more beneficial than wasting time in dreaming over "a collection of all the editions of Vitruvius," or writing works which ought to be placed in the "*index expurgatorius*," alluded to in Observations No. 9.

II. Some time ago a writer in the Foreign Quarterly Review bestowed some praise on the naissant taste for the revival of architecture in Germany; no sooner does this meet the eye of Mr. Gwilt than he rushes into print, and fulminates against "amateurs and literary idlers," on the supposition that the article in question was the offspring of a non-professional pen. In taking up an offensive position against these intermeddlers, Mr. Gwilt serms to have totally overlooked in a military point of view, the necessity for taking care that his own lines should be capable of being defended, in case of an attack, even from so humble an assailant as the writer of these observations. At the end of the article given at page 139 of this volume, a question is put to Mr. Gwilt, which he has not answered, it may therefore be interpreted to mean that he *cannot*, answer the question; and so let him rest; "York Stairs" will do for his monument, but when next he advances to attack "mere amateurs" let him recollect that he has left one unanswered behind. In speaking of monuments, let me beg Mr. Gwilt's pardon whilst I digress to remark the omission of a writer in a late number of this journal on that subject, namely the outrageous violation of propriety in putting the *pro Cristo* insignia of martyrdom on Johnson's monument in St. Paul's; as well might a cross-legged effigy be placed on the tomb of some knight-errant who, under the guidance of a second Peter the Hermit, had engaged in a crusade to drive amateurs out of the would-be preserved field of architectural knowledge. Certainly the Dean and Chapter of Westminster might have admitted the statue of Lord Byron with more propriety than their brethren of the other Chapter did this—as to Byron, his genius is above all defence, some of his errant writings below it; let us, in charity, whilst we admire and do honour to the one, pity and regret, but not magnify, the others.

III. "Architecture" occupies a very respectable portion of the catalogue of the present exhibition at the Royal Academy, namely, from number 1046 to 1264, thus we ought to have no less than 218 architectural designs; but what is the fact of those which have any thing to do with the art, there is not more than one fourth of that number. The first exhibit under the head of "Architecture" is the portrait of a General Officer, which has nothing to do with the art except having a cocked hat, which may be considered by some as a model for a window pediment, and the last is a portrait in wax of a lady deceased, who may have worn a pulvinato, such as we see represented above the windows of the Reform Club; in fact there is only a sprinkling of strictly architectural designs, and the greater part of these would have been better at home. We are favoured with a design by Mr. Papworth, for a collegiate edifice. He has shewn in this, by his broken entablatures and non-supporting columns, an inveterate leaning to the Palladian school, and by leaving the columns unfluted (even in a fancy design), a total want of perception of the beautiful in architectural composition. It will answer very well, however, as it stands, for a *chateau en Espagne*. Another design is a proposed, or as I rather hope only a supposed, addition to the Banqueting House at Whitehall, by Messrs. Wyatt and Brandon. Inigo Jones design is bad enough, and his architectural sins numerous enough, but in the supposed addition they are not only perpetuated, but others are committed from which the Banqueting house is free, namely, broken horizontal cornices and a window like that of the East end of St. Martin's Church and the one in the Gresham Club, spoken of at page 98 of this volume. If I err in condemning this description of window, at least I err in good company; Professor Hosking, in his excellent treatise, says—"The large circular headed with two conjoined smaller rectangular windows found in the later works of the Italian school, and called Venetian' is radically inelegant." Mr. Barry's views of the New Houses of Parliament are by far the best designs exhibited, and on the Palace of Westminster he may base his claims for fame; but we regret to see in the edifice itself, that in neither his pointed nor four centered arches has he chosen the most pleasing forms; the former are generally too obtuse and the latter not flat enough; the finials on the minarets are, to our eyes, rather too much Byzantine, and not the light ærial things which should accompany the pointed style. The machicolated attic of the interior court is rather heavy; we mention what strikes us as defects, the beauties of the building itself must be seen to be rightly appreciated.

IV. The Irish Institute of Architects has taken a step in advance of the British; on the 28th ult. Sir Richard Morrison, the Vice President, delivered a lecture [1] as it was called, but which was rather an oration in praise of the art, and indeed with a little variation of names it would answer equally well for an oration in praise of any thing else. It had little which was peculiarly applicable to the art, not a single drawing nor model was exhibited. Many things were stated which were perfectly true, but nothing that was at all new; and we much doubt if any of the small, but respectable and attentive, audience have been more fortunate than ourselves in carrying away a single new idea on the subject. It put me in mind of the late Lord Castlereagh's speeches in the House of Commons, all he said appeared to be to the purpose, but the moment he ceased speaking it was impossible to recollect any thing that he had said. Still the Vice President is entitled to the thanks of the public and the profession for breaking the ice, and setting an example which he intimated would be followed up by others of the Institute. The only point at all forcibly urged (and with which we fully agree), was that proper edifices could only be built by properly qualified persons, and that it was not proper to put architects' plans into the hands of builders. He also stated "that a few but surpassingly beautiful edifices have been erected in Dublin," but to our great regret omitted to mention where we could find them out. A high encomium was passed on the late President Lord Vesey Fitzgerald, but we do not recollect any mention being made of our own proper exertions to bring into notice the beautiful façade of his Lordship's Antrim house, see page 97 of this volume.

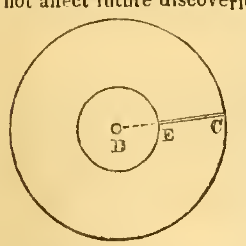
Clonmore, Dublin,
July, 1844.

[1] A copy of the oration has come into our possession, which we have given in another part of the Journal.

ON THE GENERAL PRINCIPLE OF ROTARY ENGINES.

THERE has been a prevalent opinion from the time of Watt to the present, that if any grand improvement of steam engines be introduced, it will be effected by causing the steam pressure to produce rotatory motion *immediately without the intervention of a crank*. This opinion has however received great discouragement from the high authority of Tredgold, and in his condemnation of rotatory engines, he has committed in one instance, such an important error in mechanical principles, that attention ought to be called to it.

Throughout his great work on the steam engine, Tredgold excuses his brevity in noticing various rotatory engines on the score of practical objections, such as leakage, friction, and the difficulties of construction. Not content however with these *practical* objections, he attempts to prove theoretical objections also; these are now to be considered—of the practical objections no more need be said at present, than that he seems to have overrated them, owing to his supposed discovery of an error in the first principles of rotatory engines, and that his objections after all can only extend to those rotatory engines known and examined by himself. It seems impossible for him or any one else to predicate *a priori* practical objections to an unexamined engine. The same objections have been made long ago to reciprocal engines, and arguing abstractedly, there is no reason on earth for assigning greater difficulties to rotatory than reciprocating engines. With regard to the practical difficulties, then, experience can alone guide us; all we can safely say is, that in all rotatory engines *hitherto* known, great practical difficulties do exist: this does not affect future discoveries.



With regard however to Tredgold's theoretical objections, something more may be said; because if those objections were correct, they would affect not only all present, but also all future constructions. His objection, which is not expressed very clearly, is this—"The pressure on an inch at the most distant part C, from the centre of motion is the same as the pressure on an inch at the part E nearest that centre. But since the piston is constrained to move in a circle, the effects of these equal pressures are as their distances from the centre of motion, and limited by the effect of the pressure at the most distant part C. If the centre of curvature were nearer the side of the vessel, the effect at E would be less. Therefore the effect of the pressure to produce motion is less than in a straight vessel having the same base; and if the bases be the same, the space the pressure acts through will be as the quantity of steam, consequently the quantity of steam being equal the power of rotatory action, will be less than that of rectilineal action." P. 158, sec. IV.

He then proceeds with an analytical investigation, and concludes the power in the rectilineal engine to be greater than that in the rotatory; his reasoning is however vicious in principle.

This error in the analytical investigation cannot be better explained than in the words of his own Editor Woodhouse, whose observation, being among the errata of the work, has frequently been overlooked. "Tredgold has here made use of the moment of the pressure of the steam, instead of the actual pressure on the parts. The force at the distance x from E is $f\,y,\,d\,x$, which multiplied into $2\,\pi\,(r+x)$, the space described, gives $2 f\,\pi\,y\,d\,x\,(r+x)$; and the integrate is $f\,\pi\,a\,y\,(2\,r+a)$, the power expended at each revolution. It is hence plain that no power is lost, the factor $\pi\,a\,y\,(2\,r+a)$ being the volume of steam employed at the pressure f, r is the distance D E, y the breadth of the piston, f the pressure on a square inch.

The above calculation by Woodhouse, shows the quantities of power exerted by equal quantities of steam are the same in rotatory and reciprocating engines. To understand the important error of Tredgold, it may be observed that the "moment of pressure," is "the pressure multiplied by the length of leverage by which it acts," and this quantity Tredgold has mistaken for the pressure itself. To explain, without mathematical reasoning, we must consider what is meant by the phrase "loss of power." It does not mean that of pistons of equal size, the reciprocating piston will produce most force. This is not the question—it is rather whether, when equal quantities of *steam* are employed, the reciprocating engine has most force. This distinction, simple as it is, explains the whole difficulty. The pressure on an inch at E in the above figure, has certainly less force than pressure on an inch at C, and if E were very near the centre D, the pressure at E would produce scarcely any effect whatever. To compensate this, however, the parts at E describe less space in their revolution than those at C, and consequently require less steam. And it is found by mathematical investigation that this compensation is so exact, that where *equal quantities of steam are employed*, the force is exactly the same in both kinds of engines; in fact this conclusion might have been suspected beforehand, by considering that if power were lost, it must have expended itself *somewhere*, and this could only be by one of these two ways—either by the escape of the steam, or by its being employed to produce motion in something else besides the piston—both which suppositions are excluded from the investigation.

There is however another way of viewing the matter in which there is a positive gain of power on the rotatory system. It is known that in all reciprocating engines the number of strokes per minute is limited, and the larger the piston, the greater the difficulty of increasing the number of strokes. This arises from the momentum acquired by the piston's motion in one direction having to be destroyed before it can return. The direction of the motion is constantly changing, and it is obviously more difficult to make a large body move *up and down* rapidly, than continue the motion always in one direction. Hence arises the well-known contrivance of cutting off the steam before the stroke is completed: if the pressure were not stopped, the piston must violently strain the connecting crank, or must be met by a great pressure of steam on the side opposite. Now although by cutting off the steam, no power in one sense is lost, because no steam is lost, still there is a loss of *time*, owing to the steam being unemployed during part of the stroke, and the rapidity of the engine is consequently limited. In a rotatory engine however, the motion would be always in one direction, and would be constantly accelerated by the steam.

There are other advantages which may be expected from a practicable rotatory engine. It may be concluded from these already patented, that such an engine would have little external machinery, that is, all the moving parts would be contained in the steam chamber containing the piston. Hence might be expected these immense advantages—the great diminution of the weight and bulk of the engine—and consequent on the simplicity of the mechanism would be the facility of making it, and the diminution of the danger of getting out of repair.

When the great desideratum of a practicable rotatory engine has been accomplished, a new era in the history of the steam engine must commence. Correct theoretical principles must prevail when the practical difficulties have been overcome. That there are no theoretical disadvantages may be mathematically demonstrated—of the practical difficulties it is illogical to predicate *generally*. It is a common custom to do so, because rotatory engines already tried have failed. But until some proof can be shown of the *necessary* difficulties of the rotatory principles, this condemnation must be considered an unreasonable generalization. There were full as many in the way of reciprocating engines, but the perseverance of Watt did that for removing the practical difficulty which his genius did for removing the theoretical. H. C.

THE WESTMINSTER HALL EXHIBITION.

Within the last month has been opened at Westminster Hall, the exhibition of fresco painting and sculpture for the decoration of the New Parliamentary Palace; the frescos being an extension of the cartoon competition, the sculpture a primary competition. If opinions were very various at to the merits of the cartoons, still more discordant are those with regard to the frescos, though when carefully examined they all show the same real result. The large artistic faction, attached to oil and water colour, unwilling, often unable, to try a new medium, have been consistent in decrying fresco and those who have the courage to practice it. Many critics and connoisseurs of extensive learning, well acquainted with the fine works of the great fresco masters of antiquity, have determined to gage the exhibitors by the standard of Michael Angelo and Raffaelle, and to denounce it if, as was sure to happen, it did not in merit come up to the limit so assigned. These parties too have in many cases vehement prejudices in in favour of oil, and strong misgivings as to the genius and capabilities of English art, being generally *laudatores tempora acti*, and prepared to maintain the supremacy of old masters, because old masters. There are others again who without any pretension to knowledge of art will, *more vulgari*, apply their noses to the frescos, and finding they have often a coarse plaster surface, pronounce instant condemnation. Hence it was a matter of course if there were strong denunciations of the trashy character of the cartoons, the condemnations of the present exhibition would be loud and deep. This, however, as we have before intimated, does not disturb the real conclusion. It must be palpable to the least reflecting that in a country where historic art was uncultivated, and the manipulation of fresco universally unknown, no immediate exhibition could result in the production of masterpieces, neither was it contemplated by the Commission of Fine Arts. The best that could result, and what has resulted has been to show the capabilities of English artists for learning, and to show what they can do with the benefit of time, practice and opportunity. These are exhibitions not to be judged by their immediate effect, but by their ultimate tendency, and it is plain it can be but justice to award to them praise or blame in conformity with the circumstances. Hence while those who had fixed too high a standard of comparison have pronounced condemnation so decided, others not less intimate with art, not less learned in its traditions, or less conversant with its works, have expressed their extreme contentment and their great thankfulness, that such and so much talent is to be found in the country, capable of making such progress in so short a time, and of doing the greatest honour to the country and themselves in the future. This too is the feeling of the members of the commission, men who have had to contend with all the prejudices of their own predilections and with the insinuations of their artistic associates and counsellors, making them in the first instance unwilling and mistrustful ministers of the public voice, but now feeling more confidence at every step, and more satisfaction at the gratifying results of their proceedings. The whole affair has been an attempt to make out a case for the employment of art and English artists—the exhibitions have been virtually legal pleadings to show cause why such a rule should be granted by the supreme authorities, and it is evident with success.

When it is considered that the members of the Royal Academy, those by their talents and position at the head of art, have, with about half-a-dozen exceptions, held back from this competition from motives which do little credit to them, and are an insult to the country, it is naturally to be expected that the talent available for a competition will be much restricted in number, while with regard to sculpture an unfortunate indulgence has tended very much to reduce its character. With a view to diminish the labour and expense of those sculptors who might compete, works were allowed to be exhibited, which had been executed within five years prior to May in last year. The effect of this has been not to relieve the poorer artists, but prevent artists of eminence having capacious studios from sending in original works of importance, while it has filled the hall with nymphs sleeping, boys bathing, Greek, Roman and other gods and saints, which are not proper subjects for the place of meeting of the imperial English legislature. Artists are, as it is, little enough disposed to execute works of high character, calling forth the resources of intellect, so that instead of encouragement being given in their usual meretricious pursuits, every care should have been taken to exclude those whose works showed want of sympathy with the noble purposes, to which art is called upon to apply itself, in that edifice. Two things should be strongly enforced, the selection of a suitable subject and its proper treatment, or if we are to judge from what we now see, the most awful perpetrations of ignorance will disgrace that very cradle of our history and liberty, an English House of Parliament. To pass over Boadicea and the Britons being represented as Romans, Greeks or English instead of Celts, King Alfred with the countenance of an Athenian or a Jew, and Jews with English features, there are numerous works strikingly inappropriate. Beatrice Cenci meditating the murder of her father, a Roman Contadina, Recollections of Naples, a Bacchante, a wounded Greek, Kilchurn Castle, are with many others equally irrelevant in character to be found among the frescos. There are also numerous scripture pieces, the relevancy of which to the English constitution, may very well be questioned. What principle of English law, administration or glory, is illustrated by Samson slaying Philistines with the jawbone of an ass, we cannot conceive, neither do we find greater appropriateness in its courtiers. We question too the propriety of such works as the deeds of Cassivelaunus, Boadicea or Caractacus, because they have nothing to do with the national history, however rightly they would be introduced in an illustration of local history. If we rightly comprehend the subject, the Palace of Westminster, the seat of the Imperial Legislature, is to be appropriately decorated in accordance with its history, its character and its functions. Ancillary to these are decorations illustrative of the national glory as expressed in deeds of arms, the works of poets and authors, the discoveries of philosophers, and the inventions of mechanics. The functions and actions of individual members of the legislature, however trivial, may in this case be appropriately represented, while many important local actions must be excluded. While the pageants and personal deeds of Kings of England and Scotland, make legitimate pictures, the deeds of King Cassivelaun, Vortigern, Brian Boru, or Llewellyn, are strictly inappropriate. Thus too we may admit a Council of Ancient Germans as exhibiting the germ of English liberty, while the councils and legislative bodies of Ancient Britons and Irish, as having no connection with the constitution and no influence upon it, would only suggest solecisms and anachronisms. Strictly speaking the conquests of Ireland and Wales would be appropriate constitutional subjects, but a feeling of delicacy would suggest the exclusion of such. We think it necessary to make these remarks, as artists generally show such deplorable ignorance of the national history, and particularly of its constitutional bearings, hence such lamentable nonsense, as a "Council of Ancient Britons, Nucleus of the British Parliament," in which an artist of merit has completely wasted his time. No student, however careless, of Hallam or Palgrave, could make such a deplorable blunder, and indeed a third form boy at any public school would be justly flogged for such disregard of the pages of Cæsar and Tacitus, which so vividly depict the ancient nations of Northern Europe. How different on the other hand is Martin's noble cartoon, the Trial of Canute, where we are reminded by the vivid, truthful and able delineation of the scene that nearly a thousand years ago, that palladium of our liberties, trial by jury, was in existence, and that it even then constituted a tribunal, which kings and people honoured. This is a true and great constitutional lesson, replete with interest of the highest character, and one which would speak with equal effect to all ranks, in future ages as in the present.

Having made these preliminary remarks, we must avow our conviction that an exhibition has never been seen in this country showing greater genius or finer works than the one now in question, and we have little fear of its being adequately appreciated by the public at large. Whatever indeed may have been the character of the works, the Westminster Hall exhibitions constitute an era in art, having done more to instruct the public, than we are sorry to say the Royal Academy has done since its foundation, and proving the utility and necessity of opening to the public annual free exhibition of works of modern art. We now proceed to the examination of the individual works.

Designs and Paintings.

No. 1 is an encounter between Cæsar and Cassivelaunus by Henry Melling, a cartoon, because cartoons are allowed to accompany specimens of fresco. The subject is scarcely a proper one, but its treatment shows a good deal of ability, though marred by confusion and extravagance. Mr. Melling's Britons have aquiline noses, which we believe is not a common thing in the Vale of Llangollen or the regions of Vannes.

David Scott of the R.S.A. has a fresco No. 2, called Guards on a Battlement, which exhibits the shoulders of one figure and the legs of another. This we consider a defective arrangement, and we are sorry we cannot say more of it.

No. 3 is Boadicea leading her troops against the Romans, a cartoon. Here is a good deal of care, though the style is harsh. Boadicea is represented with a plaid. Now, although some few individuals may countenance this, there appears no reason to suppose that the vary-coloured garment of Boadicea was a plaid, or that any other members of the Celtic race ever wore it beyond its present wearers, if it be not indeed, comparatively speaking, a modern invention.

No. 4, a fresco, is the Accusation of Susanna, by Robinson Elliott, perhaps illustrative of English trial by jury, or a special jury in a crim. con. case. It has some fair design, but is a bad fresco, being in single layers of colour, looking unfinished, with large masses of raw colour.

No. 5, a fresco, by the elder Aglio, one of the earliest practitioners of fresco in this country, is a Representation of the Bay of Naples, showing great capabilities in fresco for landscape and perspective.

Law and its Attributes, No. 6, by S. Bendixen, is executed after a method invented by the artist. This, like No. 31, is violetty, or rather of a plum bloom tone, but clean, and showing apparent care in handling. The figure, however, is not Law but Meekness.

A very curious work is No. 7, by Ford Madox Brown. It is a cartoon of the Body of King Harold brought to William the Norman after the Battle of Hastings. There is some able grouping, some good drawing, but after French masters, and there is a demoniacal grin on most of the countenances which mars what might otherwise be a good work. From a misrepresentation of a passage in Thierry, William is represented with two great human thigh-bones suspended round his neck, although it must have been tolerably apparent to the artist, that it was impossible for the Duke to move about on horseback with such a Cossack decoration. The figure of King Harold is too old, while the mouths of all the figures are wide open. The coloured sketch No. 8, has the same disagreeable effect of colour which the cartoon has in design.

9, Prayer, by John Calcott Horsley, the border by Owen Jones, and the border is the best. This is a decent work in the Wordsworth and Rogers vein, and by a favoured artist, who received on the previous occasion a £200 premium, in our opinion equally ill-deserved as the commission he has now obtained.

10, Beatrice Cenci, said to be meditating the death of her father, but that is doubtful. John Zephaniah Bell was a two hundred pound prize man. To our simple eyes, this prize fresco is raw and unfinished, badly designed and badly executed.

No. 11. Two Heads, by John Martin, fresco, is sketchy, but has more feeling and ability than its two neighbours, and raises our estimate of Mr. Martin's capabilities. We wish he would, regardless of the neglect he has on the present occasion felt, devote himself to historical art.

No, 12. Fair Rosamond, by Edward Corbould, fresco, the frame by Simpson, in the Strand. This is tame and the colouring wants breadth, while the subject shows how well the artist understands what is due to the dignity of the country. The frame is good.

No. 13. An Act of Mercy, by William Riviere, fresco, poor, coarse, and brown, the hair like mops.

No. 14. A study in oil for fresco, by E. Butler Morris, the Overthrow of the Druids, has much gesture and grimace, is tame and tells no story.

No. 15, is a cartoon from Milton, by G. Page, in which a number of queer, strange-looking animals are huddled together, one of them a caricature of the Apollo Belvidere. The principal figure looks as if he had just been whipped and was squalling after it.

No. 16, by Ambrosini Jerome, and 17, by James Archer, both frescos, have no adequate subject, and if not sunk in the depths of ignorance, have few merits to attract attention, though there is much bright colouring. The latter artist may do in time.

No. 18. Boadicea, a fresco, by Henry Warren, the President of the New Society of Painters in Water Colours, is a great stark staring woman with her mouth open.

The study in oil, No. 19, by E. Butler Morris, Discovering the body of King Harold, is a much better work and subject than No. 14.

A Bacchante, by Jones Barker, fresco, 20, has bright colouring. No. 22. A Girl reading, the same.

The cartoon from the Tempest, by Salter, 21, shows some excellent drawing.

No. 23, is a Study on Fresco, by Augustine Aglio, jun. It has a good deal of merit, but the figure wants interest.

William Edward Frost received a premium of 100 guineas last year. His fresco of Samson slaying a Philistine, No. 24, shows Samson as a *jeune extravagant.* The figures all brown. We must not, however, depreciate it too much, for it is has merits above many of its compeers.

No. 25, is an oil painting by William Riviere. Council of Ancient Britons. Nucleus of the British Parliament. We have pointed out the nonsense of this; however, there is very good grouping and the arrangement excellent; as if, nevertheless, to show a disregard of everything appropriate, a beautiful English boy is represented in a corner of the picture.

The drawing and figures in the cartoon 26, by Joseph West, are French. It is Margaret of Anjou protected by the Robber in the Wood. It has considerable merit.

Alfred the Great, 27, is a piece of decoration.

A wounded Greek, by Stephanoff, 28, is a piece of this artist's dandyism. We were not over impressed with the treatment of the cartoon for which he received one of the £100 additional premiums, nor are we more so with the fresco, which is dauby.

A fresco, 29, the Combat, by Charles Hancock, has some good horses, but the artist, to avoid making mistakes in his human figures, has cased them in armour.

The Signing of Magna Charta is a cartoon, said to be by Douglas Guest. To avoid doing dishonour to an artist once respectable we shall say no more.

S. Bendixen's other work is Peace receiving a wreath of Flowers, which is rather a better work than No. 6, but in the same style and tone. To our mind, Peace seems turning round the wreath on her finger, as jugglers do plates. The figure, though pleasing, wants dignity.

The fresco, 32, of the subject No. 19, is very fair, but wants finish.

No. 33. King Henry, is nothing, if not raw.

No. 34, the Empress Aggrippina interceding on behalf of the Family of Caractacus, is only part of a fresco, which is to be regretted, as the artist, Charles Lucy, shews himself capable of grappling with his subject and his tools. To our mind Agrippina was never so brown.

The cartoon, 35, by Harold John Stanley, Alfred compiling his Laws, is one of the few appropriate subjects, and the artist deserves much credit for the very great attention he has shown to the details, and to the drawing. The fresco 36 is, however, weak.

Mr. Hart's Head of David, in fresco, 37, is one of the finest works in the exhibition, and in our mind entitled the artist to have been among the six selected, instead of some of the favoured. It is a work which justly excites admiration.

The Golden Age, 38, a fresco, is better than 28, but still it suggests the idea of a sitting room or a lady's boudoir.

The Trial of Canute, a cartoon, by John Martin, No. 39, is the next work. It details the circumstance of King Canute the Great having in a fit of intemperance slain a soldier, when descending from the throne, he insisted on being tried and punished for the offence. This subject is a fine one, and is carefully carried out. The composition is replete with interest, though of a subdued and solemn character. The large expanse of vaulting overhead may perhaps be objected to as giving a nakedness to that part of the design, though contributing to the serenity and imposing effect of the whole. This is a work which, for research and originality of subject, is entitled to great applause.

The Study of a Head, by R. W. Buss, a fresco, 40, shows the artist in a much higher strain of art than he has hitherto practised. We hope he will follow up the career so ably begun.

Kilchurn Castle, in Scotland, No. 41, is a fine landscape in fresco.

The next number is attached to a daub.

No. 43 is unimportant. No. 44 is best adapted for a public house, for which we suppose it is ultimately destined.

No. 45, 46, 48 and 49 are by Armitage, one of the competitors of last year, who received the premium of £300 for the cartoon of Cæsar's Invasion of Britain. The cartoon of Ophelia treats excellently, with originality and with feeling, a hacknied subject. It must, however, be carefully looked at to be appreciated, when the arrangement of the lights and disposition of the figure can hardly fail to meet with approval. The encaustic painting of The Fates, is one of the gems of the exhibition. It is a grand subject, in which dignity is maintained, and the realms of imagination entered without the truthfulness of those of nature being impaired. The execution is good. The two studies in fresco show boldness in treatment and firmness of hand, and are also in the class of superior works, though possessing some palpable faults. Armitage is an artist whom we have gained by these competitions.

The cartoon, 47, by Stephanoff, is the Death of Wat Tyler, treated in holiday style.

The fresco of King Alfred, by H. C. Selons, 50, has some merit but is wanting in firmness, drawing and study.

No. 51. Redgrave's Loyalty, a fresco. Catherine Douglas barring the door with her arm to withstand the assassins of James the First of Scotland, is a subject difficult to be treated, but which Mr. Redgrave has done himself much honour in mastering. While the painting powerfully arrests public attention, we are glad to see that its artist has been selected as one of the six artists for the House of Lords.

The Throne of Intellect, Nos. 52, 54, and 55, by W. C Thomas, is undoubtedly a fine composition, but suggests to our minds the idea of imitation from the works of Raffaelle. We recognize the ability of the artist, but we are not quite inclined to approve his selection as one of the six.

No. 53. The meeting of Jacob and Rachel, by C. W. Cope, has placed its artist among the six selected. It is a work the merit of which is incontestible, and which forms with the Fates of Armitage and the Loyalty of Redgrave the trio of leading works. Particular criticism is unnecessary.

No. 54. The Death of Abel, by Marshall Claxton, £100 additional premium man of last year, has some good foreshortening but wants interest and effect. His other fresco, 59, the building of Oxford University, exhibits figures too brown, and a want of shades, but relieved by vigour and simplicity.

Salter's Study, 21, is not worth much.

No. 58. The Battle of Bosworth Field, by Alex. Blaikley, is hacknied, and wants interest, but it is a fair cartoon for superficial decoration.

No. 60. The Parting of Sir Thomas More and his Daughter, a fresco, by S. A. Hart, is one of the fine works, but has scarcely reached the intensity of the subject.

Wat Tyler, No. 61, by W. B. Spence, is one of a common run of cartoons, an indifferent subject, some tolerably drawn figures, and a decent allowance of extravagance.

John Bridges, who gained a £100 premium last year, has a fresco which is to be classed with the superior works. It is Milton dictating to his Daughters, 62. It does not, however, carry out the subject to its best.

Peace, a fresco, by J. C. Horsley, one of the selected, has the merits and defects of No. 63.

The Death of St. Thomas à Becket, 64 and 67, by John Cross, we also mark as a good work. The figure of the archbishop is imposing.

No. 65 we may safely pass by.

No. 66, by William Dyce, is a fresco representing two heads, a work conceived in the antique style, but destitute of the antique spirit. We are assured the Commissioners must have been rather dazzled by prepossessions to place Mr. Dyce among the six selected.

E. T. Parris last year received a premium of 100*l*. We confess we are surprized after his long practice at finding no better work than his King John, No. 68. This may be very useful as showing how gaudy fresco can be made, and is a good work of the class, but then the class is meretricious. King John here beats King Solomon or King George the Fourth, in all his glory of purple, crimson and gold.

H. J. Townsend, who received a 200*l*. premium last year, has sustained his reputation by his Puck's Mission, No. 69, one of the best works in the room.

We have some respect for the Messrs. Foggo, so we shall allow our personal feelings to weigh down our strong objections to Nos. 70, 71, and 72.

The remarks we before applied to Mr. Buss are equally justified by his fresco, No. 73, the Conversion of King Ethelbert. It decidedly raises his reputation.

No. 74, fresco, is the Knight, by Daniel Maclise. Mr. Maclise is one of the six selected artists, and our readers may perhaps be curious to know what No. 74 is. We repeat, "The Knight, by Daniel Maclise." All Maclise's merits, with all Maclise's well known defects. He is the same in fresco as in oil. We think however the Commissioners are justified in their choice.

The fresco No. 75, by J. H. Nixon, is the tame Henry reading the Bible in Old St. Paul's. A cartoon, by Thomas Sheraton, No. 76, wants mind and interest. We thought Mr. Sheraton could do something better.

Love, a fresco, No. 77, by Augustus Egg, is a young artist's subject with French colouring and sentiment. In a lady's boudoir it would be considered a fair work.

Pickersgill's fresco, Sir Calepine rescuing Serena, is on the motif of the National Gallery picture. His 100*l*. additional premium last year seems not to have done him much good.

Mr. Severn also received a premium of 100*l*. last year. His English Bible read in the Churches is a fresco, totally unworthy of him.

Mr. Rippingille received last year one of the additional premiums, a decision which we in some degree doubted, we think however his fresco, No. 80, Luna and Endymion, a superior work, which raises his character much. The management of the floating figure is excellent.

The cartoon of the Angel of the Pillar, No. 81, by John Bell, the sculptor, is a laudable effort, and does him credit.

Nos. 82, 83, and 84, cartoons, occupy what we suppose is the condemned hole, in accordance with their character. If Mr. F. M. Brown is extravagant in No. 7, in No. 84 he shows a want of discretion, which would incapacitate him from employment elsewhere. Adam and Eve are most ludicrous caricatures, which would excite any one's laughter.

Sculpture.

The sculpture is arranged in the middle of the hall as the painting is around it.

No. 85, Lord Bacon, by John Henning, jun., has some dignity, but is more meritorious for its frill. No. 86, the Descent of Mercury, by Mr. Patrick Park, is a decidedly clever and original work, but spoiled by conceit. The Statue of Chaucer, No. 87, by Thomas Plumley, is finely conceived. Leopoldo Bozzoni has two Apostles tamely but smoothly executed. No. 90 is Captain Cook, by W. G. Nicholl. Mr. Rivers does not shine in Richard I., No. 91, which is unworthy of him, his Statue of Rennie the elder is however a redeeming work, but is only on a small scale. No. 92, a Statue by John Ternouth.

Hamilton and Carleton MacCarthy have given infinite spirit to St. George and the Dragon, No. 93, one of the most striking and meritorious groups. It however shows haste, and wants finish. There are no muscles under the horse's skin. Caractacus No. 94, by J. D. H. Browne, is a fair work, but not rising above the herd. St. John the Divine, by G. Templeman, is a dandified affair, but manifesting ability.

The last Prayer of Ajax, by James Legrew, No. 97, only requires of us that we should say, "it is life," being one of the choice works of the hall. R. C. Lucas has 98 and 99, both fine works, and the latter to be classed among the best. King Canute the Great wants dignity, but the subject of Lilla is novel in itself and in its treatment, impressing the spectator, though we do not absolutely concur in the arrangement, particularly of Edwin with his arms extended. Chaucer, No. 100, by W. Calder Marshall, is fair. William Scoular has a Shepherd Boy, and Adam and Eve lamenting over Abel. We need not say more. Nos. 103 and 104, by Henry Sibson, are costume portraits, to show off tailoring and haberdashery. Sophronia and Olindo at the Stake, No. 105, by A. H. Ritchie, is a work which we like for its treatment, though we doubt its admissibility in the Palace of Westminster. It is a superior work.

John Bell is one of the three selected sculptors. His Eagle Slayer, No. 106, is a work which would give him reputation did he not possess it already, and it fully justifies the Commissioners. The attitude is striking, but the arrangement of the drapery is indecent, it would be better if there were none. No. 107, we pass over. Its artist W. F. Woodington, has another subject, Milton dictating to his Daughters, which is fair. No. 109 is Sir Thomas More. The Hesitation of Pandora, by J. B. Howkins, has as much expression as can be communicated to sculpture, and is among our favourites. No. 111 is Chaucer, by John Hancock. No. 113 is Boadicea, a group, by John Henning, jun., who deserves credit for his exertions. King William IV., by C. B. Robinson, No. 114 must be meant for the Royal Exchange. Nos. 115 and 116 are Statues of Talbot, Earl of Shrewsbury, and King Charles the First. No. 117, Alfred the Great, by F. S. Archer, is fair, but is not Alfred. Benjamin Spence deserves credit for his group of the Death of the Duke of York, 118. Hercules and Lycas, 119, is a vigorous composition, by Henry Timbrell. No. 120 is a Statue of Alfred, by J. S. Westmacott. No. 121, Bacon, by Thomas Sharp, but the countenance interesting. John Francis has thought fit to send a Statue of Prince Albert, and David Dunbar, jun., of Mr. Robert Burns. The Newton, by William Jackson, has good expression, but is not equal to No. 132. Frederick Thrupp has two works, Nos. 125 and 127, both works of considerable merit, a Hindoo throwing a Javelin, which is however not a Hindoo, and Arethusa reclining. No. 128 is by R. G. Davies.

Lough is almost the only sculptor of eminence who has exerted himself for the present exhibition. No. 120 is a large group representing a wife, during the wars of the roses, discovering her husband's lifeless body on the battle field, with the charger standing over it. The charger occupies perhaps a position too prominent, but his expression is fine, and the whole group tells its tale. Mr. Lough's other group, No. 139, is on a still larger scale, and also historical. It is Edward I. creating a Dying Warrior a Banneret. This is a grand work, and shows what can be done in large groups in a national edifice. No. 130, Charles the First parting with his Children, by Henry Mares, is made ludicrous by the king being robed in a flowing bed-gown, a most womanly affair. We must not however contest that the artist has ability. No. 131, Cardinal Wolsey, by Thomas Grimsley, is well expressed, but No. 132, Newton, when young, by Edwin Gahagan, is an admirable specimen of refined and poetical portraiture. Milton reciting to his Daughters, by James Legrew, No. 131, is one of the choice works, showing how to infuse expression and truth into a subject so often treated. Jane Shore, by John Bell, No. 134, is a fair work. Bede is a portrait.

Carew has exhibited his Falconer, 136. We should be glad to give him due credit for it, but it is too well known; No. 152 makes up for it. Richard Cœur de Lion, 137, by J. S. Westmacott, is good, but the king is made too old. Hollins has sent for exhibition a bit of a tomb. Wyatt's Cœur de Lion is an equestrian figure life size, the warrior being mounted on one of Wyatt's horses, which he keeps for the use of such George the Thirds, Wellingtons, and Cœur de Lions as may be entrusted to his care. The expression of No. 141, Margaret of Anjou and the Robber, is good. The sculptor is John A. P. Mac Bride. Weekes has a good statue of the Marquis Wellesley. Nos. 143 and 144 are by W. Spence, Theseus killing the Centaur and Caractacus before Claudius Cæsar; works creditable but not remarkable. Edward A. Foley has Canute, No. 145, a work which does not rise above mediocrity. R. Westmacott, jun., has part of a tomb. Behnes has taken no trouble, having sent a statue of Lady Emily Somerset and a Cupid with Doves. He has the means of doing something, and he should have done it. Joseph also sends casts or copies of his old works, Wilberforce and Wilkie. No. 151 is a Girl at Prayer, by P. Mac Dowell, effective and with the eyes well managed.

No. 152, by Carew, Venus appeasing the anger of Vulcan, is one of the best classical subjects, and most polished groups in the collection. The Burial of the Princes in the Tower, by H. C. Shenton, jun., is another first rate work, so is the Death of Boadicea, No. 154, by Thomas Woolner. J. H. Foley is a selected sculptor, he has two fair works, Nos. 155 and 156, a Youth at a Stream, and Ino and the infant Bacchus. We think his place might have been better supplied. Baily has a portrait statue, 157. The Penitent, by John Ternouth, is fair, but mediocre. No. 159 is an historical subject, by Thomas Milnes, the Death of Harold at the Battle of Hastings. It is to be regretted the artist did not execute this work on a larger scale, when it would have advantageously contended with many competitors of greater pretensions. The figures of Harold, the horse and the assistants are good. Timidity, 160, by E. G. Physick, is good, but affected. No. 161 is the Marquis of Londonderry by J. E. Thomas. An Ancient Briton as a Scout, 162, by George S. Adams, is only a single figure, but a life and interest are communicated to it by its able treatment so as to place it among the most effective works. William Thomas's Prince Henry, 163, has nothing remarkable in the design or execution, though not contemptible. No. 164 is Hagar and Ishmael in the Wilderness, by Edward B. Stephens, a fair composition. No. 165, Eve, by W. Calder Marshall, did not prepossess us, and we were somewhat surprised to find its author one of the three selected sculptors. No. 166 is a Nymph Sleeping, by Baily, an old subject. Edgar Papworth's two works are commendable, Lord Brougham, and a Sleeping Girl. Thomas Earle has also two works 169 and 170, an Ancient Briton protecting his Family, a bold and expressive production, and Edward the First presenting his Son to the Welsh, which is not of equal merit. No. 171 is William of Wykeham, by John Thomas, a good statue. The Jealousy of Medea, 172, by Thomas Thornycroft, is a vigorous group. No. 173 is Alfred the Great, by E. B. Stephens, showing some expression. P. Hollins has another statue, 175, Dr. Warnford.

No. 176 is by Park, a Greek Warrior in ambush, clever, but far from giving satisfaction. The Falconer, 177, by R. Smith, is a costume piece. The next is a statue, by J. Panormo, of Caractacus, fair. No. 178 is a clever statue of a British Warrior by Samuel Nixon. No. 179 is Gower. No. 180, John Carpenter, by Nixon. No. 181, Edward the First presenting his Son to the Welsh, by P. L. Crowley.

In the saloon or entrance hall are some frescos which did not arrive in time, among them is a work of considerable merit executed by Eugenio Latilla, the author of the work on fresco painting. It represents the Murder of the young Princes in the Tower. Some parts are weak, but the assassins are treated with considerable merit. Mr. Latilla is at Rome, pursuing his studies in fresco, which accounts for the delay in the transmission, and we think should have entitled him to some indulgence.

ROYAL COMMISSION OF FINE ARTS.

The following is a copy of the circular addressed to each of the artists selected by Her Majesty's Commissioners to execute certain designs for the decoration of the New Houses of Parliament. The document is in itself so clear and intelligible as to render further explanation of the subject quite unnecessary:—

"Whitehall, July 15.

"Sir,—I have to acquaint you that Her Majesty's Commissioners on the Fine Arts, with the sanction of the Lords Commissioners of Her Majesty's Treasury, have resolved that six arched compartments in the House of Lords, each measuring 9 feet 3 inches wide, by 16 feet high to the point of the arch, shall be decorated with fresco paintings; that the subjects of such fresco paintings shall be illustrative of the functions of the House of Lords and of the relation in which it stands to the Sovereign; that the subjects of three of the said fresco paintings shall be personifications or abstract representations of religion, justice, and the spirit of chivalry; and that the three remaining subjects corresponding with such representations, and expressing the relation of the Sovereign to the Church, to the law, and, as the fountain of honour, to the State, shall be—the Baptism of Ethelbert; Prince Henry, afterwards Henry V., acknowledging the authority of Chief Justice Gascoigne; and Edward the Black Prince receiving the Order of the Garter from Edward III.

"I have further to acquaint you that the Commissioners have resolved, with the sanction of the Lords Commissioners of Her Majesty's Treasury, to employ six artists, selected by the Commissioners from the present exhibitors in Westminster Hall, to prepare designs for the subjects above-mentioned, and that the Commissioners have selected you as one of the six artists to be so employed, under the following conditions:—

"You are requested to prepare a cartoon, being a design for one of the aforesaid subjects, The size of the cartoon is to be 9 feet 3 inches wide, by 16 feet high to the point of the arch, and 10 feet 3 inches high to the springing of the arch (outlines in lithography, showing the form of the arch in the compartments referred to, may be obtained at the architect's office, in New Palace-yard.) You are further required to prepare a coloured sketch, not less than 18 inches in its shortest dimension, of the entire design represented in your cartoon, and a specimen of fresco painting, not less than 3 feet in its shortest dimension, representing a part of the design in the full proportion.

"You are requested to send in such cartoon, coloured sketch, and specimen of fresco painting, during the first week in June, 1845, for exhibition, to Westminster-hall.

"You are to be remunerated for the works aforesaid with the sum of 400*l.*; but the Commissioners do not bind themselves to employ you finally on the fresco paintings in the House of Lords.

"I have further to acquaint you that the six subjects are distributed among the six artists as follows:—

"The subject of Religion is given to Mr. Horsley.

"The subject of Justice is given to Mr. Thomas.

"The subject of Chivalry is given to Mr. Maclise.

"The subject of the Baptism of Ethelbert is given to Mr. Dyce.

"The subject of Prince Henry, afterwards Henry V., acknowledging the authority of Chief Justice Gascoigne, is given to Mr. Redgrave.

"The subject of Edward the Black Prince receiving the Order of the Garter from Edward III. is given to Mr. Cope.

"I have further to acquaint you that although the six subjects are required to be undertaken by and among the six artists, the artists are at liberty to exchange subjects; and that although the commission given to each artist is for one only of the aforesaid subjects, each artist is at liberty to treat any other of the said subjects, in addition to the one subject which he is commissioned to undertake.

"I have further to acquaint you that a general competition is invited among artists for designs for the same subjects, to be prepared by the time before specified; and that the six commissioned artists are not allowed to be competitors for the premiums offered for such designs.

I am, Sir, your obedient servant,

"C. L. EASTLAKE, Secretary."

It will be observed from the last paragraph of this letter, that a general competition is invited, and as an encouragement to artists who have not been selected, the Commissioners offer three premiums of 200*l.* each for the best subjects produced. Thus another exhibition, doubtless far exceeding in interest either of those already opened, will take place in the summer of next year.

In addition to the selection of six artists to execute designs for frescos, the Commissioners have chosen three sculptors from among the number contributing to the exhibition in Westminster Hall.

"Whitehall, July 9, 1844.

We the undersigned, having inspected the models for sculpture submitted to us in Westminster Hall, are of opinion that the exhibition is highly creditable to the country. We have recorded our judgment on the merit of many of the exhibitors; but not being at present in possession of sufficient information as to the extent of the decorations in sculpture which may be considered desirable in the Palace at Westminster, or as to the time when such decorations may be required, we have thought it expedient to limit our present selection to those artists whom we consider have especially distinguished themselves in the exhibition referred to; and we hereby recommend the following artists—viz., W. Calder Marshall, John Bell, and John Henry Foley, for employment on such works in the Palace at Westminster, and for such remuneration as may hereafter be determined. At the same time, we wish it to be understood that the present selection does not by any means imply the exclusion of other sculptors, whether they may or may not have exhibited specimens of their ability on the present occasion.

Albert.	Mahon.	H. G. Knight.
Sutherland.	Ashburton.	B. Hawes, jun.
Lansdowne.	Colborne.	L. Rogers
Lincoln.	C. S. Lefevre.	G. Vivian.
Aberdeen.	R. Peel.	T. Wyse.
Palmerston.	J. R. G. Graham.	
Melbourne,	T. B. Macaulay.	

Extract from the Report of the Committee appointed to inspect the Works of Decorative Art, exhibited in King Street, St. James's, in April and May, 1844:—

Your Committee have examined the specimens of casting in brass and iron which have been sent in by persons desirous of being employed in the embellishment of the Houses of Parliament.

They have recorded their judgment on the comparative merit of many of the works in question, but for the reason specified in the report of this Committee on the specimens of carved wood and painted glass, they have thought it expedient in general to enumerate the names only, without further distinction of the exhibitors whose works have received the commendation of the Committee.

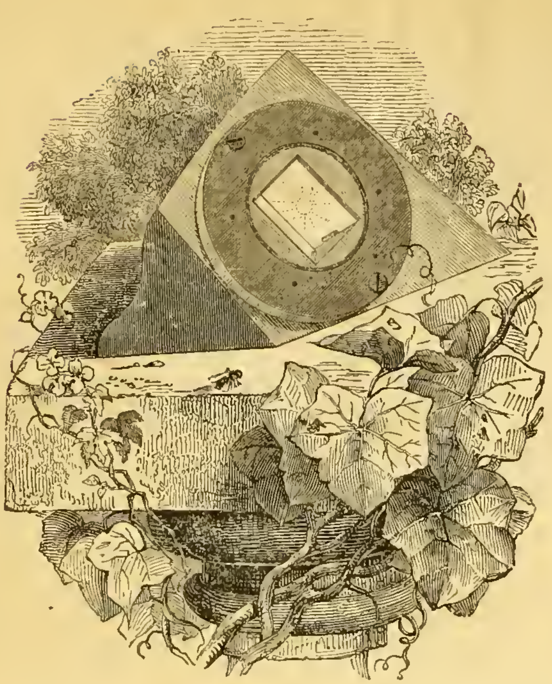
In the department of Ornamental Metal Work, the exhibitors so noticed in the detailed report of the Committee, are Messrs. Messenger and Sons, Messrs. Bramah and Co., and Mr. Abbott.

Mahon.	B. Hawes, jun.
Colborne.	George Vivian.
T. B. Macaulay.	Thos. Wyse.

Earl of Durham's Monument.—A monument to the late Earl is proposed for erection on Pensher-hill, near the base of which runs the great Northern line of railway. "The design," says the 'Durham Advertiser,' "is an approximation to the Temple of Theseus, and is to consist of a rectangular base of solid masonry 97 feet long, and 54 in width, rising 10 feet above the platform of the hill, and surmounted by 18 lofty, open, equidistant columns, supporting at each end a magnificent pediment, and on each side a broad, deep entablature, which will serve as a promenade. The edifice will be at least 70 feet in height, and will be visible from a great portion of the surrounding country. The trench for the foundation has been dug down to the limestone rock, and in a short time the foundation stone may be expected to be laid."

THE DIPLEIDOSCOPE.

Fig. 1.



MR. DENT, the eminent chronometer maker of the Strand, had long felt persuaded that the interests of Horology would be greatly promoted, if the public could obtain a cheap, simple, and correct transit-instrument, requiring little or no scientific knowledge for its right use, and not readily susceptible of injury or derangement. To this end he devoted much time and thought; and, in 1840, he considered that he had succeeded in inventing an apparatus which, by means of *shadows*, would produce the desired result. This idea he communicated to Mr. Bloxam, who thereupon informed him that his own attention had been for some years devoted to the same object, and that he had contrived an optical arrangement, which, by the agency of a single and double reflection, determined the sun's passage over the meridian with great exactness. When the optical instrument, although complicate in its then form, was shown to Mr. Dent, he was immediately struck with the superiority of the contrivance over that which had suggested itself to *him:* his own method afforded three observations, but it was attended with the defects and inconvenience which result from the uncertainty of shadows. Convinced that the reflecting planes would effectually accomplish the desired end, he entered into an arrangement with Mr. Bloxam to undertake their manufacture; and, after nearly two years' attention on the part of that gentleman, and at great labour and expense on the part of the proposer, the instrument which we are about to describe was perfected, and may now be had at the trifling expense of 2 guineas.

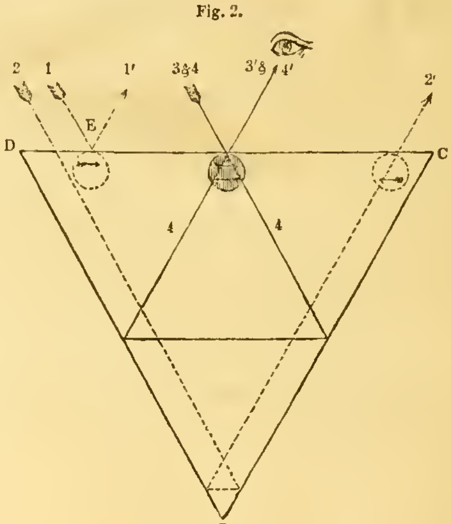
The instrument possesses great advantages over any other of similar correctness; being exceedingly simple, it is not liable to get out of adjustment or repair, nor does it require any attention beyond that which is, of course, necessary in the first instance, viz.: that it be placed on a level surface, and in the meridian. The observations to be taken afterwards, can be made by any one, although previously unacquainted either with astronomical apparatus or practical astronomy; the instrument being as simple as a sun-dial, while it is infinitely more correct, since it gives the time to within a fraction of a second. The utility of possessing an indicator of this kind in addition to the most perfect time-keeper, must be evident; for, however excellent a clock or watch may be, experience shows how difficult it is to obtain exact time, *for lengthened periods*, by any mere mechanical contrivance. To remedy the defect of mechanism, it has been already remarked, that actual observation of the heavenly bodies becomes indispensable; as, without it, the best time-keeper cannot be implicitly depended upon for any considerable interval. On the importance of exactness in this essential matter, it is not necessary to enlarge: it will suffice merely to allude to the inconvenience of missing a railway train. An advantage also not to be overlooked, is the gratification of knowing, especially in remote parts of the country, that you are in possession of the true time. Perhaps, then, it is not saying too much to affirm, that a Dipleidoscope should be placed in all country Parsonages, as well as in Railway stations, and government establishments, both at home and abroad.

By the aid of this new patent meridian-instrument, which is called The Dipleidoscope, any person may obtain correct time with the greatest facility, by an observation either of the transit of the sun over the meridian by day, or of the transit of the stars by night. In the following explanation, however, it is intended, for the sake of consulting both brevity and simplicity, to confine the directions to solar observation.

In the language of philosophy, the law which governs the transmission of light is, that the angle of the rays of incidence is equal to the angle of the rays of reflection. In other words, supposing the rays of light proceeding from an object to fall upon a reflecting plane, the eye of the observer must, in order to see the reflected image, be placed at precisely the same angle with regard to the plane, as the rays proceeding from the object to the plane. The rays falling upon the plane from the object are styled "the rays of incidence;" as the rays again proceeding from the plane to the eye are termed the "rays of reflection." Keeping this law or principle in view, let us next consider the construction of the reflecting planes of the instrument in question.

There are three reflecting planes, DC, DB, and BC, fig. 2. Suppose DC to be so divided that the ray, No. 1, falling on DC, at E, will be reflected to the eye at 1′, and the image of the sun will appear to advance in the direction from D to C. The ray, No. 2, passing through D C, is reflected from C B, impinges on D B, and reaches the eye in the direction 2′. The image of the sun thus formed will appear to move from C towards D, because it has been *twice* reflected, and thus the two images will *approach* each other. Suppose the ray No. 1 to have advanced to the position No. 3, and the ray No. 2 to the position No. 4; it will then be evident that their reflected rays will be in the same direction 3′ and 4′, and, therefore, that the two images of the sun coincide, as shown by the arrows being in the position of crossing each other, and indicating the instant of apparent noon; as the rays continue to advance, the images, having passed over each other, will, of course, be seen to separate.

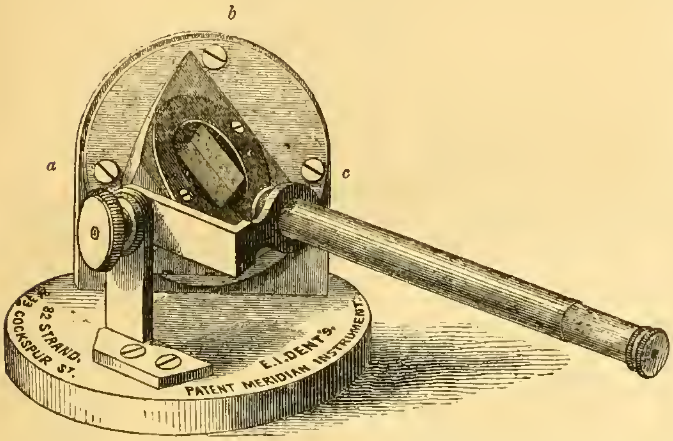
Fig. 2.



The following familiar illustration is introduced to further explain the optical construction. When the sun is about setting, it is not uncommon to see the rays so reflected from the windows of a whole range of houses, as to convey the idea of a public illumination. While some portions of the sun's rays are thus reflected, other portions pass through the glass into the rooms. The rays thus transmitted (the rays of *incidence*, as they were styled above) may be thrown at pleasure in any direction consistent with the range of the sun, by a person within the room, having a looking-glass in his hand: exactly as children produce what they call a *Jack o' lantern.* Now if, instead of throwing the rays upon a non-reflecting object (such as the wall, &c.), he were to transfer them to another looking-glass, they would be again reflected from this latter glass. Supposing these two looking-glasses to be placed at an angle of less than 90°, in a manner corresponding with the position of the two silvered planes seen in the instrument, and also shown in the diagram at D B, B C, he can reflect the sun's rays again out of the window. Now, if we imagine the window to represent the outer reflector of the meridian-instrument, its construction is, by this process, completely exemplified. To proceed a little further; it is evident, that the angle and situation of the two looking-glasses could be so arranged as to direct the rays of the sun through any particular pane of the window; so that a person standing without, in a proper position, would see, in addition to the sun's rays reflected from the *outer* surface of the pane, the rays of incidence that had passed through the window, and were thus reflected from the double mirror. One of the luminous objects (the flash or glare of the sun) so produced, would be reflected from the surface of the window, and would be a *single* reflection; while the rays of incidence, which had passed through the window, and undergone a *double* reflection by means of the *two* mirrors would, on being thrown back by the mirrors through the window, move in a direction contrary to that taken by the single reflection from the surface of the window pane. Hence, any one of the heavenly bodies, subjected to the eye by a process of the above description, would not only appear as two distinct objects, but those objects would be seen to approximate and cross each other in an *opposite* course: a desideratum being hereby secured which increases the power of the instrument in a double ratio, and renders it proportionably preferable to any other that has been hitherto employed.

The wood-cut, fig. 3, represents a Dipleidoscope fitted up with a telescope, and having all the usual meridian and vertical adjustments, to be effected by means of the screws, *a*, *b*, *c*. This form of mounting the instrument is suited to the observatory or library, where it should be placed on a pedestal of stone or cast-iron.

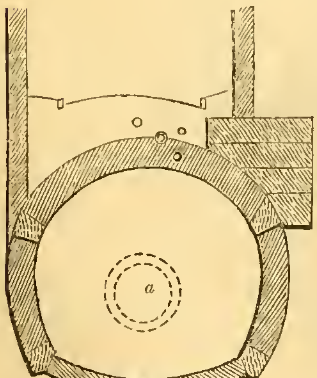
Fig. 3.



The wood-cut, fig. 1, at the head of this article, shows the instrument fixed on a pedestal in the open air; for as the workmanship is impervions to the weather, it needs no further protection than the brass covering with which it is supplied.

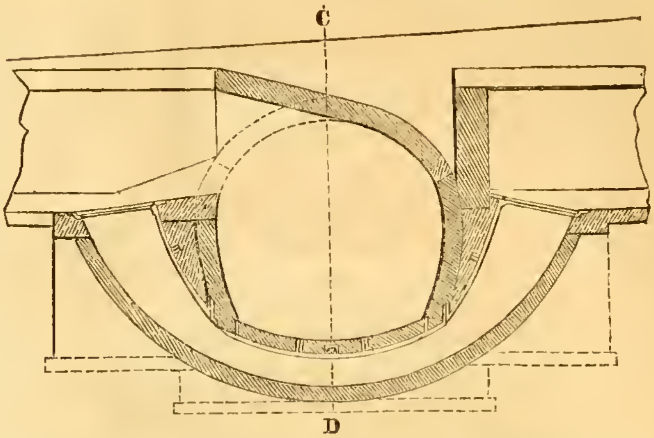
THE SEWERAGE OF DERBY.

Fig. 1.—Section of New Sewer.



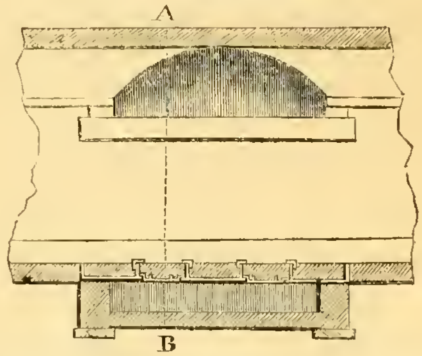
The new sewerage of Derby extending from the Morledge to Cheapside, designed by Captain Vetch, R.E., has been let by the Commissioners of the Derby Improvement Act, for the sum of 3,200*l.* to Messrs. Booth and Thompson, of Rotherham. The principal work is a sewer 10 feet diameter and 9 feet in height, and about 709 yards in length. The section is nearly a square, see fig. 1, with a segment of a circle added on all sides, being arched at top, and the dish of the invert at bottom, and the batter of the curvilinear side walls, making the appearance above described. The arch and side walls are from 1 to 1½ brick in thickness, as circumstances require, the invert being only 1 brick throughout. The course of the sewer is as follows:—commencing at the junction of Cheapside with Wardurck along the latter place, and Victoria Street and St. Peters Street, and down Thornton Lane and the Morledge to Cockpit Hill. By reference to the plan of Derby, this course will be very clear, and the cause of this expenditure will be in the recollection of your readers to have arisen from a sudden inundation of the town about three years ago, when the market-place was flooded in a sudden manner, supposed to have arisen from a water spout bursting above the town, on the course of the Derwent.

Fig. 2.—Section through A D, of fig. 3.



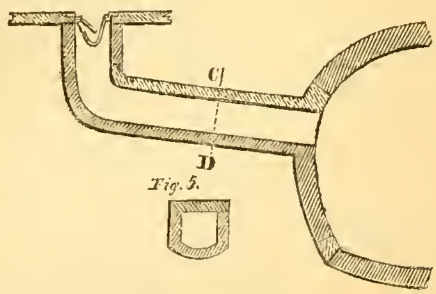
The situation of the town is very low and is intersected with rivers, brooks, and canals, and the engineers have had recourse to the passing of Becket Well Brook, underneath the sewer, by a cast iron syphon. The water in the brook being retained to a certain level, the surplus running over a waste weir into the new sewerage, and the body of

Fig. 3.—Section through C D, of fig. 2.



water in the brook being passed underneath the sewer, and continuing its course. This ingenious plan of the engineer is shown in the annexed engravings. Fig. 1 is the section of the main sewer; fig. 2 is a section of the sewer, showing the passage of the brook or syphon under it; and fig. 3 a transverse view of the brook syphon; fig. 4 is a section of the gully holes or grate drains, with trap; fig. 5 transverse

Fig. 4.—Section of Gully Hole.



section of drain at C D. Fig. 1 also shows the difficulty occuring in Thornton Lane, also a comparative view of the size of the old (*a*) and new sewers. In calling attention again to drawings 2 and 3, of Becket Well Brook, it is obvious the drainage might be all the depth of the water pent up in the brook improved, if it were not for the purpose of preserving right in the stream.

O. T.

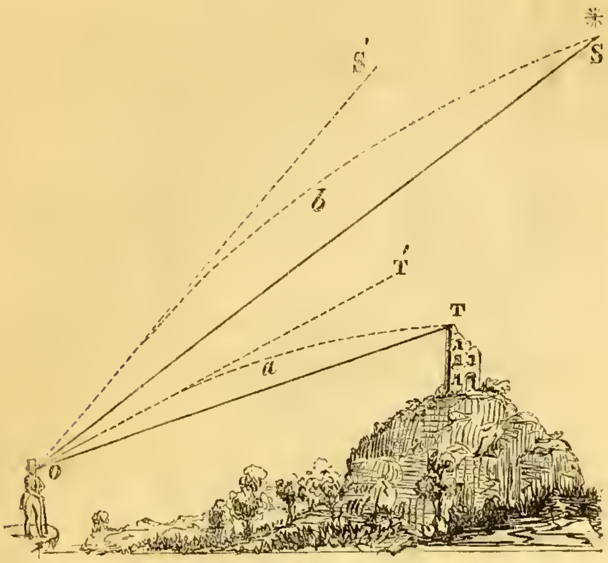
Newcastle-on-Tyne, April 18, 1844.

OF TERRESTRIAL OR HORIZONTAL REFRACTION.

By OLIVER BYRNE, Mathematician.

Rays of light passing from objects whether terrestrial or celestial, proceed in curves concave to the earth, thus:—rays of light passing from objects T, S, to the eye of an observer at O, take curvelinear directions T *a* O, S *h* O, instead of the straight lines T O, S O.

Fig. 1.

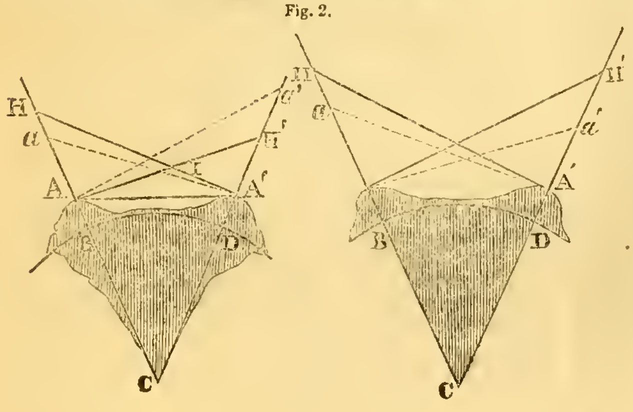


Now as the eye always traces the places of objects to the direction in which the rays enter the eye, hence the observed elevations of objects are always greater than the true one, for the direction in which rays enter the eye is the direction of a tangent to the curve at the eye of the observer. The objects T, S, will appear in the directions of the tangents O T′, O S′. The reason that the rays of light are bent in passing through the atmosphere or part of it, is because the air is densest at the surface and continues to decrease in density to the top of the atmosphere: it is well known that a ray of light becomes bent towards the perpendicular in being transmitted from a rare to a dense medium, therefore the rays passing through the atmosphere are being continually bent as they pass through a medium continually increasing in density. The increase in the angular altitude of objects by being observed in our atmosphere is called *refraction:* there are two sorts of refractions, horizontal or terrestrial, and astronomical. Horizontal refraction affects objects situated in the atmosphere, astronomical refraction is that which affects the altitudes of the heavenly bodies. Refraction changes with the atmosphere, with regard to heat, cold, humidity, dryness, &c.; when tables of refraction are given they are calculated for a mean state of the atmosphere, in such a manner that they can be made to answer any other state of the atmosphere with some trifling allowance.

The exact amount of terrestrial refraction is by no means satisfactorily settled: however it may be determined by the following method, for all practical purposes.

Let A and A′ be two elevated stations on the surface of the earth; B D the intercepted arc of the earth's surface; C the earth's centre; A H′ and A′ H horizontal lines at A, A′, produced to meet the opposite vertical lines C H′, C H.

Fig. 2.



Let *a*, *a*′, represent the apparent of the objects A, A′, when viewed from A′ and A; then is the angle A A′ *a*, the refraction of A, and the angle *a* A′ *a*, the amount of refraction of A′; half the sum of these two angles will be the horizontal or terrestrial refraction, supposing it equal at each station.

Now an instrument being placed at each of the stations A, A′, the reciprocal observations are to be made at the same instant, which is determined by means of signals, or watches previously regulated for that purpose: that is the observer at A, takes the apparent depressions at A′, at the same time exactly, that the other observer at A′ takes the apparent depression of A.

In the quadrilateral A C A′ I, the two angles at A and A′ are right angles, and therefore the angles at I and C are together equal to two right angles: but the three angles of the triangle A A′ I are together equal to two right angles, consequently the angle at C which is measured by the arc B D is equal to the angles I A A′ and I A′ A taken together. If therefore the sum of the two depressions H A′ *a* and H′ A *a*′ be taken from the sum of the angles I A′ A, I A A′ which are together equal to C, (the angle C is known because its measure is known;) the remainder is the sum of both refractions, or angles A A′ *a*, A′ A *a*′.

Hence the following rule.

Take the sum of the two depressions from the measure of the intercepted terrestrial arc, and half the remainder is the fraction.

If by reason of the minuteness of the contained arc B D, fig. 3, one of the objects, instead of being depressed, appears elevated; suppose A′ to appear at *a*″ above the horizontal line A H′.

Then

$$a\,A\,A' + a\,A'\,A = H\,A'\,a + H'\,A\,A' + a''\,A\,H;$$
$$= H\,A'\,A + H'\,A\,A' + a''\,A\,H' + H\,A\,a;$$
$$= C + a''\,A\,H' - H\,A'\,a:$$

For $C = H\,A'\,A + H'\,A\,A'$. In this case, because $a''\,A\,A' = a\,A'\,A$, we have this *rule:*—

To the contained arc add the elevation, from this sum subtract the depression, and half the remainder will be the refraction.

As we have previously remarked, the amount of terrestrial refraction is found to vary considerably with the different states of the atmosphere; it is stated in the account of the trigonometrical survey of England (vol. I. p. 160—355) that, the quantity of terrestrial refraction varies from $\frac{1}{7}$ to $\frac{1}{18}$ of the contained arc.

Although every practical man considers the amount of terrestrial refraction to be more or less according to his experience, yet all range between $\frac{1}{7}$ and $\frac{1}{18}$ of the contained arc. Dr. Maskelyne considered it to be $\frac{1}{10}$, M. Legendre $\frac{1}{14}$, M. Delambre $\frac{1}{11}$, Mudge and his companions $\frac{1}{12}$, at a medium. A similar table to the succeeding, would be convenient to engineers, when they have made up their minds which of the fractional parts of the contained arc, that range between $\frac{1}{7}$ and $\frac{1}{18}$, best suit their purpose.

	$\frac{1}{100}$ths ″	10ths of ″	Seconds	ens of ″	Hundreds of ″
1	1	0	1	4	3
2	2	0	2	8	6
3	3	0	4	2	9
4	4	0	5	7	2
5	5	0	7	1	5
6	6	0	8	5	9
7	7	1	0	0	2
8	8	1	1	4	5
9	9	1	2	8	9

Feet and decimals.

EXAMPLES.

I. Suppose the angle of depression of an object five miles distant from the place of observation, to be 3° 47′ 45″, what is the true depression, supposing we take Dr. Maskelyne's allowance?

5 miles = 26400 feet.
$\frac{1}{10}$ of 26400 = 2640
20″ — 2028·6

611·4
6″ — 608·59

2·81
0·02 — 2·0286

Refraction = 26·02 seconds ·7814
From 3° 47′ 45″
Take 0 0 26·02

Angle of depression = 3° 47′ 18·98

When the angles of elevation or depression are small, the remainder, after the hundreds are obtained, will be sufficient allowance for the reduction of the right line, which joins the objects to one which measures the arc between the radii of the objects in the surface of the earth.

II. Having observed in a horizontal line, the top of Mr. Muspratt's chimney at Newton, near Liverpool, (which is the highest edifice in the world,) from a neighbouring hill, 30 miles distant:—taking M. Delambre's allowance of $\frac{1}{11}$ the arc of distance, what is the depression of the object?

30 miles = 158400 feet;
$\frac{1}{11}$ of 158400 = 14400
100″ = 10143 from table.

4257
40″ = — 4057·2 ditto.

199·8
1″ = — 101·43

98·37
0·9″ = — 91·289

141″·9 7·081 &c. &c.

Hence the angle of refraction = 141″·9, or 2′ 21″·9, which is also the angle of depression, as the object appeared in the horizon.

III. The angle of elevation of an object 298 yards distant is 33° 41′ 20″, what is the true angle when terrestrial refraction is allowed for according to M. Legendre, who takes $\frac{1}{14}$ the arc of distance?

298 yards = 894 feet;
$\frac{1}{14}$ of 894 = 63·857
0″·6 = 60·859

2·998
0·02 = 2·0286

9694
0·009 = 9128

0·629 . . .
From 33° 44′ 20″
Take 0 0·629

Correct angle = 33° 44′ 19·371″

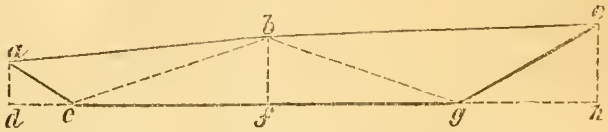
All Art, Invention—*i. e.* original art—is but the embodiment of "spirit" in some form directly or indirectly useful to man. Art is but the combination or arrangement of natural principles to produce new results; and the organization of bodies of men or bodies of matter are, in all cases, operations of the "spirit." The art by which Michael Angelo found the statue in the marble block, and the art by which Oliver Cromwell found a cavalry regiment in the rude mass of men and horses, were alike operations of the "spirit." The spirit of Watt could discern the form of the steam-engine in the metallic ore, with the dim vista of countless thousands of human beings set free from drudgery in the hewing of wood and the drawing of water; and the spirit of Arkwright beheld the forms of various kinds of matter combining into a mill for grinding out clothing by miles. These men put forth their "spirit" in actual forms to the cognizance of the world. Other spirits, as Homer and Shakspeare, gave their creations to the world in written descriptions; their ideal embodied their actual. Michael Angelo, Oliver Cromwell, Watt, and Arkwright, actualised their ideal. But there it is, the self-same "spirit" in all, making itself obvious to man's apprehension in one or other of the various modes by which man holds converse with his fellows, of greater or lesser significance.—*Westminster Review.*

AREAS OF CUTTINGS AND EMBANKMENTS.

(From the American Journal of the Franklin Institute.)

Short methods of calculating correctly the Sectional Areas of Excavations, or Embankments. By Solomon W. Roberts, C. E., *of Philadelphia.*

In the construction of most canals and railroads a large number of calculations are required of the sectional areas of excavations and embankments, many of which (called cross-sections of three cuttings) have the general form of the figure *a b c g e*; the depths of the cutting, or filling, being taken at the points *a*, *b*, and c. The point *b*, is in the centre line, and *a* and *e*, are the points where the side slopes strike the surface of the ground.



The three following methods, devised some years since, for accurately and readily obtaining such areas, are well adapted to facilitate the operation, and their correctness may be easily demonstrated:—

No. I. Multiply the extreme width of the excavation, or embankment, measured horizontally, by one-half of the depth at the centre; multiply the sum of the depths at the sides, by one-fourth of the base line, or bottom width *(c g)*—the sum of these products will be the sectional area required.—Thus, in the following diagram the centre stake standing at *b*:

$$\left(dh \times \frac{bf}{2}\right) + \left(\overline{ad+eh} \times \frac{cg}{4}\right) = \text{Sectional Area of } a\ b\ c\ g\ f\ e.$$

The diagram in this position represents an excavation, by inverting it an embankment.

No. II. The same result may be obtained with less calculation, by the use of a table, as follows, the cuttings being taken in feet and tenths, as usual:

Prepare a table of three columns, the first containing the depths at the centre, the second the sectional areas for each depth on level ground, the third the horizontal distance from the centre stake to the side slopes—such a table may be readily constructed. Then find the difference between the centre depth, and the average of the side depths, and multiply this difference into the number in the third column of the table opposite the centre cutting. If the average of the side depths is greater than the centre depth, add this product to the number in the second column, if less, subtract it, and the result will be the cross-section required.

No. III. The following method, after making the table, is very convenient, on account of the substitution of addition and subtraction, for multiplication and division:

Prepare a table of twelve columns, the first containing the centre cuttings for feet and tenths, and the second the sectional area for each centre cutting, when the sum of the side cuttings is equal to that at the centre. The remaining columns, numbered from 1 to 10, are to be filled by inserting in the first, half the distance from each centre stake to the side slope, measured horizontally; in the second column twice the amount in the first; in the third three times the amount in the first; and so on.

To calculate a Sectional Area by this Table.

Subtract the centre cutting from the sum of the side cuttings—suppose this difference to be 4·70, for example—then from the column numbered 4, take out the amount opposite the given centre cutting; and for the seven-tenths take the amount in the 7th column, and move the decimal point one figure to the left; add these two amounts to the number in the column of areas, and *the sum will be the sectional area required.*

If the number of feet in the difference between the centre cutting, and the sum of the side cuttings exceeds ten, the amount for ten feet must be taken from the table, and be added to that for the remaining height taken from its corresponding column.

In those rare cases in which the sum of the side cuttings is less than the centre cutting, the amount caused by the difference must be deducted from that taken from the column of areas.

The demonstration of the foregoing rules depends upon simple trigonometrical principles, and it does not require to be elucidated here.

HYDRAULICS.

General Sketch of a Theory of the Contraction of Veins in Water discharged from Orifices in thin Plane Walls. By M. Bæyer.

In comparing the different experiments upon the flow of water from vertical openings in thin plane walls, we are struck by the great variation undergone by the coefficient by which, in each case the theoretic formula for the discharge must be multiplied. On examining the facts more strictly, we find two sorts of distinct variations, of which one depends solely upon the amount of the charge, and the other upon the form of the orifice. The existence of the first is a certain sign that the formula used does not accord with the experiments. The second proves that the water of the reservoir is subject to a law of motion, the effect of which is modified by the form of the opening. While reflecting upon these difficulties, I was struck by a very simple idea, and one which deserved a rigorous investigation. This investigation is the subject of my memoir. To present the results in a proper light, I will here give, in a concise manner, the sketch of my work. I assume hypothetically, that the molecules of water in the reservoir, move towards the centre of the orifice, with velocities which are inversely proportional to the square of their distances from that centre. Hence it follows, that molecules equi-distant from that centre will have the same velocity, and are situated upon the circumference of a hemisphere described from that centre with a radius equal to, or greater, than that of the orifice. As soon as the molecules have arrived at the hemisphere described with the radius of the orifice itself, their velocity is decomposed into two others, of which one is parallel to the axis of the orifice, and the other perpendicular to this axis. The first gives the velocity perpendicular to the plane of the orifice, and the other represents the velocity of contraction. But in order to determine, in conformity with the hypothesis adopted, both of these velocities, it is required to find the mean distance from the plane of the orifice, of the particles in the section of a hemisphere passing through its axis; that is, the mean distance of the molecules upon the periphery of a semicircle of the same diameter. We arrive, by this means, for circular orifices, at results conformable to those of the experiments of Bossut, Poleni, Eytelwein, &c. By this examination we find, for the orifices in question, the variation in the discharga dependent upon the form of the orifice; nothing more is wanting than to seek for that which depends upon the charge, or to determine the true velocity of discharge, which is done by the known methods. Thus, in determining the coefficient of contraction (k) of vertical rectangular orifices, we arrive at the general formula,

$$k=\frac{l}{b}.0.1140449\,\frac{(m+\sqrt{\pi})^{\frac{3}{2}}-\left(m+(1-\frac{b}{l})\sqrt{\pi}\right)^{\frac{3}{2}}}{\sqrt{m+1}\left(\frac{1}{2}-\frac{1}{64(m+1)}-\ldots\right)}$$

Where l, is the base of the rectangle, b, its height, π, the ratio of the circumference of a circle to its diameter; m is determined by means of the equation $m=\frac{(H-a-l)\sqrt{\pi}}{l}$, where H is the charge above the lower edge of the rectangular orifice, a, is the height of a column of water equivalent to the difference of the atmospheric pressure upon the surface of the water in the reservoir, and upon the centre of the orifice. This value taken for the following table is equal to 0·0020 metre.

In order to show the correspondence of the formula with observations, I have compared it with the admirable experiments made by M. Poncelet, et Lesbros, at Metz, in 1828; calculating only the coefficients of the first experiments in the six tables, from No. 4 to No. 9, I get

Number of the Tables.	Charge above the lower edge H.	Sides of the Rectangular Orifice. Ver. side. b.	Hor. side. l.	Value of the Coefficient k. Observed.	Calculated.	Difference.
	Metres.	Metres.	Metres.	Metres.	Metres.	
4	1·5720	0·20		0·6026	0·6034	— 0·0008
5	1·6054	0·10	0·20	0·6111	0·6135	— 0·0024
6	1·7151	0·05	0·20	0·6175	0·6180	— 0·0005
7	1·3960	0·03	0·20	0·6229	0·6225	+ 0·0004
8	1·4102	0·02	0·20	0·6217	0·6234	— 0·0017
9	1·4070	0·01	0·20	0·6204	0·6246	— 0·0042

These differences do not exceed those which the results of experiment several times repeated, show. The calculated values of k, are found a little too large, because all the other small corrections have been neglected, such as the friction on the edges of the orifice, the temperature, the resistance of the air, &c.

In the memoir I have employed an approximate formula, which differs very little from the exact value, and which is formed by supposing that the velocities, in rectangular orifices, are as the square roots of the charges above their centres.

All these formulæ, however, suppose that the level in the reservoir remains constant, which is not the case in practice, except when the charge is ten, or twelve, times greater than the radius of the orifice. In small charges there is a depression of the level above the orifice, for which allowance must be made, in order to obtain exact results; for this reason it is necessary to multiply all the formula by a factor which depends upon the depression; by this means I obtain equations which are applicable, at the same time, both to great and small charges, and even to overfalls.

Finally, the different forms of the veins of water are determined by means of the theorum mentioned above, that the force of contraction is proportional to the radius of the orifice. Hence it follows that the contraction in the diagonal sections of a square orifice is greater than that in the sections passing through the centres of parallel sides, and as the contraction may be regarded as a force acting perpendicularly upon the axis of the vein, it follows that the particles of water in the larger sections approach the axis, whilst the particles, in the smaller sections, are farther from it, which explains the forms found by experiment.—*Comptes Rendus, translated for the American Journal of the Franklin Institute.*

ON THE FLEXURE OF BEAMS.

Report upon a Note relative to the Flexure of Beams Loaded in a Vertical Position; presented June 20th, 1842. By M. E. Lamarle. *Committee, Poncelet and Lionville.*

In this note M. L marle has chiefly proposed to establish the following principles:—

1. The loads, which beams, loaded vertically, can support without permanent alteration, are independent of their lengths, and simply proportional to their sections, so long as the ratio of their lengths to the least dimensions to their transverse section does not reach a certain limit.

2. Beyond that limit, and in all cases of practical application, the maximum load may reach, but can never exceed, the pressure corresponding to the initial flexure.

M. Lamarle also shows that (the pieces being supposed prismatic,) it is sufficient to know the greatest change in length compatible with the preservation of elasticity, in order to determine numerically the limit alluded to. He remarks besides that the results furnished, by calculation, accord with the facts generally observed, and that they imply the consequences announced by M. Duleau, in the following terms: "A rectangular bar pressed vertically, resists until the compressing weight attains the value, $Q=\frac{\pi^2 c}{4a^2}$. This weight causes the piece to assume a curvature in the direction of its smallest dimension, and it at once folds together." The deductions of the author rest essentially upon the analysis given by M. Lagrange, for the problem of the flexure of pieces loaded vertically, but by imposing the condition of not surpassing the force capable of producing a permanent alteration, and by expressing this condition numerically, M. Lamarle has introduced into the question an element of which advantage had not yet been taken to solve it practically. The introduction of this element fixes the degree of convergence of the series which are obtained, and permits the deduction from the general solution, of rules valuable to the builder.

We know, and Lagrange has proved, that the flexure of pieces pressed vertically, becomes possible only when the pressure has obtained a certain minimum value. If the pieces are prismatic, the load corresponding to the initial flexure, increases in the inverse ratio of the squares of their lengths. The contractions which it produces, independent of all flexure, are, therefore, more considerable in reference to the unit of length, in proportion as the pieces are stouter, and we may conceive that for a given cross section there exists always a length below which there is already an alteration of elasticity, even when the load is too small to cause a commencement of flexure. Hence the first principle announced by M. Lamarle.

Let us now consider the case of flexure, and let us suppose the ratio of the length to the smallest dimension of the cross section to be so great, that flexure may commence before a permanent alteration has taken place. In this case the strain *due to the effect of flexure alone*, increases as the versed sine; and M. Lamarle shows that an almost imperceptible increase of the pressure corresponding to the initial flexure, is sufficient to cause an instant alteration of the elasticity. Hence the second principle of the author, not absolute, but sufficiently general to include all the cases which might escape the first, under the circumstances usual in practical applications.

These two principles taken together, offer a satisfactory solution to the question of beams loaded vertically.—*Ibid.*

ECONOMY OF JACKETS FOR STEAM ENGINES.

Note upon the Influence of Jackets upon Steam Engines. By M. Combes.

A steam engine built by Farcot, was provided with an envelope to the cylinder, into which the steam was freely admitted from the boiler, and from which it passed as required into the cylinder. It having become necessary to repair this jacket, it was found that the expenditure of fuel was increased in the ratio of 6 to 10. A similar fact has also been observed in an engine of the same builder, erected near Sedan. A series of experiments was instituted by M. Combes, and conducted as follows:—

First, the machine was worked as usual, the steam being admitted to the jacket, and from the jacket to the cylinder: these experiments were continued for four days, the quantity of water pumped into the boiler being accurately measured, and the quantity of coal weighed; the amount of water condensed in the jacket was also ascertained, and every half hour the tension of the steam in the cylinder was measured by an indicator, and at the same time the pressure in the boiler, and in the condenser, were taken by gauges, and the number of strokes per minute of the piston counted.

Second, for three days the machine was worked by conducting the steam directly into the cylinder from the boiler, the jacket containing air only. The same observations as before were carefully made.

Third, for three days the steam was conducted directly to the cylinder, but the jacket was kept in communication with the boiler, and was, consequently, filled with steam. The same observations were made as before.

The following are the results of the table:—

Experiments.	Duration.	Total Consumption.		Mean Pressures.			Consumptin. per hour.		Water Evaporated by lb. of Coal.
		Coal.	Water.	Boiler.	Cylin.	Condens	Coal.	Water	
		lb. avoir.	lb. avoir.	Atmosp.	Atmo	Atmosp.			
1	43*h*. 15*m*.	1482·7	8387·1	3·82	2·57	0·26	34·28	193·9	5·66
2	33*h*. 30*m*.	1982·12	11111·59	3·5	2·55	0·28	58·16	331·7	5·61
3	32*h*. 30*m*.	1469·5	7822·23	3·5	2·73	0·24	45·22	240·7	5·32

M. Combes attributes the increased quantity of fuel necessary when the jacket is not used, to the formation of water by condensation of the steam during its admission into the cylinder, and the consequent necessity of furnishing more steam to supply this loss by an additional evaporation from the boiler.—*Ibid*

OXIDE OF ANTIMONY A SUBSTITUTE FOR WHITE LEAD.

M. de Ruolz, in the *Comptes Rendus*, states that the oxide of antimony, (flowers of antimony,) possesses the following advantages over white lead:—by means of a manufacture selected by us, it is obtained directly from the native sulphuret of antimony—Its adoption will give a new vigour to the languid working of the mines of antimony which abound in France.—Its price of production is less than the third of that of white lead of average quality.—It may be immediately ground with, or without, other manipulation.—The workmen who are engaged in its manufacture, will be exempt from all danger,—and it is altogether improbable that the painters who may employ it mixed with oil, will experience the least inconvenience from it.

THE CONSTRUCTION OF CHIMNEYS.

[We have been requested to give publicity to the following translation of a notice issued pursuant to a resolution passed on the 18th May, 1843, by the Lower Austrian Society of Manufactures.]

Notice.

A prize to be given by the "Society for the encouragement of Arts and Manufactures" of Vienna, in Lower Austria, for the best treatise on "the most advantageous dimensions and arrangements of chimneys, and other essential parts of furnaces used in manufactories and similar places.

Notwithstanding the many investigations that have been made, there still exists a great deficiency in our pyrotechnical knowledge as to the dimensions of several most essential parts of furnaces, particularly those of chimneys, which are at present determined upon, on very uncertain definitions. It is known by experience how very much the situation of a chimney operates upon the success of an industrious enterprize, and how detrimental some arrangements partly in the expense of construction, and partly in the consumption of fuel.

Chimneys varying in height are used to furnaces for boilers to steam engines of equal power, without any difference of result in the consumption of fuel, whereas it has been found that low and narrow chimneys afford the greatest advantages in the economy of fuel.

Whether is it more desirable, therefore, with a large furnace to have several narrow chimneys or one of large diameter? What extent of draught is requisite? What influences chimneys have on the furnaces by attenuating the air? are questions which experience has not yet elucidated.

In order to combine principles which are based upon fixed laws, examine the causes, and frame a theory, which from observation will hold good in practice, so that means may be afforded in erecting furnaces to determine *a priori* the right dimensions for the chimneys and flues of large furnaces, the "Society for the encouragement of Arts and Manufactures," resolved at a general meeting on the 8th May, 1843, (similar to the example set by the Société industrielle in Micklhausen) to offer a reward of a small gold medal to the author of the best treatise, in accordance with the aforesaid proposals. The medal is to be adjudged at the general meeting in May 1845. The treatises are to be delivered before the 1st of February 1845, by persons domiciled in Vienna, to the Secretary of the Society, who will give the requisite receipts for the same.

Treatises published before the expiration of 1843, will be admitted to the competition. Such treatises to be accompanied by a sealed note, containing both the name of the author and address, also a similar motto or sign to the one written on the title-page of the treatise.

The successful treatise, and that nearest to it in merit, will be opened at the general meeting for adjudging the prize. The candidates for the prize retain their right of publication up to the end of 1845, after which the right devolves to the society in case the author has not published his work. The unsuccessful treatises will be returned at the Society's office to authorized persons, on giving up the Secretary's receipt.

THE NUNHEAD CEMETERY AFFAIR.

Sir—The information given in your last number, relative to the course pursued in the competition for the two chapels at the Nunhead Cemetery was altogether new to me, for I had not even so much as heard of there having been any exhibition of drawings,—which last, indeed, appears to have been rather more for form's sake than any thing else, if it really consisted of "more than four hundred drawings," yet was kept open only two days!—hardly time enough for persons to learn that there was any exhibition of the kind at all, it not having been previously announced by public advertisement. That this exhibition was little more than a nominal one—at least quite a private one—is tolerably evident from the fact of its being kept so close a secret, that not even any mention of it transpired through any of those journals and periodicals which attend to all matters connected with art, and which, had they been aware of it, would hardly have failed to speak of what is by no means a common occurrence. At all events I may confidently say that no card was sent to the "Civil Engineer," apprising you of the exhibition and soliciting your inspection of the designs, otherwise we should have had some remarks upon them at the time. As far therefore as that point is concerned, I must beg leave to differ from the opinion, expressed in your Journal, since I do not consider the exhibition part of the business, by any means "a fair example" of the manner in which such matters should be conducted.

It is further a question with me how far it was fair on the part of the committee to nominate a professional man as their umpire, without the concurrence or even privity of the competitors; thereby giving to that individual—who not being associated with a single colleague, could not at all benefit by learning other opinions than his own,—the power of pronouncing an unappealable Fiat, deciding the fortune of sixty-five other professional persons. That the Committee should have chosen to delegate their authority to Sir Robert Smirke, placing the matter entirely in his hands, can be accounted for only by their feeling quite assured that *he* was not a competitor, because he has invariably refused to enter any competition whatever—even that for the "New Houses of Parliament," notwithstanding that the occasion offered a prize, which even he might have condescended to struggle for. If, therefore, it was not very strange that the Committee should have applied to him, strange it certainly was that Sir Robert should have so greatly relaxed his own principles as to comply with the request, and after having set his face strenuously against competitions, have made himself to a certain extent a party in one, and that, too, very prominently. Hardly did he consent to accept the office profered him—in itself rather an invidious one—for want of fair excuse for rejecting it, since to have expressed his well known horror of competitions would have been a sufficient one.

Accept it, however, he did, and having done so, was, I conceive, bound to comply with the request of the Committee that he should select three other designs as being next in merit to the two to which he had adjudged the offered premiums. Yet this he declined to do, though apparently for no reason whatever that ought not to have equally deterred him from making any choice at all. Surely it could not have been a more embarassing or ungracious task, to point out the three best of the remaining sixty-three designs, than it was to decide upon two as being the very best of all out of sixty-five. Possibly, Sir Robert may have had very sufficient reasons in his own bosom for declining to recommend any more than two designs,—and what those reasons were it may be easier to guess, than it would be exactly proper to say. At all events his refusal could not have been very agreeable to all the remaining competitors, because it deprived three of them of an *accessit.*

Even in regard to the two designs which he pointed out as those deserving the premiums, Sir Robert's letter is exceedingly vague and unsatisfactory, as he does not assign a single reason for the preference given to them; which he ought to have done, and was, it is to be presumed, capable of doing. Since, however, he did not think it expedient to do so, it is to be hoped that the Committee place implicit confidence in his taste and judgment. Those who have seen all the designs, fully described in their respective plans and other drawings, can best tell how far the two selected by Sir Robert surpassed all the rest—to such degree, it would seem, that he could point out no others approximating to them in merit. Two others, however, have since been shown at the Royal Academy Exhibition,—not however that which obtained the second premium,—both of which possess no ordinary merit; and one of them at least (Mr. Brandon's model) would, I should have thought, have certainly obtained Sir Robert's recommendation, it being in the style he himself is so greatly attached to; as it did not, I can account for its being passed over by him only by supposing that he was apprehensive it might give rise to very unpleasant and awkward comparisons, and that its striking and picturesque effect in regard to the disposition of its columns, would not tend to reconcile us to his own very humdrum and commonplace *design* for the façade of the British Museum. The other competitor who has appealed from Sir Robert's judgment, is Mr. Allom, and as far as his design can be understood from merely a single drawing, showing a portion of the interior, I should call it one of no ordinary merit,—at the same time admit that it was not calculated to find favour with such a formal architectural puritan as Sir Robert Smirke.

Mr. Brakspeare's design not having been sent to the Academy, I cannot pretend to say how far it was better entitled to the second premium, than either of the two just mentioned. In fact, I have yet to learn even in what style it was.

For thus freely commenting on an affair which is now settled, and therefore has lost its main interest with many, I offer no apology, being of opinion that it is exceedingly bad policy to suffer matters of the kind to drop quietly, and escape animadversion merely because it can have no effect in regard to the particular case which gives rise to it, that being already settled. Let them be managed as they may, it is requisite to keep a strict eye upon competitions; and that for the Nunhead Cemetery ought to be able to bear the strongest scrutiny, considering with whom the decision rested. If Sir Robert Smirke's name be a sufficient pledge for unerring judgment, to both the Committee and the competitors, I must confess that it is not so to myself. His decision no more than a mere *ipse dixit,* unsupported by any reasons whatever,—leaving them to be found out by the Committee, and was therefore according to the more convenient than commendable principle of "*Stet pro ratione, voluntas.*"

X.

CANNABICS AND CAMDENISTS.

SIR—Some account of Albano's patent Cannabic architectural ornaments would no doubt be very acceptable to many other readers besides myself.[1] Until I saw the incidental mention of them in the notice of Mr. Walker's conversazione, I was not even aware of there being any thing of the kind, nor does the term "Cannabic" enable me to form any idea of their nature,—whether they are something altogether new—a *bonâ fide* invention—or an improvement upon something before known, and now recommended by a new name. I conclude, however, from their being spoken of as "highly gilt and burnished," that there can be no novelty whatever in their appearance; nevertheless must we suppose that they have some peculiar advantages to recommend them.

I do not know whether our Camdenists here are preparing any thunder against you, on account of the slashing article against them in your present number. Probably they content themselves with observing a dignified silence; if not you must expect nothing less than sentence of excommunication,—not only on account of that article, but also of the one on "Greek Masonry," introduced in utter defiance of their recent denunciation of every thing connected with the study of Pagan architecture. The intelligence conveyed in the latter article, that Hittorff is preparing an elaborate work on Grecian Polychromy is calculated to alarm not only Camdenists, but many belonging to the established Pagan or classical school.

Well will it be for the Institute, if the Camdenists do not now fall foul upon that body, and take it severely to task for proposing as the subject of the Soane Medallion, a "College in a University, of Roman or Italian architecture."—But I must stop, or I shall spin out my gossiping remarks to such length that you will have forgotten what induced me to write at all; therefore now conclude with reminding you of "Cannabic."

I remain, your's, &c.,

J. P.

Cambridge, July 5, 1844.

[1] We must refer our Correspondent to the Journal for last March, p. 86, where some account is given of "Cannabic ornaments."—Editor.

TO THE INHABITANTS OF SAINT MARGARET'S, WESTMINSTER.

GENTLEMEN,—Permit me to call your attention to the fact that efforts are still being made to effect the destruction of your venerable parish church, and to remove it from the site it has occupied for 790 years. I much fear a Committee of the House of Commons was prevailed upon yesterday, the 4th of July, to recommend this scheme of church desecration.

I have in my works on Church-building, and on Westminster improvements, and by other means, endeavoured to expose the shallow pretexts of the destructionists, and I flattered myself that my efforts had been successful, as I had brought over some of the most influential persons to my views, when to my astonishment a letter appeared a short time since in the "Builder," announcing "the pleasing intelligence,"—the pleasing intelligence! "That St. Margaret's Church was immediately to be pulled down and rebuilt on another site, *both which had been authorized, and funds for the purpose had been obtained.*"

Let me epitomise the reasons against this measure, which I have given at length elsewhere. "That persons greatly err who would regulate Gothic architecture on Greek principles" "That Gothic architecture does not exhibit itself naked and bare" "That it delights in bold, striking, and picturesque irregularities" "veiling itself with walls and screens and towers" "Therefore appears best as an accumulation of buildings" "Therefore the Abbey Church and St. Margaret's gain by juxta position" "While the grandeur of the ancient edifice is increased by comparison with the more modern structure which stands beside it" "That when the new palace of legislature is completed, St. Margaret's will be absolutely necessary to effect a harmonious union between that and the Abbey" "That St. Edward did not think the position of St. Margaret's would injure the effect of his darling Abbey Church" "That its removal would involve the destruction of another of history's landmarks, a document of stone which cannot lie, attesting the antiquity of your parish" "That instead of your venerable temple founded by St. Edward, rebuilt by Edward I., and again by Edward IV., you would probably get a mere brick and plaster apology on a par with those modern churches which are the laughing stock of Ecclesiologists." But is mere taste, or rather the want of it, fit to be put in competition with the desecration of a spot on which your ancestors worshipped for nearly eight centurtes, or are ye on these matters below that nation of savages, who, when urged to emigrate, replied, "But how shall we remove the bones of our forefathers?"

Inhabitants of Westminster, rouse yourselves to resist the architectural barbarians. Your ancestors rose *en masse* and successfully resisted the Protector Somerset and his myrmidons when they attempted the destruction of this church. The present most excellent Dean and your highly gifted Rector are utterly opposed to the project of removal; put yourselves under their legitimate guidance—remove not St. Margaret's, RESTORE IT TO ITS PRISTINE BEAUTY AS LEFT TO YE BY THE ILLUSTRIOUS EDWARD, and you will never more hear the senseless cry of removing St. Margaret's to obtain a better view of the Abbey Church. "Perhaps the best method to unite St. Margaret's with the Minster would be by erecting a tomb-house or cloister for the reception of those mural monuments which disfigure the interior of the Abbey Church, the expense of which would probably be defrayed by the accession of new monuments." As an Architectural Antiquary I have now done my duty; let the guardians of the fabric do theirs.

WILLIAM BARDWELL.

11, *Park Street.*

THE ATMOSPHERIC RAILWAY AND ROPE TRACTION RAILWAYS.

[We are indebted for the following paper to Mr. Stephenson's valuable report on the Atmospheric Railway (see 'Journal for June last, p. 208); it was drawn up by Mr. Bidder at the request of Mr. Stephenson.]

A Report on the practical application of the atmospheric principle as a motive power on railways, must inevitably be considered incomplete if the investigation did not comprehend the peculiar circumstances involved in the working of the Blackwall Railway, the more especially as public attention has been solicited in this case. Before, however, we can enter upon such an inquiry, we must carefully review the peculiarities which distinguish the conduct of the traffic on the London and Blackwall Railway.

This railway is about $3\frac{3}{4}$ miles in length, and is worked by stationary engines of 400 and 280 estimated horse power at the London and Blackwall termini respectively, the carriages being attached to a rope by grips, which rope winds off and on large drums situated at each extremity of the line. The greater power at the London station is required in consequence of there being a total rise in the railway in this direction of between 60 and 70 feet, the steepest inclination being 1 in 100.

There are no less than seven intermediate stations on this line; five of them, viz., Poplar, West India Docks, Limehouse, Stepney, and Shadwell, communicate with the Fenchurch Street terminus; whilst four of them, viz., Minories, Cannon Street, Shadwell, and Stepney, communicate with the Blackwall terminus. This arrangement is effected by appropriating a separate carriage from the termini for each intermediate station communicating with the same, and which, whilst the trains are moving in either direction, are detached, and by means of breaks are stopped at their respective destinations. As soon, however, as the terminal train arrives at either end of the line, and the rope ceases its motion, these intermediate carriages are attached by means of grips to the rope whilst the latter are in a state of rest; so that when the rope is again in motion, these are also simultaneously set in motion, and of course arrive successively at the termini in the order and at intervals corresponding with the order and position of the places from which they started; and as they arrive, they are released from the rope, though in motion, by the sudden withdrawal of the grip iron, and then their momentum carries them forward to their proper place in the station. It will thus be perceived that the intermediate traffic is by this means provided for without causing any detention to the through-trade.

The importance of this intermediate traffic may be inferred from the fact, that in the year ending the 31st of December last, out of nearly 2,500,000 passengers conveyed during this period, nearly 1,600,000, or two-thirds of the whole number, were derived from the short stations; any system, therefore, which did not completely provide for this traffic, it is clear could not under any circumstance be introduced with propriety on this railway.

To meet the case, it has been suggested, in the event of the atmospheric principle being adopted, that more frequent trains than at present should proceed from each end, and stop alternately at the intermediate stations, so that this important element of revenue might be accommodated.

This suggestion was made in consequence of the necessity of stopping the through-trains at each of these stations, as the system of separate carriages could not conveniently be applied to this mode of traction. This plan, if otherwise unobjectionable, it is obvious would afford a partial communication between some of the intermediate stations. This, as far as it goes, is an advantage over the rope system, which only admits the intermediate stations to communicate with the termini. It is, however, believed that this traffic would not be important, whilst it is of the utmost consequence to the cultivation of the intermediate intercourse that the intervals between the trains at each station should not exceed a quarter of an hour.

The average number of carriages in the terminal trains throughout the year is four; whilst in summer, to prevent the labour of having constantly to be adding or taking carriages off, as many as seven or eight are continually in motion, independent of the intermediate carriages. This great number of carriages is requisite in consequence of the extremely fluctuating nature of the traffic, which during the season is mainly derived from steam boats, whose living freights, amounting occasionally to 400 or 500 passengers, have frequently to be transported in one train. In the following calculations, I have, however, only assumed four carriages for the accommodation of the terminal traffic, and two more for the intermediate traffic, which though on the whole larger than the former, is nevertheless more equally diffused. Besides the above, the trains which stop at the Poplar station will be augmented by one goods' truck, though at times two will be added. Thus the trains will consist alternately of six or seven carriages constituting gross loads of 100,000 lb. and 112,000 lb. respectively. I also assume the actual time of stoppage at each station, independent of time lost in accelerating and retarding the trains, at half a minute, except at Poplar, where I allow one minute, as the goods' trucks would have to be pushed from a siding and attached to the trains. Thus, supposing the trains to stop alternately at 4 and 3 stations, the latter, however, embracing the Poplar station, the total time of stoppage on the trip would be two minutes; and assuming an average velocity of 30 miles per hour were maintained, including the time lost in accelerating and retarding at each stoppage, the actual time of travelling would be $7\frac{1}{2}$ minutes; thus the whole trip would occupy $9\frac{1}{2}$ minutes.

But to accomplish this with only average trains would require a tube 2 feet in diameter, with a vacuum of 20 inches, and this on the farther assumption that a conductor was appropriated to each carriage, and that the brake is applied to every wheel in the train, thus giving an adhesion of $\frac{1}{8}$th the gross load; and further, that the brakes are applied with mathematical accuracy. But with engines very far exceeding the power of the present engines, the time required to exhaust this tube would be at least 6 minutes. Thus the interval between the trains from the termini would be augmented to $15\frac{1}{2}$ minutes, or say $\frac{1}{4}$-hour intervals; that is, the same interval as is now allowed, but then the intermediate traffic would be subject to $\frac{1}{2}$-hour intervals, which I believe would reduce the traffic to less than half the present amount. It has, however, been suggested that an average speed of 40 miles per hour might be attained; but with four intermediate stoppages, to accomplish this would require a tractive force, independent of the great ordinary resistance which has to be overcome at these high velocities, (as in this case a maximum speed of 80 miles per hour is requisite,) equal to $\frac{1}{10}$th the gross load of the train. This with only an average train would require tubes of a size and engines of a power that would be entirely inadmissible. Seeing, therefore, that with intermediate stations on a line of the extent of the London and Blackwall Railway, very high velocities and trains of a greater frequency than $\frac{1}{4}$-hour intervals were unattainable, we may see what would happen by adopting the existing engines with a pipe which, at a vacuum of 16 inches, would be adequate to take a maximum load up the steepest gradients.

This pipe would for a gross load of 225,000 lb., or $100\frac{1}{2}$ tons, require to be 24 inches in diameter. Now, assuming as before the actual stoppage at each station to be $\frac{1}{2}$ minute, except at Poplar, which I assume to be for the up-train 1 minute, but $\frac{1}{2}$ minute only for the down train; assuming also a conductor on each carriage and the brake applied throughout the train, obtaining an adhesion therefore for retardation equal to $\frac{1}{8}$th the gross weight of the trains; on the above data, together with the hypothesis of the engines at each end working continually at their full power, I find that an average train will occupy 16 minutes on the up and $16\frac{1}{2}$ minutes on the down trip, whilst a maximum train will occupy 22 minutes on the up and 20 minutes on the down trip; but as 5 minutes at least must be added for exhausting the tube to 8 inches for starting, it is clear that trains at less than $\frac{1}{2}$-hour intervals could not be maintained on this line, especially when we consider that the above times include no contingencies, which must frequently occur on a line so worked; as, for instance, in a London atmosphere the adhesion frequently will not exceed $\frac{1}{15}$th the insistent weight: this alone, when it occurs, would add 2 or 3 minutes to the trip, and as in the event of a train overshooting a station it is impossible to move it back, the guards must commence applying the brakes sooner than is indicated by calculation, in order to ensure avoiding such a dilemma.

Unless, therefore, some expedient with which I at present am unacquainted can be devised for obviating the necessity for stopping at each intermediate station, it would appear that the trains could not be run more frequently than at $\frac{1}{2}$-hour intervals with the engines now at work, thus reducing the trains to one-half their present number, and this, too without effecting any saving in the working expenses, inasmuch as there would be no reduction in the staff of conductors, whilst the constant and severe breaking would increase the cost of maintenance of way and carriages; the wages of the ropemen also would not compensate for the extra cost arising from the engines being kept continually at work, instead of for 10 minutes only out of every

¼ of an hour, as is now the case; and, lastly, the interest of the outlay requisite to introduce this system would exceed the annual cost of repairing and replacing the rope.

REVIEWS.

Crosby Place Illustrated. By Henry J. Hammon, Architect. London: Weale, 1844.

We look upon this work as valuable in a double point of view, as illustrating an interesting monument, and as giving a stimulant to the restoration of our ancient edifices. We are afraid that we can say but little with regard to this book, for its merits can be briefly and favourably canvassed, while to give any account of the edifice itself is impossible, as it is now so well known. Mr. Hammon has performed his duty with ability and care, while he has given a neat and accurate account of the building, he has not suffered himself to be deluded into fine writing or swelling out his brief narration. The plates are justly made the principal and prominent parts of the work, and are well executed, illustrating every part of the ancient mansion. Mr. Hammon, therefore, has well responded to the exertions of the patrons of the restoration, the public spirited lady Miss Hackett, its chief promoter, and the architects, and we can award him no higher praise. We almost fear it is useless to recommend this work to the profession, for we see by the subscription list that nearly every architect of eminence has possessed himself of it. However, to those who have not done so, or to those in the provinces we earnestly recommend it. By the bye the history of restorations in the metropolis would make an interesting work of itself. Showing what we have done of late years to the honour of the works of other days, thereby securing to posterity more respect for our own. Crosby Hall, St. Saviour's, the Temple, the Savoy, and St. Bartholomew's would make a good commencement.

Collection of Architectural Ornaments of the Middle Ages, in the Byzantine and Gothic Style. By Charles Heideloff, Architect and Professor of the Polytechnic School, Nuremburg. Vol. I. with 64 Plates. London: Hering and Remington.

Messrs. Hering and Remington seem disposed, in virtue of their connecnection with the continent, to render the same service to the arts which M. Didot does to literature. The present volume will be most acceptable to architects and antiquaries here, as it is by a man of eminence and reputation, and records examples, most of which are new even in Germany and are inaccessible here. An additional merit is that many details of the Byzantine style are given, which is attracting great attention in Germany, and which affords new resources to our ecclesiastical architects here. The work was originally published in parts, and contains above four hundred examples of every kind of ornament, many of which are novel, and all sanctioned by good authority. Nuremburg is a treasury of middle age art, having been the Florence of Germany, and abounds with the finest work by native artists. Indeed, the history of the arts in Nuremburg has copiously employed the pens of Von Murr and others. From this city Professor Heideloff has been able to obtain much material, but he has also profited by other places in Bavaria, Wurtemburg and elsewhere, as the Cathedral of Bamberg, the Holyrood monastery at Neissen, Nossen, Kloister Heilbrann, Hershruck, Ellwangen Cathedral, Hirschau Abbey, Erlbach, Murrhard Abbey, Furth, Coburg Castle, Tubingen, Stuttgart, Bobenhausen, Reutlingen Cathedral, Offenhausen, Lilienfeld, Lorch Abbey, Vienna, Urach, Anhausen, Schwabischhall, Freiburg Castle, Salzburg Castle, Robweil, &c.

We feel confident that our readers engaged in the pointed styles will find this an admirable and useful work of reference. We sincerely hope that Professor Heideloff will continue his laudable undertaking.

Polygraphia Curiosa.—*The Book of Initial Letters and Ancient Alphabets for Ornamental purposes.* London: David Bogue, Fleet Street.

This is what is rare, a magnificent book and a cheap one, most useful to all engaged in design. The compiler has here presented a copious volume of initials from sources of the greatest authenticty, most of which can only with difficulty be referred to by the ordinary student. We wish in some plates, however, more attention had been shown to discriminating the exact date of the letters, nevertheless this does not detract from their intrinsic value.

In fact, the work may vie with many of the illuminated missals; some of the plates are gorgeously coloured and show to what perfection Mr. Jobbins, the proprietor and compiler of the work, has brought lithography in conjunction with polychromy. We are happy to see that he has announced his intention of publishing a second volume to embrace a variety of ornamental designs, some of a heraldic nature.

A Manual of Electro-Metallurgy. By George Shaw. Second Edition, considerably enlarged. London: Simpkin, Marshall and Co.

It is pleasing to see a second edition in a department of science so new as electro-metallurgy, and more pleasing to consider that such edition has been rendered necessary by the progress of discovery. Now that electro-metallurgy is becoming a practical process, a manual like Mr. Shaw's is requisite, which gives the principles and manipulations in a clear and comprehensive manner, so as to be available both to the student and practical man.

Appendix G. to the New Edition of Tredgold on the Steam Engine and on Steam Navigation. London: John Weale.

This concludes Weale's Edition of Tredgold on the Steam Engine, one of the most magnificent and useful works which has ever been published for the engineering profession in any country. The work is of such a character, so extensive in its bearings, so copious in its illustrations, that we have been indeed surprised at the enterprise of the publisher, and the cordial support of the public. On both it confers honour, on the publisher for his spirited undertaking, on the public, and the engineering profession in particular, for responding to such an appeal. No part of the steam engine, in its numerous applications and varied improvements, has been left unillustrated, but whether as regards the railway, the mine, or the ship, the steam engine is seen here delineated from the best models, with a degree of sumptuousness more usually looked for in a national work than in the publication of a private individual. To have conceived such an expensive undertaking, one requiring so much labour, so much energy and such an outlay of capital, and to have prosecuted it successfully entitles the publisher to the sincere thanks of all those who desire to encourage practical and valuable works.

The concluding part contains an able Treatise on the Cornish Pumping Engine, by William Pole, who, for his high scientific attainments, was lately appointed by the Hon. East India Company, Professor of Elphinstone College at Bombay. This treatise is divided into two parts.

"The first part is devoted to a historical notice of the application of the steam engine to the purpose of draining the mines of Cornwall, and of the progressive improvement it has received in that district. Beginning with the projects of Savery, we pass on to the actual use of the atmospheric engine, and notice the peculiar circumstances connected with its general introduction into the south-western mining districts. Smeaton and Watt come next in order, and the subsequent improvements by the Cornish engineers are the more prominently dwelt on, because their nature and history are comparatively so little known. The account of the introduction of the *Duty Reports* cannot fail to be interesting, as showing not only the means by which the progress of improvement is so easily traced, but also the great stimulus which has acted to encourage the efforts of the engineers.

"The second part contains a minute and detailed description of the Cornish single-acting pumping engine, according to its most modern construction; particularly noticing its various peculiarities as contrasted with the ordinary Boulton and Watt single-acting engine generally used in other parts of the country."

This part, illustrated with nine splendid plates, shows minutely every part of a Cornish Pumping Engine, manufactured by Messrs. Sandys, Carne and Vivian, of Copper House Foundry and Engine Works, Hayle, Cornwall; the engine has been erected at the mines of the Languin Coal and Iron Company, near Nantes, for the purpose of draining the collieries.

We have not been able to peruse the paper with that attention it deserves we must, therefore, reserve till a future opportunity the remarks which we are desirous of making.

Original Geometrical Diaper Designs. By D. R. Hay. London: Bogue. Parts 3 and 4.

Mr. Hay is proceeding vigorously with his work, and in the present numbers he has commenced his dissertation on the elements of design. From some of his views we dissent, but it would be premature to discuss the whole question. At any rate we can give our testimony to the utility of the work, and to the earnest desire of the author to perform his duty.

A Treatise on the Steam Engine. By the Artizan Club. Part I. London: Longmans.

This may be considered as an introductory part to the intended work. We are, therefore, precluded from offering any remarks until the work is more advanced.

Weale's Quarterly Papers on Engineering.—Part 4. London, 1844.

The present part of Weale's Papers has two original articles by Capt. Vetch and Mr. Clarke, and several valuable papers republished. It commences with a very interesting article by Capt. Vetch, of the Royal Engineers, on the Construction of Harbours of Safety in the Downs; reclaiming the Goodwin Sands and Sandwich Flats. Of the practicability of these undertakings we are fully convinced, and also of the very great advantages which would accrue to the commerce of the empire from such an enterprise; as, however, the method proposed by the gallant captain is novel, we should not like to commit ourselves to the opinion that it is *per se* the most efficient, though we are bound to admit its ingenuity, and the prima-facial evidence of its applicability. The principle on which the author proceeds in forming his roadstead is thus explained, and is one, which, although pregnant with the most valuable results, has not been always duly borne in mind.

ON HAVENS OF SAFETY, BY JAMES VETCH, CAPT. R. E., F. R. S.

Of all the natural havens which occur on the east and south coast of England, that formed by the Isle of Wight is the most complete. It has two large openings or entrances, great capacity, and good anchorage, and it may be pretty safely assumed that the best harbours for all purposes are those formed by an island lying near the main shore, and with the channel between them, sheltered by projecting points or banks; if we can therefore, by any reasonable means, convert the Godwin Sands, the Scroby Sands, and the Smithick Bank into islands, we should render the Downs, Yarmouth Roads, and Bridlington Bay, havens of the best qualities; but other advantages result from converting these barrier sandbanks into islands, since, by raising their crest above high-water mark, they cease to be hidden dangers, and it is obviously more prudent to build on the foundations laid by nature, and to complete her works, than to extend long piers or breakwaters into deep water for the purpose of inclosing an anchorage, not only without any assistance from natural circumstances, but possibly in direct opposition to them.

* * * * *

The great question that now remains to be solved is, whether it be possible in a reasonable time, and at a reasonable expense, to raise the crest of the Godwin Sands above high-water mark; and the writer is of opinion that the same may be accomplished, first, through the means of a light but strong frame work of malleable iron with other concomitants; secondly, through the circumstance of the low prices to which iron has now descended; and, lastly, by means of obtaining the operation of nature to accumulate sand around and within the contrivances erected to catch and retain it; and without undervaluing the application of iron framings for breakwaters under other conditions, the writer considers the superior utility of the principle will become most manifest in the conversion of sandbanks into islands. * *

The Godwin Bank is of an oval, or rather egg shape, the extreme length measured from the three fathom level at the north sand head to the same level at the south sand head, being 17,980 yards, or $10\frac{1}{4}$ statute miles nearly, and the extreme breadth from the west excrescence at the Bunt Head to the Barrier Edge, being 7667 yards, or somewhat better than $4\frac{1}{4}$ statute miles. The extent of the portion of the bank which is left dry in spots at low water is 12,364 yards long and 6532 yards broad, that is, about seven statute miles by $3\frac{7}{10}$, or 3·7. The elevated spots inclosed within the last dimensions, at ordinary spring tides, are left dry at low water to the amount of $3\frac{1}{2}$ to $5\frac{1}{2}$ feet; average $4\frac{1}{2}$ feet; and at these times their surfaces remain dry and workable upon, for three hours, and the rise and fall of tide being $16\frac{1}{2}$ feet, these spots are covered on the average at high water to the extent of 12 feet. The nature of the sand is remarkably clean and free from clay and mud, as might naturally be expected from the constant washing to which it is exposed, and Mr. Smeaton, who landed upon the bank in May, 1789, states that he "visited and landed upon the Godwin Sands to have a view of them, and examine their nature, and found that though of the nature of a quicksand, clean and unconnected, yet the particles lay so close that it was difficult to work a pointed iron bar into the mass more than to the depth of six or seven feet." Captain Bullock, who made a boring lately, found at the depth of $7\frac{1}{2}$ feet the sand become so dense and cohesive as to break the borer in the efforts to make it penetrate lower, and it is stated that Captain Hewett was unable to bore to a greater depth than 8 feet.

Capt. Vetch then proceeds to make some ingenious remarks as to the probable nature of the substratum under the Goodwins, and his views on this question seem to us to be well founded. We do not accord with him, however, as to his next point, combatting the received notion of the origin of the Goodwin Sands from the submersion of a part of the Earl of Kent's estates. We are rather afraid that our engineer has been induced to take such a course from the motive he assigns, of combatting possible prejudice that if "the locality was once firm land, incapable of resisting the sea at a former period, it is improbable that it can be regained or resist for the future," rather than by a comprehensive view of the evidence on the subject. The negative evidence of present submarine appearances would be just as conclusive against the inundation of the Zuyder Zee or of Zealand, or against the serious abrasions of our eastern coast, by which, in our own time, villages and parishes have been worn down into the domain of the sea. We know that other districts have been lost for want of attention to their sea banks, and we can see no reason why the strong traditional evidence of the submersion of the Goodwin district should be doubted, or that any argument should thence be drawn against its subsequent recovery by the resources of engineering science, either under the direction of the gallant engineer or some other colleague equally able to grapple with the opposing difficulties. To proceed with the Captain's plan.

The writer proposes to conduct a spinal embankment or nucleus of the nascent island along the sandbank as would readily permit the tides and depositions to visit both sides of it. The spine may be carried down the middle of the bank, or along the most elevated ridge, and if of a concave form, greater shelter would be given for the deposition of material, and the writer would prefer following such a line as would serve so far for a barrier bank to the island when completed. Thus on the Godwin Sands it is proposed to carry the spine or nucleus breakwater parallel to the great crest of the sands, as particularly developed along the eastern margin of the bank, and at the average distance of 500 yards from the edge, that the artificial barrier may be secure from damage by any temporary shifting of the outline of the bank, and also that sufficient space may be left outside the spinal embankment for the deposit of matter, which being sustained in reverse, would not be so subject to be carried off by currents or storms as at present, and would afford mutual support to the spine.

The specific mode of construction is thus detailed:—

To meet the condition of the Godwin Sands in constructing the spinal embankment, it is proposed to use iron rods, in a position nearly vertical, penetrating $7\frac{1}{2}$ feet into the sands and rising $7\frac{1}{2}$ feet above their surface; the upright rods to be about one foot apart, and arranged in square frames of 12 feet each side; and these squares complete, (called iron gabions, for facility of description,) will each contain 48 iron rods on a space of 12 feet square penetrating the sand $7\frac{1}{2}$ feet, and considering what has been stated of the tenacity or closeness of the sands at that depth, it may safely be allowed that so great a number of prongs will give the gabion all the strength that can be required against any lateral force applied above the level of the sands, and so far from seeking to go deeper for a foundation, it might be better to employ means to prevent any farther settlement of the gabions. The iron gabion being fixed, and the rods inserted in the sand to the depth stated, it is next proposed to floor the interior space with hurdles, and on these to line the gabion with one row of fascines firmly fastened to the iron rods; and this first stage of the structure to remain, without further addition, until the action of the sea has heaped up the sand externally and internally to the top of the fascines, when a second floor of hurdles and second row of fascines will be introduced, and the operations continued until the gabion is filled. The gabions now described form but the first tier in the structure, and when the interior and exterior surface has become elevated seven feet, a second tier of gabions is to be keyed on to the first, and these last treated as the first. In the foregoing manner the author merely attempts to raise a barrier one foot high at a time, and composed of materials not offering a solid resistance to the waves, but calculated to receive and retain the sand on either side as thrown up. It will be obvious that on such a surface as that of the Godwin Sands, and where we cannot safely plant a heavy structure or acquire a solid foundation, that we must endeavour to supply these deficiencies by embracing and holding on by as broad a surface as can conveniently, and economically be attempted; and with this principle in view, it is proposed on the line of spinal embankment to lay down two parallel rows of gabions 36 feet apart, bonded and tied together with cross rows at every 36 feet, by which means a base 60 feet wide would be procured for the spinal embankment, and by the numerous cells of which it is composed, every facility would be offered for the accumulation and retention of sand, &c., an object which would be still farther attained by throwing out ribs from the spine at suitable points to intercept the passing sedimentary materials, and these ribs embracing the sand to a still greater extent of surface, would increase the stability of the spine.

The proposed spinal embankment or breakwater on the Godwin Sands will employ about two tons of malleable iron per lineal yard; and the expense of the materials and structure, per lineal yard, may be roughly estimated at £24; and the cost for 12 miles, or 21,120 lineal yards of spinal embankment, at £24, gives a total expense of £506,880. The first tier of gabions would cost about £253,440, and if the whole was finished in four ye rs, the expense would be about £125,000 per annum.

We should observe that this ingenious paper is copiously illustrated with copper plate engravings.

The second paper is Sir J. Rennie's Report on Holyhead and Port Dynllaen Harbours, already known to the public.

The third an Investigation of the Comparative Loss by Friction in Beam and Direct Action Steam Engines. By Wm. Pole, C. E., Professor of Civil Engineering, Bombay. This is the paper which was read before the Institute of Civil Engineers, and reported in this Journal of last year, page 170, the present paper is illustrated with mathematical formulæ and engravings.

The fourth paper is on "The Engineering of Holland." By Hyde Clarke, C. E. The first section only is given here, which enters at considerable length into the minute practical details of the construction of dykes and seabanks, as derived from Dutch authorities, a subject with regard to which very little or nothing is known in this country. It promises to be a very interesting and valuable series, got up with great labour, and calculated to do good in keeping up our acquaintance with the great school of hydraulic engineering in the Netherlands, and in inducing our engineers and capitalists here to improve our own shores and coasts. The extent of coast open to the labours of the engineer is well shewn in the annexed summary by Mr. Clarke.

RECLAIMING OF LAND.

Sunk Island, near the mouth of the Humber, has been recovered and converted into a parish almost in our own time, and the space between it and Spurn Head on the north shore, called Trinity Sands, might be advantageously embanked, and would afford 10,000 or 12,000 acres. A good deal of land, by careful management, might be obtained in the Humber, as the Dutch have treated the Rhine. Probably another 10,000 acres might be obtained without injury to the navigation, and to the great improvement of the wapentake of Lindsey in Lincolnshire. Some good polders or water meadows might also be gained between Grimsby and Saltfleet.

The large estuary called the Wash, now hemmed in on every side by the labours of the engineer, presents an opportunity for embanking such as should not be neglected. Upwards of 100 square miles, or nearly 100,000 acres might be ultimately recovered, and Sir John Rennie has formed a most judicious plan for the gradual prosecution of this undertaking by sections, so as to meet the views, it would seem, of the most timid. The neighbouring districts, fertile in cattle and corn, show to what advantage this acquisition could be turned, while the drainage and navigation of the whole up-country would be vastly promoted.

The rivers Alde, Debden, Orwell, and Stour, in Suffolk, admit of great improvement, and the consequent recovery of much valuable soil. The same may be said of Horsey Island in Essex, and the coast washed by the estuaries of the Coln, Blackwater, and Crouch, in the same county. This is a district much like the province of Zealand, and under systematic treatment would produce from 30,000 to 40,000 acres, the whole of Danesey Flats and the Maplin Sand admitting of recovery. The condition of this district is far from complimentary to the country in an engineering point of view, but nothing else than a central management and operations on a grand scale can do much good here; partial efforts may do a little, but they cannot carry out measures effectually.

There would be strong interests to contend with in the case of the Medway, or the district from the Isle of Grain to Whitstable might with great benefit be put under proper treatment. It would greatly benefit the navigation and land communications, while it would produce a great accession of available agricultural soil.

Chichester harbour and Langston harbour, in Sussex and Hampshire, would produce a considerable quantity of good ground without injuring the navigation, but the contrary. The embanking of Brading harbour, in the Isle of Wight, was, it is said, undertaken by Sir Hugh Middleton and others, and they formed a dam across the mouth of the harbour, but found the soil worth nothing. Had they known how to turn the river Yaver to account, they might easily have remedied that defect. The area is about 600 acres; and as the mouth is narrow, a small dam would close it. It is also said that, on the occasion just mentioned, a stone wall was found in the channel, as if a similar attempt had previously been made. In the Solent, about 1,000 acres might be secured between Lymington and the North Channel.

Poole harbour, in Dorsetshire, has very much ground wasted by the upland streams, clearly not by the sea, for the mouth of the harbour is not half a mile across.

In Somersetshire, the probability is that if a new channel were cut for the river Parret, the greater part of Bridgewater Bay might be silted up, and an addition made to the levels in that district.

The Welsh grounds, as they are called, lying off Monmouthshire, in the Bristol Channel, seem to be caused by the small streamlets from the Coldecot level. The Candecot and Wentloog levels, it may be observed, are portions of these sands, containing 30,000 acres, which have been reclaimed, perhaps by the Flemish settlers.

South Wales, too, presents several estuaries which could be treated by the engineer with very beneficial results.

The estuary of the Dee is of little value for navigation at present, having a very bad channel at low water. This might, however, be remedied, and 20,000 acres be easily reclaimed. By the diversion of part of the channel at a former date, 4,000 or 5,000 acres have been already obtained in the upper river.

The Mersey, it would almost create a panic to attempt; and the more so, as much space is required for the shipping. But it may be said with truth, the navigation of that river is in a very unsatisfactory state; and although Captain Denham has done something, it requires very able and energetic management to secure the river in a competent state. The outer channels are very bad; and it is evident the process is going on which has already created the peninsula of Wirrall between the two rivers, and which has almost destroyed the river Dee. Some day a new port will be made at Formby, or elsewhere, on the coast to the north-west of Liverpool; as indeed I proposed some years ago, which will save an hour or more in each tide, and carry on the packet business to more advantage. If the Mersey were taken in hand on a comprehensive scale, 20,000 acres might be reclaimed; but local interests are so much involved in its present condition that this is quite hopeless.

In the river Ribble 15,000 acres might be obtained; and it is a pity, in the recent measures for the improvement of the navigation, this object also was not provided for.

Morecambe Bay is one of our largest estuaries, twenty miles deep, and fifteen miles across; the greater part of which is dry at low water, and used as a high road. In 1836, I proposed a plan for its embankment, the recovery of 40,000 acres, and the carrying of a railway across it. This was considered insane at the moment, but has been subsequently affirmed by the voice of three public meetings of the county of Cumberland, and by the professional opinions of Messrs. Stephenson and Rastrick. At a subsequent period measures were in agitation for its prosecution; but disputes as to the rights of the crown, the Duchy of Lancaster and the local proprietors then interfered with the negociations. The same plan of railway proposed to cross the Duddon and the Solway Firth. Morecambe Bay contains two splendid ports, those of Fleetwood-on-Wyre and Piel of Foudrey, and also Lancaster and Ulverstone. The upper part of the bay was, however, the only part I then proposed to touch. The silt or soil is very fertile, as has been proved in several small embankments which have been made on the coast, and the substratum within a few feet is a fine clay which would be available for the works. The value of the land recovered would amply repay the expenses, and the greater part of the cost of the railway uniting Lancashire and West Cumberland. The Duddon embankment has also met the approval of local parties, and it is to be hoped will not be long delayed. By shutting off the mouth from the Cumberland coast to the Isle of Walney, 9,000 or 10,000 acres would be recovered, and the harbour of Piel of Foudrey, the best on the north-west coast of England, be much benefited. It is singular, by the bye, that this district is almost as little known as some parts of Ireland or Scotland. The Solway Firth, with the estuary of the Wampool and the Waver in Cumberland, which are dry at low water, would afford about 20,000 acres, and by embankment greatly facilitate the land and water communications of the neighbouring districts.

On the east coast of Scotland a little has been recovered from the estuaries, but a good deal more might still be obtained; on the east coast of Ireland also; but the drainage of the Irish loughs would be the grandest and most valuable enterprise. These would afford upwards of 500 square miles, or a new country, besides much facilitating the drainage of the adjoining districts. An Act of Parliament has been passed for the embankment of Lough Swilly and Lough Foyle, which, I believe, is now being proceeded with, the banks consisting of a rich mud, dry at low water.

The following moderate estimate will show the large area available for the enterprise of our capitalists and the skill of our engineers :—

ENGLAND.	Humber, &c. . . .	40,000 Acres.
	The Wash . . .	60,000 „
	Suffolk and Essex . .	40,000 „
	Hampshire and Dorsetshire	10,000 „
	The Severn . . .	30,000 „
	Cheshire and South Lancashire	50,000 „
	Morecambe Bay . .	40,000 „
	The Duddon . . .	10,000 „
	Solway, &c. . . .	20,000 „
		300,000 Acres
IRELAND.	Loughs . . .	300,000 Acres

The total extent in the two countries cannot be estimated at less than 1000 square miles, or 600,000 acres, worth at the lowest average £20 per acre, though much of it, as in Morecambe Bay and Lough Swilly, would be worth £60 per acre. The total value, if reclaimed, would be between £12,000,000 and £20,000,000.

We sincerely concur in the feelings which induce the author to urge this subject on the consideration of the profession, for we are convinced that under proper auspices a great deal might be done. We must, however, have a more enlightened system of legislation for enterprise; we must not have parliamentary countenance to the vexatious opposition of landowners and interested parties; we must not have joint stock undertakings impeded and repressed to check a solitary case of swindling, or the exaggerated evils of jobbing. Let us have protection and not discouragement; let every facility be given to engage in useful undertakings, and while the spirit and enterprise of the country is kept up, our capital will be usefully applied, and our labourers receive immediate and permanent employment. To increase our home territory and our home resources is one of our first duties, and that it is practicable is, without adverting to other authorities, fully shewn in the present work by Capt. Vetch and Mr. Clarke. How necessary, too, it is for some better disposition on the part of the legislature is shewn in the cases of the Great Level of the Wash proposed by Sir John Rennie, and the Morecambe Bay Embankment by Mr. Clarke, plans approved by the highest authorities, of evident benefit and profit, and yet suffered to languish, uneffected and unattempted, purely from the difficulty of obtaining the preliminary legislative sanction and authority to raise funds.

The processes adopted in the formation of dikes are extremely simple, but are necessarily detailed with such minuteness that we cannot seize any salient point to exhibit to our readers, although many of the features discussed are very interesting, the necessity of a strong grass turf covering, the mode of contending with the London clay formation, and the plans for carrying dikes across broad and deep creeks of the sea. In the copious notes are many interesting illustrations. The author mentions a work of the celebrated Captain John Perry, the engineer, who stopped Dagenham Breach. Unfortunately the pamphlet in question is not to be found in the British Museum. It is a plan for the improvement of the Bedford Level, published in 1727.

Mr. Woods' paper on the Consumption of Fuel in Locomotive Engines, read before the Liverpool Polytechnic Society, and Sir John Macneill's Report on the Atmospheric Railway, conclude the part, both papers are copiously illustrated with copper-plate engravings.

ROYAL INSTITUTE OF THE ARCHITECTS OF IRELAND.

Lectures of Architecture.

On the 28th of June, the venerable Vice-President of this Institute, Sir R. Morrison, delivered an introductory lecture of a course intended to be given upon architecture, in the Board-room of the Royal Dublin Society.

Sir Richard proceeded to say—It is my pleasing duty, on this occasion, to congratulate you on the success which has attended our exertions to establish an Institute for promoting the advancement of architecture in this country, and for raising to their legitimate place in public estimation the character and the claims of its professors. For a long period our art was neglected in Ireland—for, in Ireland, the office of its professors was misunderstood—and while, in other countries, the profession of a science requiring for its proper exhibition an union of the purest taste, with the most liberal attainments, claimed and earned an elevated position and the brightest honours for its successful practitioners, in Ireland our beautiful art has remained unappreciated; and the title of its instructed professors has continued to be applied, in ignorance, to uneducated persons, unpossessed of the slightest claim to such a distinction. However, the cloud which too long hung over us is passing away, and amongst the enlightened of our countrymen our labours are, at length, beginning to be understood and valued as they deserve. Our association has already established a high position in public estimation. It has been honoured with the distinction of royal patronage. It has been hailed by the sister Institute of British Architects, and it now remains for its members to extend its benefits, as well to the public as to professional aspirants, by endeavouring to diffuse a taste for, with a knowledge of our art, that its utility may keep pace with its advancement. With a view to this desirable object, I propose to deliver here a course of lectures on the history of architecture, its principles and its rules; and, as it is my wish, founded on a strong feeling of its importance, to bespeak for my humble efforts to elucidate architectural science the attention not only of professional auditors but of others, I am induced to preface them by offering a few observations on the advantage to be derived from some study of this highly interesting subject as a branch of general education.

I have said, in this country that the science of architecture has been much neglected by those who, from principle and from feeling, should be the liberal fosterers of the arts. The fact is obvious as its consequences have been injurious. From prejudice or from apathy amongst the educated classes the acquisition of any knowledge, and, therefore of a correct taste in this branch of the fine arts, has been too generally overlooked. There has, in consequence, been wanting a criterion to discriminate between the instructed artist and the illiterate pretender. Public and private wealth has been, from this cause, too often wasted in the erection of abortive and ridiculous structures, which, as if in mockery of an advancing civilization, remain the records of an absolute vandalism in respect of that art which should exhibit the most decided and most lasting monuments of a nation's refinement. That this unhappy neglect of architectural cultivation is not attributable to a dearth of professional talent, is manifested in the few but surpassingly beautiful edifices which from time to time have been raised in this city and through the island, to exhibit the aid which, under encouraging circumstances, Irish genius could lend to forward the progress of national refinement. But architectural ability, in order to flourish, requires the support and the encouragement of discerning sympathy for its exertions. *Honos alit artis.* The mind of taste, of imagination, and of creative fancy, thus fitted for the conception of arrangements grand and beautiful in their design, is unfortunately the most sensitive of depreciation or neglect. But to appreciate the artist's labours as they deserve, there must be a clear perception of the degree of ability which he displays; and it is evident this capability of true discrimination cannot subsist without some correct knowledge of, at least, the general principles of the art. Here, then, is the first consideration which, independently of the motive of personal improvement and gratification marks the importance of giving a place in the studies of the educated classes to the principles which should govern architectural design. If it is of importance to good feeling and enlightened judgment to encourage the development of talent in a pursuit of the most intellectual character; to be enabled to sympathise with the lofty aspirations of genius, and to protect an art which repays the taste that fosters it, by affording to the many an inducement to peaceful pursuits and to mental cultivation, teaching them, by attractive examples of harmonious beauty in design, the appreciation, with the feeling of refinement, then, indeed, will those who love their country rejoice to see the possessors of its rank and of its wealth habituate themselves to that study of architecture which will render them competent judges of its examples, and enable them to encourage with praise, not "faint" and chilling, but warm and ardent, as it is discriminating, the reallly competent professors of an art which tends at once to embellish their country and to improve its people.

There is, in connexion with this general view of the subject, a further consideration which renders it incumbent on the higher classes to acquire a competent ability for judging correctly as to architectural designs upon the the merits of which they may be called, in the discharge of duty, to decide. To the gentry of this country, in their capacity of legislators, members of committees, or grand jurors, is submitted the disbursement of large sums of money for the erection of public buildings, and in their education as well as in their integrity the nation reposes her confidence for the due fulfilment of their trust. The performance of this task involves, of necessity, the exercise of correct judgment and discrimination, that the common resources be not wasted in the erection of edifices inconvenient and unsuited to their intent; and that the national taste suffer not discredit in the eyes of foreign nations and of posterity, by encumbering the land with mean and unsightly structures, to misdirect the feelings of its people, and to blot the page of their history, instead of being the present means, as well as the tokens, of their refinements, and remaining, like the monumental temples of Greece and Rome, for future ages the memorials of their civilisation. But can this necessary faculty of correct judgment subsist independently of its acquisition by studying the principles of our art? With reference to other subjects of information the question would be deemed superfluous, though, with a strange inconsistency, many who would scarcely venture to give an opinion in a discussion (for example) of medicine or of law, with respect to a science which requires at least an equal devotion of studious labour, consider themselves competent without any preparation to pass a decisive verdict. But there is a voice, familiar to many who hear me, which gives a sad denial to this assumption. It is the voice of experience, reminding them how frequently, on occasions such as I have referred to, they have witnessed from numerous designs the worst selected; and thus giving her testimony to the principle I uphold, that those whose social position gives them the control of public money, with the ultimate decision upon public works, are called upon to fit themselves by study for the task, no less by a consideration of duty, than by that of taste and feeling to which I already have adverted. But if those higher motives, involving a principle of feeling or of duty, had not any existence, there is a personal inducement for acquiring some general knowledge of our art, which, with reference to the classes of society to whom I allude, ought, it might be supposed, to be sufficiently influential. The gentry of our country are to be considered not only as the legitimate patrons of the liberal arts and as the guardians of the national wealth and honour, but also more immediately in their private relations, and with reference to their individual interests, as well of reputation as of purse. Now, how is an individual in utter ignorance of the principles of architectural design, and about to incur a large expenditure in the erection of a mansion suitable to his station, to guard against the abuse of confidence by those whom he professionally employs? It may, no doubt, be said that (as applies to other professions) by employing an artist of reputation, he may rest his security in the decided skill which he has thus engaged. It is obvious that this principle, rigorously pursued, were inconsistent with that generous and enlightened feeling which would rather seek to open than to bar the way of the youthful aspirant to professional distinction; and although there would, indeed, be safety in its adoption, it is yet perhaps more applicable to the professions of law or of medicine, which aim but at a certain result, than to that of architecture, which affords for selection such diversity of style and character in design, in respect of which the client, though submitting to the artist's professional taste and science, is supposed to direct him by some decided feeling and judgment of his own. But, after all, there is unfortunately with reference to our profession, as to that of medicine, a venal empiricism, ever ready, for its own corrupt purposes, to take advantage of the too prevailing ignorance of architectural principles, which we deplore. How often do we, from this cause, see a large expenditure lavished on an incongruous and unsightly mass of absurdity, under the dictation of some ignorant impostor, unable to understand much less to imagine a beautiful design, requiring the exercise of pure taste and scientific judgment, and poetic or classic feeling for its conception? or else do we see the general forms of a design procured from a master of the art, to be, with an ill-judged and most delusive economy, placed for their completion in the hands of some assuming journeyman of the profession, with a judgment as erroneous as that which might have induced a publisher to hand over the outline of a tale of the Great Magician, to be filled up by some penny scribe, with all its detail of well delineated character and natural expression, and historic associations and wondrous imaginings, the lights and shadows of ever-varying incident, and its deep and absorbing interest. The attempt would not be less absurd, and would afford just an equal prospect of success. But independently of the waste of money, there is another loss, which under such circumstances is entailed by the want of information to which I advert.—I allude to the loss of estimation which the deluded client must suffer in the opinion of better instructed persons, by the exhibition of the memorial he has erected to mark his sad deficiency in judgment and in taste. The edifice which he regards with admiration and displays with pride, is, in reality, an object of ridicule to those who have learned to distinguish structural deformity from graceful beauty; and the very praises which he lavishes on the abortion but bear witness to the decided ignorance of his views.

It has often been my lot, as I dare say it has been that of many who hear me, to listen with a painful feeling to such notes of praise uttered by persons of enlightened views on other subjects, when accompanied by observations which have evinced their incapacity for discerning the grossest errors in the structures they have admired, even when their vicious faultiness has been pointed out. How often on such occasions, is the censure, of which they cannot perceive the justness, vainly combated by such expressions as "tastes differ," and "though the building may not be strictly architectural, it still is handsome," &c. I need not point out to you the total incorrectness of such observations. It is only necessary to say that they evince, as they proceed from, total ignorance of the subject to which they refer. A little study of the principles of architectural composition would have taught those who use them that no design can be beautiful which is in violation of harmony, or of proportion, or of fitness—that is, accordance with and adaptation to the character which it assumes; and although it is true that "tastes may differ," even amongst correct judges of architectural propriety, one preferring perhaps the harmonious symmetry and chaste solemnity of a Grecian temple; and another the picturesque forms of a Norman castle or a Tudor mansion; still there can be no difference of taste, properly speaking, as to what is really excellent and what is totally erroneous in design; unless, indeed, the term "taste" can be applied to such a perverted judgment as would prefer the cherubims of a country tomb-stone to the sculptures of a Phidias or a Lysippus, or the flaunting colours of a signboard daub to the magic creations of a Titian or a Claude. If, from the considerations to which I have directed your attention, it appears clearly how deeply interested are the unprofessional public in acquiring some correct knowledge of architectural design, for the perception of its merits, or for the detection of its faults; the instructed artist is equally interested in the general cultivation of such knowledge, as in its diffusion will be found his surest safeguard against the injurious encroachments of ignorance and pretension. It will, indeed, be readily supposed, and experience has proved that those who, by studying the principles of architecture, have been taught to judge of it aright, who are thus aware of the extent of information, the laborious attention, and the continued practice required to qualify the skilful architect; and still more, the historical research, the poetic associations, the refinement of feeling, and the creative fancy, chastened by taste derived from the purest sources, which must combine to form a master of the art, have ever been found the warmest patrons of its professors, and the most ready and anxious to cheer the labours and to reward the merits which they have learned truly to comprehend,

It is not, certainly, to be assumed that an attention to the study of architecture, whether more or less extended, will supply the want of individual talent, or, in its exercise, produce a correct taste for the beautiful in design, where nature has denied to the student its perception; but, at least, it will oppose a barrier to the gross violation of rule and order in structural composition. It will be sufficient to prevent the sanctioning of what is incongruous or inharmonious in its effects; it will tend to the discouraging of assumed ignorance; and, by directing the all-powerful influence of high example and generous sympathy in aid of a most worthy cause, it will promote the developement of native talent; and, while it elevates the intellectual character of the country, it will spread with a refinement of feeling and of pursuit an increase of civilization and of happiness amongst her people—

Ingenuas didic sse fideliter Artes,
Emollit mores, nec sinit esse feros—

Let us turn our eyes on Greece and Italy, and mark the light which is shed from their glorious ruins in illustration of the position I maintain. There the arts, and architecture, above the rest, held a distinguished place, and marked with their beautiful memorials each advancing step of national improvement. Those were no unhonoured artists who raised or restored the Parthenon, or gave to Athens the glories of the Erechtheum and the Propylæa. There was no want of a people's sympathy for the skill that had shone in Rome's temples and triumphal arches. Those nations have fallen, "fallen from their high estate." "Time and the barbarians" have both done their work; and in later days, the hand of Moslem rudeness has driven the genius of architecture from the land of her adoption and her glory. But in Italy she still holds an honoured place; and amidst the many political errors and changes which she has there witnessed, she has continued to receive that votive homage at her shrine, which attests how highly she has been and is still regarded as the object of a people's respect and of their love. Much of this enthusiastic feeling of the Italian is, perhaps, attributable to the pride of national reminiscences associated with the architectural monuments of their country's greatness—much of it, perhaps, to the ardent temperament of the people, which renders them peculiarly susceptible of the impressions which the beautiful and classic examples around them are calculated to produce.

From whatever cause arising, it is certain that in the midst of political faults, a strong feeling in favour of the fine arts has pervaded the country, influencing at once the rulers and the people; establishing schools for the cultivation of architecture, of painting, and of sculpture, and encouraging with the noblest rewards and honours the aspirants to professional distinction. The result is such as might be expected. If the ancient architectural glories of Italy are not, under her depression, equalled by her modern productions, they are not, at last in many instances, disgraced by the deformities of ignorant pretension; while whenever an opportunity has been afforded for the exercise of talent, it has been witnessed in the production of chaste and classic structures—in taste, if not in grandeur, worthy to succeed those splendid monuments which, even in their ruin, testify "the eternal city" to have been once in arts as well as in arms the mistress of the world. There was no indication of degeneracy in the idea of elevating the proudest temple of ancient Rome to an ærial position, or in the professional skill and scientific attainments which would have enabled Michael Angelo to carry that sublime conception into effect had it been adopted. That in Britain a love for architecture, with a perception of what is correct and beautiful in design, has not prevailed to an equal extent, is the result of circumstances both natural and adventitious. The reasoning character of the people, which determined their pursuits and actions less by sentiment than by calculation, and which is enhanced by their essentially commercial habits, is, itself, unfavourable to the appreciation of an art in which practice, feeling, and imagination must combine with science to produce a perfect work. In the course of education, too, adopted in the universities, directed almost solely to the consideration of classical literature and of abstract science, and which, in its exclusiveness, is, perhaps, more the result of habit and of prejudice than is admitted, the study of architecture, as a branch of mental cultivation, is not included—and in after life, the occupations of political excitement, and the pursuits of ambition or of fame, and the studies which apply to them, leave to those of elevated rank but little time, and supply to them but little inducement for considering a subject in which they have not learned to feel a previous interest. However, notwithstanding these opposing circumstances, there are, happily, many among the educated and influential classes in Britain who have studied our art, as well from principle as from taste, and who, from the associations connected with the proud baronial castles, and the graceful ministers, the Ragland and the Melrose ruins of their own historic land, or from the monuments of classic elegance with which they have, in foreign travel, become familiar, have learned to appreciate a science which cannot be truly valued but as it is both felt and understood. This advance in "the march of mind" is evinced not less in the chaste and beautiful design of many modern structures, than in the endowment of schools and in the establishing of galleries for the arts; a contribution of wealth to a national property, of which Great Britian may be most justly proud. It is also witnessed in the victory of good feeling and taste over unworthy prejudice in the sympathy of high birth and influence with professional talent, and in their association for an object of reciprocal interest, whereby the noblest are seen enrolled as acting members of British Institutes of art, which they adorn not less by their scientific and tasteful acquirements, than by the lustre of their station and their name. It was with the hope of promoting in this country a similar appreciation of the liberal arts, by raising that which we cultivate from its unmerited depression, that first was established the Institute over which I have the honour professionally, to preside; and in furtherance of this object I conceived the idea of delivering a course of elementary lectures which should principally tend to give to unprofessional persons some general information as to architectural design and the principles which it includes. If by such efforts as this, continued, and, no doubt, improved upon by others, there shall, at length, be excited in the public mind a decided interest in this subject, it will be a source of most legitimate congratulation, in which the members of this institute will participate with every true lover of his country or of the arts; for sure I am that the period which witnesses the awakening of such a feeling amongst us, will be a happy era as well for the social improvement of Ireland as for the advancement of a profession in which I have learned to centre my attachment and my pride.

Unfortunately to many of the causes which have opposed the interests of architecture in Great Britain, there have been added in Ireland other circumstances on which it is not my province to dilate; but which, however variously judged of in other respects, are admitted in their effects to have impeded the progress of almost everything calculated to improve the country, to harmonise the affections of her people or to refine their taste. Under such circumstances it was scarcely to be expected that the blossoms of architectural cultivation, which require the genial soil and climate of national civilization and social quietude, should overcome the difficulties which from other causes retarded their expansion. They drooped indeed neglected amidst our country's moral desolation; or if in some instances they flourished under happier auspices, those were but few, and uninfluential as examples. By the majority who should have cherisheed so fair a plant, it remained unvalued, and to them if not its very existence, at least its sweetness was unknown. I will not, however, dwell on a painful retrospect, while the dawning of a brighter day for Ireland enables us to indulge in a more grateful anticipation. The eminence and talent of the Royal Institute of British Architects have given us the aid of their sympathy and of their fellowship in our efforts to elevate our profession in this country, by diffusing a knowledge of its principles, and already have the highest in rank responded to our call, to promote our object by the weight of their example; amongst whose names (with that of our late noble President, for whose too early loss to his country and her interests we, in common with all who love Ireland and the arts, have to pay the tribute of our deep and lasting regret) it is our pride to enrol that of one other, not less influential from personal character than from individual and official station. Under the same just and generous influence which seeks to advance the true interest of all, I trust, indeed, it is no delusive dream to anticipate, in many ways, a decided improvement for Ireland; and to indulge the expectation that, amongst the means which are essayed for her amelioration, the encouraging of those liberal arts which sweeten the asperities of life, by giving a taste for intellectual pleasures, and by affording, in their contemplation, to those who learn to value them, a source of innocent and refined enjoyment, will not be forgotton. I trust with confidence that we shall have the gratification of witnessing a rapid progression of the fine arts, with their decidedly most useful influence in this country, under the warm and discerning protection of those who value such pursuits, as well for their good effects as for their intrinsic merits; and if it may be permitted to one, who as an artist is not the less an Irishman, to indulge in an anticipation grateful to his feelings as a lover of his country, I would fain congratulate those whom I address on the prospect of a happy epoch, when, under an administration wise and enlightened as it is benevolent and impartial, the clouds which still hang over our country shall disappear; when the pursuits of science, of literary enjoyment, and of social happiness will prevail in this land above all others but those of virtue, of charity, and of religion; and when the hearts of all Irishmen, united in a common anxiety for the prosperity of their country, shall form, not less in their strength of unanimity than in the nobleness of their object, "one arch of peace."

MESSRS. BOULTON AND WATT ON THE STEAM ENGINE.

(Continued from page 152.)

42. The guide posts, or Y posts, of the plug frame must be fixed exactly, according to the drawing sent for that purpose; and the cross swords, which slide in the guide posts, must be of oak or beech, two inches thick and eight or nine inches broad. The plug tree itself should be of hard, straight-grained, seasoned oak; the hole, one and quarter inch diameter, bored off both sides by a centre bit; for if you bore them by an auger, they will be apt to break into one another; care must be taken to bore a sufficient length of the plug. The opening horns, or arches of the Y shafts, which act upon the levers of the regulators, must be bent exactly to the curves of the full size drawings sent for them. This is best done by taking a piece of soft iron, an inch broad, and three sixteenths thick, and bending it cold, until its hollow side exactly fit the drawing; and by applying this mould to the arch, whilst red hot, you can set it truly into form. These moulds should be carefully laid up, lest by any accident the arches should require repairs. To fix the Y shafts, make the levers of both the regulator spindles truly horizontal, and so long, as just to reach their proper places on the Y shafts. The lower side of the exhaustion lever, and the upper side of the steam lever, will then point to the axes, or centres, of their respective Y shafts.—The coupling brasses for the Y shaft pivots or gudgeons, must be fixed one inch from the inside of the guide posts, and the centres of the pivots must lie exactly in the line of the inner sides, or rabates, of the grooves, in which the swords move; a piece of wood, with a slit in it, three inches wide, and about three feet long, having holes in it like an old fashioned plug-tree, must be pierced to receive the opening horn and lever of the steam regulator; and by means of wooden pegs, one inch diameter, put through its holes, and saddles of leather laid above them, regulate the opening of the steam regulator. To prevent shaking and noise, the lower end of this piece of wood must rest on the ground in the floor of the cellar. The lower end of the guide posts must be fixed upon the sills parallel to the working beam; otherwise the weight of the exhaustion will fall upon them, and shake them every stroke. The floor, over the eduction pipe, must be easily moveable, that the pipe may be easily got at. There must be a window towards the condenser to give light to the plug-frame. The weight which hangs to the detent of the exhaustion, and which serves to raise the arch and open that regulator, must be of lead, cast on the rod; and square pieces of lead with a notch in them, to admit the rod, may be laid on, if the weight prove too light. Some oakum must be laid between these saddles to prevent noise. A box, eighteen inches square, and two feet deep, must be fixed about the blowing pipe, to prevent the hot water from mixing with the cold, in the cistern; but there must be a few holes in the bottom of this box, to suffer the water to go out below. This box should rise six inches above water.

43. Care must be taken that both the regulators fall into their seats without touching sooner on one side than the other; and if the the copper cones, under the regulators, be not already rivetted or screwed to them, it should be done before you begin; but avoid bending the valves in so doing. Some threads of oakum, well puttied, must be lapped round the necks of the regulator spindles, beyond the shoulders, to keep them steam and air tight; but this must be done in such a manner, as not to prevent the spindles from going quite home to their shoulders, otherwise the regulators cannot fall right in their places.

44. The brass of the cylinder stuffing box must be fixed in its place, and the upper, or thin edge of it, set out against the sides of the iron part. When the piston rod plays truly up and down, in the axis of the cylinder, put on the stuffing box, and screw it down by its flanch; then pack the box with soft rope yarn, wrapt round the rod, until you have nearly filled the box; then take a collar of deal wood, two inches thick, made easy for the rod and for the box; divide it in two by its diameter, lay it on the top of the stuffing, and apply the gland above it; as you go on with the packing, melt some grease and pour amongst it, and when finished, screw down the gland moderately tight.

45. The cylinder lid must have no screw holes over the square pipe; its joint must be made with pasteboard, puttied on the lower side, but not on the upper side; and the lid being greased with tallow the pasteboard will not stick to it, but will lie in its place when the lid is raised. Two long iron rods with hooks at their lower ends, must be hung to eye bolts in the spring beams; so that, when the lid is raised about three feet from the cylinder, these hooks may be put into two opposite screw holes, to support the lid at that height, while the piston is being packed.

46. To pack the piston, take sixty common sized *white* or untarred rope yarns, and with them plait a gasket or flat rope, as close and firm as possible, tapering for eighteen inches at each end, and long enough to go round the piston, and overlap for that length; coil this rope the thin way as hard as you can; lay it on an iron plate, and beat it with a sledge hammer, until its breadth answers its place; put it in, and beat it down with a wooden driver and a hand mallet; pour some melted tallow all round; then pack in a layer of white oakum, half an inch thick; then another rope; then more oakum; so that the whole packing may have the depth of about four inches, or only three inches if the engine be a small one. *Cast* segments of a circle of lead, about twelve inches long, three inches deep, and one and a quarter inch thick, fitted to the circle of the piston, and cut down square at both ends; lay them round upon the packing as close as they can lie to one another without jamming, and screw down the piston springs upon them. The piston springs must be bent downwards at the end next to the piston rod, and a little mortoise must be cut in the cast iron there, for the bent down point of each of them to lodge in, which will prevent their coming forwards to touch the cylinder.—Previous to the piston being put into the cylinder, the hollows among the crosses must be quite filled up with solid pieces of deal wood; put in radius fashion. The packing of the piston must be beat solid, but not too hard, otherwise it will create so great a friction as to hinder the easy going of the engine. Abundance of tallow must be allowed it, especially at first; the quantity required will be less as the cylinder grows smoooth.

47. The joints being all made, the regulator valves in their places, and their covers screwed on, but no water in the condenser cistern, admit steam, and when the cylinder and steam case are thoroughly warmed, screw up the nuts of all your screws, and caulk the pasteboard or oakum of such joints as may require it with a caulking chisel, until you find that every thing about the cylinder is perfectly fleanch; then pour three or four feet deep of water into the hot water pump; stake down the injection and blowing valves, and also those on the air pump, then let the steam into the condenser, which will show the defects or leaks, if there be any.

48. Screw on the steam guage to the steam case near the nozzle, and behind the engine man's place; pour as much mercury into it as will half fill the open leg; put a float on it, broad at bottom, but very slender in the stem; cut the float or index off close to the end of the open tube, and fix a scale to

it, reckoning every half inch the float rises, equal to an augmentation of the elasticity of the steam, corresponding to the supporting a column of mercury an inch high, because the surface has sunk as much in one leg as it has risen in the other. Solder a small copper fosset pipe, to fit the copper communicating tube of the barometer, into the eduction pipe, twelve inches under the fosset of the blowing valve, and on the opposite side of the eduction pipe; place the barometer in the door way to the condenser, on the further side from the plug tree, so that the engine man may see it when at his station; join the copper tube to it, by pouring melted sealing wax into the copper cup at top; fill the short leg of the barometer with mercury, within four or five inches of its top; and put a light float in it, long enough to reach to the top of its frame.

49. Fill the condenser cistern; shut the lower regulators; and (there being no steam in the cylinder, or its communication with the boiler being cut off,) take off the bonnet or cover of the exhaustion regulator; shut that regulator; and work the air pump by means of the brake. If then you find that air enters by the regulator, pour some water on it, and continue pumping until you have raised the barometer, *i. e.* sunk its float to twenty-seven or twenty-eight inches; leave off pumping, and observe if the vacuum continues good, or is a long time in being destroyed. If it loses fast, seek for the leaks which must be somewhere in the eduction pipe, and will make a noise if touched with a wet hand. If the condenser moves by the pumping secure it. After having cured these leaks, you may try the tightness of the cylinder by staking the working beam, so that the piston cannot descend: then take the cover off the cylinder, open the exhaustion regulator, and shut the steam regulator. On beginning to pump you will perceive if the piston be tight; if it is not, it may be beat a little, and some water being thrown upon it, and on the steam regulator, whatever air enters must be by leaks, which must be sought for, and cured, by screwing, or caulking in with oakum.—N. B. A critical tightness in the piston cannot be obtained until the engine has gone a few days, without beating its stuffing too hard, to permit the engine to move easily. When no more leaks can be detected in this way, the steam must be admitted, and the same examination made as before.

50. The piston chain must be so adjusted that the piston shall descend within one inch of the lead ring at the bottom, when the springs are pressed down by the catch pins; and that, when it is at its highest range, its upper edge shall be level with the square opening at top; so that no water may lodge there, but may run down the perpendicular pipe; and the engine should always be made to work full stroke; otherwise it will spoil the cylinder.—A collar of soft rope must be lapt round the piston rod, under the lid, to prevent the piston striking it, if it should rise with a jump; and if the cap of the piston rod does not touch the gland of the stuffing box, when the catch pins have pressed down the springs above, a collar of iron must be fitted on the rod, to make up the deficiency, and to help to save the blow, if the chains should give way and the piston fall. For though it should break the cylinder lid, that is much smaller damage than the bottom of the cylinder would be, as the lid may be clasped or otherwise mended.

51. There ought to be cleets, or strong brackets of wood, firmly bolted to the dry pump rods; and beams should be put across the pit, at proper distances, to receive those cleets, in case of the accident of their breaking.

52. After the engine has been set to work, and has gone a few hours, the holding down screws must be screwed tight, and so from time to time as they become slack; and in like manner all the other screws about the cylinder or nozzles must be screwed up as they slacken; and the joints be caulked and puttied where they require it.

Directions for Working the Engine.

53. It being necessary, (say Messrs. Boulton and Watt,) that the uses of he several regulators be thor oughly nderstood by those who attend to the engine, we shall begin by describing them. In the lower nozzle, or regulator box, are two regulating valves. When the upper one is opened, it admits the steam from the perpendicular steam pipe into the cylinder, below the piston, and thereby permits the piston to ascend; or, in the engine man's phrase, allows the engine "*to go out of the house.*" This regulator we call the "*steam regulator.*" The lower regulator, which is placed in the bottom of the nozzle or regulator box, when open, suffers the steam to pass from the cylinder into the air pump of the condenser; and thereby a vacuum is produced in the cylinder. This valve is called the "*exhaustion regulator.*" There is a third regulating valve, called the "*top regulator,*" placed in the cross pipe at the upper end of the perpendicular steam pipe. This serves to proportion the quantity of steam from the boiler to the load of the engine; so that when the load is less than ten pounds and a half on the inch, the steam in the upper part of the cylinder, which presses upon the piston, may be less dense, or weaker, than the steam in the boiler; and consequently a smaller quantity of it be employed to do the work, than would be required were the engine fully loaded. This regulation may be effected in two ways; either by opening the top regulator fully, at the beginning of the stroke, and shutting it before the piston arrives at the bottom; or by opening it so far as just to give the piston a sufficient velocity, and keeping it open until the end of the stroke.

54. The engine being supposed to be in motion, the operation of these valves will be as follows. When the piston is at the bottom of the cylinder, and the exhaustion regulator is shut, if the steam regulator be opened, the steam will pass through the perpendicular steam pipe, and that regulator, from the upper part of the cylinder above the piston into the lower part of the cylinder, below the piston; and the steam thereby becoming equally strong, or dense, above the piston and below it, will give no resistance to the ascent of the piston, which, therefore, will be pulled up by the superior weight at the pump end of the working beam. When the piston has reached the upper end of the cylinder, the steam regulator must be shut; the exhaustion regulator opened fully; and, at the same instant, the top regulator opened so far as to admit the proper quantity of steam.—the degree of this opening must be determined by experience,—the steam contained below the piston will then rush from the cylinder, through the exhaustion regulator into the vacuum, or empty space in the eduction pipe, where it will meet the jet or stream of injection water, which will instantly condense, or reduce it to water; and thereby exhaust, or empty the cylinder of steam.—The steam in the upper part of the cylinder being no longer balanced by steam below the piston will press upon it by its elasticity, and the piston will begin its motion downwards. As it moves downwards, the steam in the upper part of the cylinder will become less dense than that in the boiler, which will therefore enter the upper part of the cylinder by the opening of the top regulator, and will maintain the steam in that part of the cylinder in a proper degree of density, or strength, to give the necessary velocity to the piston, and to press it to the bottom of the cylinder. But if the engine be underloaded, it will be necessary to shut the top regulator a little before the piston is at the end of its stroke. It has been observed, that the precise time at which the top regulator should be shut must be determined by experience, no certain rule can be given, because it depends upon the degree to which it is opened, and upon the load of the engine at the time; but it must always be shut sooner than the exhaustion regulator, which is kept open to the end of the stroke.—The injection valve should be opened a little before the exhaustion regulator, that the exhaustion pipe and the water, remaining from the last stroke, may be cold when the steam enters; by which means the condensation will be performed more suddenly. The injection should be shut very soon after the piston begins to descend; observing, however, to let it play so long, that the degree of vacuum, shown by the barometer, may be greater in the latter part of the stroke than in the beginning of it. The opening or adjutage. of the injection pipe must be proportioned to the load of the engine; so that the proper quantity of water may enter in about one second of time; and as the load increases, the opening must be enlarged.

55. The eduction pipe serves to convey the injection water, and condensed steam, to the foot of the air pump of the condenser; the injection pipe enters it at its knee, and spouts along the horizontal part of it; and from its side issues the blowing pipe, the use of which is to empty the eduction pipe of air and water when the engine is put into motion, after it has been stopped at any time. At the bottom of the eduction pipe is a hinged valve, or clack, which permits the water and air to pass into the air pump; but prevents it from returning. This valve should be very tight; it is called the valve of the eduction pipe foot.

56. The air pump is the lowermost and widest pump of the condenser. When the steam enters the eduction pipe, it spoils the vacuum for an instant; and then presses upon the water in the lower part of the eduction pipe, and forces a part of it into the air pump. As the piston of the cylinder descends, the bucket of the air pump ascends; carries up along with it the hot water which was above it; and leaves a vacuum under it; into which the remaining injection water enters—first because it stands higher in the eduction pipe than in the air pump; and secondly, because the vacuum, in the eduction pipe, is not quite so complete as in the air pump.—The water, raised by the air pump bucket, passes through the clack of the hot water pump, into the vacuum produced by the rising of the bucket of that pump; which is raised at the same time with the bucket of the air pump; and no part of it will come out at the valves, or the lid, or the cover of the air pump, unless the bucket of the hot water pump is not tight; or unless an overplus quantity of water enters the eduction pipe, or condenser, by leaks; for if there be a sufficiently empty space left by the bucket of the hot water pump, it is evident that the water will rush into it, and fill that space before it can open the valves on the lid; which valves are kept shut by the pressure of the atmosphere, so long as there is any degree of vacuum in the upper part of the air pump, or that part of the hot water pump which communicates with it.—When the air pump bucket descends, it leaves a vacuum behind it, because the water is detained by the hot water pump, and the water in the lower part of the air pump passes through the valves of the bucket, which lifts it up the next stroke as before.—The hot water pump raises the water high enough to let it run into the boiler by the feed pipe, or into a reservoir to be cooled, and so to serve the purpose of injection the second time.

57. The barometer serves to shew the degree, to which the cylinder is ex-

hausted of air and steam. It consists of a longer and a shorter tube of iron, both of one diameter and truly bored, and joined together, at bottom, by a bent iron pipe. It should be fixed up perpendicularly, and should be filled with mercury until it stands eighteen inches deep in the shorter or open leg; a light float of wood, something like a gun-rammer, should be put into the short leg, and cut off even with the top of the scale when the engine is at rest, and the eduction pipe filled with air. The scale is divided into half inches, which correspond to inches on the common barometer, because for every half inch the mercury rises in the long leg, it falls half an inch in the short leg, which, added together, make one inch difference of height. A pipe from the top of the long leg is joined to the eduction pipe, below the blowing valve; for were it fixed higher, steam might come through it and loosen the cement, which connects the pipe and the barometer. When the mercury in the common barometer stands at thirty inches, it should stand at twenty-eight and a half inches in this barometer, providing your engine be in good order; and at proportionate heights at other states of the atmosphere.—The steam guage is a similar instrument, in which the steam presses up a column of mercury, proportioned to its elasticity. When the engine is underloaded, it ought to be wrought with steam able to support one inch of mercury; and when fully loaded, it ought not to exceed two inches; but if the engine be loaded to more than ten pounds and a half on the square inch of the piston, the strength of the steam must be increased accordingly.—It is never advisable to work with a strong steam where it can be avoided, as it increases the leakages of the boiler and joints of the steam case, and answers no good end.

58. A very important article is the proper packing of the piston, directions for which have already been given. (See Section 46.)

59. The buckets of the hot water and air pumps must be packed with a flat rope, wrapt round them edgeways; and the ends of these gaskets must be made fast by being drawn through holes made in the buckets for that purpose; and secured there by wooden pegs, hard drove in. The gaskets should be well smeared with tallow, before the buckets are put in; and they should not fit the pumps too tight; as their sticking is very troublesome, especially at first.—The stuffing boxes of the cylinder and air pump must be packed, by wrapping a soft rope round the rod, and beating it until it nearly fills the stuffing box, remembering to soak it well with tallow, as you go on. Above this rope lay on the wooden collar, and screw the gland down upon it moderately tight.

60. To set the engine to work, raise the steam in the boiler until the index of the steam guage is at three inches on the scale. When the outer cylinder is fully warmed, and the steam issues freely on opening the small valve at the bottom of the syphon, or waste pipe, which discharges the condensed water from the outer bottoms, open all the regulators. The steam will then forcibly blow out the air, or water, contained in the eduction pipe by the blowing valve; but cannot immediately take place of the air in the cylinder itself. To get quit of it, after you have blown the engine a few minutes, shut the steam regulator. The cold water of the condenser cistern will condense some of the steam contained in the eduction pipe, and its place will be supplied by some of the air from the cylinder. Open the steam regulator, and blow out that air, and repeat the operation, until you judge the cylinder to be clear of air. When that is the case, shut all the regulators, and observe if the barometer shows that there is any vacuum in the eduction pipe. When the barometer guage has sunk three inches, open the injection a very little, and shut it again immediately; if this produces any considerable degree of vacuum, open the exhaustion regulator a very little way, and the injection at the same time. If the engine does not commence its motion, it must be blown again, and the same operation repeated, until it does move. If the engine be very lightly loaded, or if there be no water in the pumps, you must be very nimble, and quickly shut the exhaustion and top regulators, so soon as it begins to move; otherwise, it will make its stroke with great violence, and perhaps do some mischief. To prevent which, open the top and exhaustion regulators only a little way, and put pegs in the plug-tree, so that they may be sure to shut these regulators long before the piston gets to the bottom.—If there is much unbalanced weight on the pump end, you must also take care to put a peg in the ladder which guards the steam regulator lever, so as to allow that regulator only to open a little way, and so to lessen the passage for the steam, when it enters to fill the cylinder; otherwise the rods, &c, at the pump end may descend too fast and be prejudicial. If you find, after a few strokes, that the engine goes out too slow, the steam regulator may be opened wider. In order to regulate the opening of the exhaustion regulator, you should have pieces of board of various thicknesses to put under the weight which pulls it open, by means of which it may be made to open more or less at pleasure, and the top regulator may be managed in the same manner.

61. Should the engine work with too great violence on account of its being underloaded, you may correct it by giving the top regulator a lesser opening, and shutting it at such part of the stroke as will give the piston sufficient force to come to the bottom. Whenever the top regulator is used, the exhaustion regulator should be thrown fully open at every stroke, in order to give a free exit to the steam, on which a great part of the good effects of the top regulator depends.—The engine should always be made to work full stroke,—that is, until the catch-pins come within half an inch of the springs on each end, which is easily managed by an attention to the pegs. Care must be taken that the piston rise high enough in the cylinder when the engine is at rest, to spill over into the perpendicular steam pipe any water which may be condensed above it; for if any water remain there, or in any other part of the cylinder while it is working, it will very much increase the consumption of steam. When the engine is to be stopped, shut the injection and secure it; put a peg in the plug-tree to prevent the exhaustion regulator from opening, and take out the peg on the other side, so as to allow the steam regulator to open, and to remain open; otherwise you may have a partial vacuum in the cylinder, and it may be filled with water from the injection or leakages, which will be a troublesome accident. The top regulator must also be open while the engine is at rest.—When an engine is in tolerably good order, it will bear to stand ten minutes, and go to work again without blowing afresh, and though it has stood two or three hours, if there has been any steam issuing from the boiler, and no air has been admitted into the cylinder, it will generally go off, with once blowing for about a minute.

62. If you find, after following the above directions, that the engine does not go to work, shut the exhaustion regulator, and give some injection; if it then makes no vacuum, it is likely there are air leaks about the eduction pipe; if it does make a vacuum, which remains but a short time, it may be owing either to air or water leaks. These may be distinguished, by blowing as before, and shutting the lower regulator for about a minute, without giving any injection. If upon opening it again, it throws out a good deal of water at the blowing pipe, before it blows steam, it is certain it either has some leak in the condenser under water, or that the injection or blowing valve does not shut close; if they are found to shut close, every joint should be examined, and also the valve at the foot of the eduction pipe.—If after blowing as before, you find that immediately on opening the exhaustion regulator, a quantity of air is thrown out at the blowing valve, the leak is in the eduction pipe, somewhere between the surface of the water in the cistern and the nozzle. The particular place of these leaks may be found by emptying the cistern of water, putting three or four feet deep of water into the hot water pump, and staking down the blowing and injection valves with those on the air pump lid; then if steam be admitted into the duction pipe, it will come out at the leaks and point them out. If not found in this way, apply the brake to the air pump, taking care first to put some water on its bucket and then by working that pump hard, you will probably, on an attentive examination, observe where air goes in, which may be known more distinctly by wetting the place suspected.—If upon shutting the lower regulator, and making a vacuum in the exhaustion pipe by pumping, or by injection, you find that vacuum continues good for a considerable time, then the fault does not lie in the eduction pipe, but in the nozzle or joint of the cylinder bottom, where it must be sought for.—In these examinations, by pumping, it is proper to take off the bonnet, or cover of the exhaustion regulator, and to examine if air enters at that regulator; if it does, and only in small quantity, throw some water on the regulator while you are examining the eduction pipe. When the leak is suspected to be in the bottom joint of the cylinder or in the lower nozzle, you must throw some water on the steam regulator and also on the piston, then by pumping and strict examination, you will find where the air enters. When you are examining the tightness of the piston, by pumping, you must stake the beam, so that the piston may not descend.

63. If in course of working, you do not find the vacuum keep good, and the engine goes sluggishly, or stops and requires to be blowed through frequently, you must examine whether an uncommon quantity of air or water issues at the hot water pump, or if any comes out at the valves on the air pump lid; if the quantity of air is great, the engine has some air leak, and if the quantity of water be great, and is rather cooler than usual, it proceeds from a water leak in the condenser; if the quantityof water be great, and at the same time very hot, it proceeds from a bad piston, or from the steam regulator not shutting close.—The engine will also work badly, if the air pump or water pump buckets, or clacks, slip the water; that is let it pass by them; you will know if this be the case, with the water pump bucket, by observing whether the water follows down after it at the return of the stroke, and leaves a part of the pump empty; if it does not, either the bucket slips the water, or the engine receives water in some way which it ought not.

64. Attention ought to be given to feeding the boiler in a regular manner, that it may not be spoiled, nor steam be wanted. When there is too much water in the boiler, the engine will not work regularly; and if there is too little, the sides of the boiler will be burnt by the flame in the flues. If by accident it should at any time run a little too low, the feed should be augmented, so as to fill it gradually; for if you run in too much at once, you will check the steam and stop the engine; but if it be run very low, stop the engine, open the puppet clack, and fill the boiler from the pool, or reservoir, if you have one, otherwise fill it by working the air pump; having first staked down the valve on its cover, and opened the injection valve. In work-

ing the engine, the steam out to be strong enough to make the index of the steam guage stand half an inch high at least, otherwise air will enter at the joints of the boiler, &c., and spoil the vacuum, causing a good deal of trouble to get quit of it again. Therefore if you perceive the steam guage to be lower stop the engine until it rises again. By a little attention, you will find the proper opening of the feed cock for any rate of working.

65. Let all the coals employed to feed the fire be thoroughly watered just before they are thrown on, as that will prevent their being swept into the flues by the draught of the chimney.—The fire should be kept of an equal thickness, and free from open places or holes, which are extremely prejudicial, and should be filled up as soon as they appear. If the fire grows foul, and wants air by clinkers collecting in the bars, they must be got out with a poker; but the fire should be as little disturbed in that operation as possible, and the greatest care taken not to make any coals, or coke, fall through, which are not thoroughly consumed. It is very common for a fourth of the whole coals to be wasted in this manner, by mere carelessness. When the fire is newly made, the damper should be raised a little, so as to let off the smoke freely, but should be let down to its proper place so soon as the smoke is gone off. The air door, in the chimney, should be always open more or less; it prevents the flame being sucked up the chimney, and very considerably increases the effect of the coals. Once a month, the boiler and flues ought to be cleaned; or oftener, if the water be very subject to encrust the boiler. Every morning the ashes ought to be taken out; the engine house swept clean; and a view taken of every part of the engine, to see that nothing be working out of its place, or want oiling. Particular attention ought to be paid to the bolts and cutters of the great chains and piston rod, so that none of them get loose.

66. Once every week let the top of the cylinder be taken off, and also the springs and leads of the piston; let the packing be beat down moderately, with the driver and mallet, and fresh oakum, or a gasket added when necessary. For every foot the cylinder is in diameter, pour two pounds of melted tallow on the packing, before you put in the leads, and for two or three hours after you have added the tallow keep the piston from rising quite to the top of the cylinder, by laying two pieces of wood three inches thick on the outside springs, that the tallow may not be spilt off before it has time to soak into the packing. At the same time you pack the piston you should examine the state of the condenser, and rectify anything you can find amiss; and while these things are doing, the pitwork should not be neglected, that one stoppage may serve for all.

67. The regulator valves should be examined from time to time, and a little fresh oakum should be lapped about the necks of their spindles, to keep them air and steam tight. The stuffing boxes also should be minded, and no steam suffered to escape anywhere; its escaping is a mark of slovenliness, and a material injury both in extra consumption of coals and in the destruction of the iron and wood work.—An engine, when in good order, ought to be able to go so slow as one stroke in ten minutes, and so fast as ten strokes in one minute; and if it does not fulfil these conditions, something is amiss that can be remedied. The hot water should issue of the heat of 96 degrees of Fahrenheit's thermometer, that is, *blood warm*, when the engine is in excellent order; and should never exceed the heat of 110 degrees, unless when the injection, or cold water, is hotter than 70 degrees, and in that case the vacuum will not be good.

68. At the end of the horizontal steam pipe, next the boiler, is fixed the *steam regulator*, the use of which is to shut off the steam while anything is doing about the top regulator, or other parts connected with it. It may also be used to stop the communication with one boiler while another is in use.

69. At setting an engine to work the first time it frequently happens, that there is a difficulty in procuring a sufficient quantity of cold water for condensation. In such case, a great deal of trouble may be saved, by exhausting the air from the cylinder, by working the air pump by that brake, having first opened the exhaustion regulator and shut the steam one. And, in any case, when the engine does not go readily to work by blowing, and the quantity of injection water is limited, it is best to set on by pumping, and even to assist the engine for a stroke or two by the same means, if it be fully loaded. As the bucket of the air pump ascends, you must hook the chain of the pump brake to a lower part of the pump chain, by which means you can keep pumping until the engine has made its full stroke.

70. *To make Putty for making or repairing the joints.*—Take whiting, or chalk, finely powdered, dry it on an iron plate, or in a ladle, until all the moisture is exhaled; then mix it with raw linseed oil, and beat, or grind it well; adding more oil or whiting until it is of the consistence of thick paint and perfectly free from lumps and inequalities.—For some purposes, where the putty is wanted to dry, and to be very sticky, use painter's drying oil; which is made by boiling the oil with a small quantity of litharge, or red lead.—Where the putty is wanted to continue always soft, mix about two ounces of butter, or common salad oil, with each pint, or pound, of the linseed oil. This soft putty is principally useful in the caulked joints of the eduction pipe, above water. N. B. White lead will not answer in lieu of the whiting.

No wet clothes should be suffered to be laid on the cylinder, boiler, or steam pipe; and every part, containing steam, should be guarded, as much as possible, from the influence of cold air and water.

The proper grease for the piston and cylinder stuffing box is melted tallow; and for the chains, gudgeons, &c., common Spanish olive oil, called salad oil, which, for some uses, may be thickened by dissolving tallow or butter in it. Linseed oil should never be used as grease, as it dries and creates more friction than would have been without it.—Hogs' lard, or train oil, if applied any where about the cylinder, or where it is hot will thicken like linseed oil. When the oil, or grease, about the great chains, or any of the working parts, grows clotted, or very thick, it should be scraped off before any new grease is added.

Additional Directions.

The Numbers denote the Paragraphs of the foregoing Directions to which they refer.

6. As the whole weight of the great beam, and also of the power to be exerted, is supported by the plummer blocks, care must be taken that they stand firmly on the spring beams, and that the latter be well supported from the lever wall. To do which, wherever the building is made of bricks, or of indifferent stone work, form the bottom of the opening, under the beam, of three planks of oak, or of the best deal six or eight inches thick and twelve or fourteen inches wide. These planks must reach at least four feet into the walls at each side of the opening, one of them must be laid in the line of the outside of the wall, another in the line of the inside of the wall, and the third, which should be the strongest, in the middle, right under the gudgeon. Upon these planks, at each side of the opening, place three others of the same dimensions upright; let their upper ends reach to the upper side of the spring beams, and let the spring beams be let into the uprights, so that only two inches of their thickness shall project beyond the face of the spring beams, and that the remaining four inches of the thickness of the uprights shall form a shoulder under the spring beams, which will support them firmly, under the sides which are next the beam, where it is most necessary; for were the insides of the spring beams, or plummer blocks, to give way to the pressure, and the outsides to be supported, the gudgeon would rest on its points, and by the leverage it would gain thereby it might be broken. The lower ends of these six uprights may have small tenants to fit mortices in their sills, which will prevent their slipping.

9. The holes through the great beam, for the screw bolts of the martingale tails, should be quite easy for them, otherwise the screws will be broken, if the logs of the beam come to slide any, upon one another. The keys, to prevent the logs from sliding upon one another, are best made of pieces of very dry and hard oak, two inches thick, six or seven inches broad at one end, and four or five inches broad at the other end; their length being suited to thickness of the beam.

16. In large engines, where the condenser pumps are consequently heavy, it is found proper to make the bottom of the condenser cistern of planks five inches thick.

18. An improvement has lately been made in the covering boiler tops. The setting being built up to nine inches above the flues as usual, a course of horse or cow dung, three inches thick, and well beaten is applied to the boiler top; on the outside of that is placed some good lime mortar, about an inch in thickness, to which is applied a course of bricks, flatenwise, with their ends upwards; on the outside of that another course of bricks (also laid in good mortar) in the same position, but so as to break joint with the first course; in which manner the covering is carried on until the whole top is covered, taking care to leave an opening for the man holes, Every flanch may be thus covered, and when well done it effectually makes the top steam tight, and also defends it from cold and rain, so that a boiler house is not necessary. The mortar employed must be such as stands water.

19. The valve put into the boiler feed pipe, to prevent boiling over, is best fixed in its upper end, so that it may be taken out when any material is wanted to be introduced into the boiler by the steam pipe. The proper valve for this purpose is of the kind used for the injection and blowing pipe, which must be put into the feed pipe, in an inverted position.

23. Instead of using painter's drying oil to make the joints with, take good raw, or unboiled linseed oil, put it in an iron pot, place it over a gentle fire, out of doors, but protected from rain, let it be watched as it heats, as it is very liable to boil over; when it boils, make the fire more moderate, but continue to heat the oil, until upon dropping some of it upon a cold stone, or piece of iron, you find it is, when cold, of the thickness of thick tar or treacle. The pasteboards for the joints are to be soaked in this oil warm, or painted over with it, and laid in a hot place to suck it up; and it is also used to make the putty with.

27. Instead of putting a gland across the bottom of the piston rod, to prevent it from dropping, it is better to drill two opposite holes through the cone of the piston, and one inch each into the cone of the rod; two iron pins put into these holes will effectually keep the rod in its place. There should be a groove about a quarter of an inch deep, and half an inch wide, cut round the

base of the cone, on the rod below these pins; which groove being lapped round with rope yarn and putty, will serve to prevent steam from getting through the piston, by the sides of the pins. To make it move easy to get these pins out, they should have flat tails, bent upwards, so as to be close against the outside of the cone of the piston, when the pins are in their places, and to screw them there, mortices must be cut in the wood which fills the hollows of the piston, to which must be fitted wooden wedges, made very tapering, by driving which down, the tails of the pins will be pressed against the cone, and the tapering form of the wedges will make it easy to dislodge them when the pins are wanted to be taken out. It is necessary to observe, that the pins should be fitted tight into the holes in the piston cone, and that the holes into which their points enter in the cone of the rod, should be made easy for them, otherwise they might prevent the one cone from being pulled far enough into the other.

29. The oakum, with which the joints are caulked, should be well smeared with the strong or thick boiled oil, mentioned in these additional directions. If the under side of the pipe of the inner bottom does not fit close to the lower edge of the opening made for it, in the outer bottom; that is to say, if the space left there for pasteboard, or caulking, be wider than one quarter of an inch, a piece of hammered iron, an inch and a half broad, must be forged of such thickness as to fill up the space, so as to make it tight by the help of a thickness of pasteboard above it, and another below it. Lead ought not to be used in these cases, as its expansion and contraction by heat and cold, are too great. Instead of putting a prop from the nozzle to the ground, it is found better to put a balance beam sideways under the floors, with a short upright, having a flat end to take a broad bearing under the nozzle. The weight of the balance should not support more than two-thirds of the weight of the nozzle.

31. The lower ring on the cylinder, to which the steam case is fixed, is sometimes made with a projecting flanch, on which the steam case rests, and the joint is then made tight, by caulking between the flanch of the steam case, and that on the ring.

32. To avoid the inconvenience of the perpendicular steam pipes occasionally proving too short, they are now made without any flanch at the lower end, and a socket is cast upon the nozzle to fit them, in which they are to be made tight by caulking.

The weight of the upper nozzle must be supported by a prop from the cross piece between the cylinder beams. And if the boiler steam pipe be very long, and consequently heavy, part of its weight should be supported by a balance beam near the wall of the house.

35. The best way of making the standing joints of the condenser is by means of rings of lead a quarter of an inch thick; as broad as the flanches; and pierced for all the screws. They may either have putty, made with the thick oil put on each side, or, for greater security, they may be covered with Russia duck and putty. In other respects proceed as directed in 35. The soft rope does not answer well.

38. Where the joints of the eduction pipe are made with flanches, they must be fixed together by strong flat rings of iron, put on each side of them as directed for that at the nozzle; and the joints must be made tight by pasteboard and putty; for, on account of its expansion, lead will not answer where it is subjected to be alternately hot and cold.

39. The hot water pump must be fixed down by two long bars of iron, with screwed ends, which must go through the bottom of the cistern and extend upwards through two of the holes of the lower flanch of the hot water pump.

42. The guide posts may be fixed upon a sill passing from one to the other; and the best way of fixing the weight of the exhaustion regulator, is to make it in the form of a saddle, moveable at discretion, upon a beam centred at the further guide post, so that the beam may fall flat upon the sill, when at lowest; and the saddle will produce a greater or less weight according as it is placed farther from the centre or nearer to it.—The door to the condenser may be converted into a window, and a seat for the engine man, as soon as the condenser and eduction pipe are fixed.

45. Some people use a plaited rope to make the joint of the cylinder lid, which is a bad practice; for though a plaited rope may make a joint apparently steam tight, yet it has been found by experience, that such joints are not air tight; but when, by working of the top regulator, a partial vacuum is produced in the upper part of the cylinder they permit some air to enter imperceptibly, and without noise, which passes to the condenser; and to persons who are not aware of this circumstance, may be thought to enter at some air leak. *We, therefore, recommend that this joint be always made with pasteboard and putty; and that a strict attention be paid to the tightness of the stuffing box, wherever the top regulator is used.*

46. The proper quantity of tallow to grease the piston with is two pounds per week, for every foot the cylinder is in diameter. But where opportunity can be obtained of adding it more frequently, the whole quantity ought not to be added at once, but divided according to your opportunities. When the top regulator is used, if the tallow is put into a flat funnel, which ought to be made to surround the piston rod, above the cylinder stuffing box, it will be gradually sucked in without the trouble of taking off the lid.

HEALTH OF TOWNS.

First Report of the Commissioners for Inquiring into the State of Large Towns and Populous Districts.

To the Queen's most excellent Majesty.

We, the undersigned commissioners appointed by your Majesty to inquire into the present state of large towns and populous districts in England and Wales, with reference to the matters hereunder specified:—

"The causes of disease among the inhabitants.

"The best means of promoting and securing the public health, under the operation of the laws and regulations now in force, and the usages at present prevailing with regard to—

"The drainage of lands,

"The erection, drainage, and ventilation of buildings;

"And the supply of water in such towns and districts, whether for purposes of health, or for the better protection of property from fire, and—

"How far the public health and the condition of the poorer classes of the people of this realm, and the salubrity and safety of their dwellings may be promoted by the amendment of such laws, regulations, and usages;" and to report our proceedings from time to time; Humbly certify, in manner following, our proceedings in the execution of your Majesty's commission.

We desire, in the first place, to express the sense which we entertain of the importance of the subject committed to us, not only as involving general benefit to the public, but especially a gradual improvement in the moral and physical condition of large numbers of your Majesty's poorer subjects. We have entered upon these duties with an earnest hope of being able in due time to fulfil the benevolent intention of your Majesty's commission.

We confine this our first report to a brief statement of our proceedings, and to a notice of such portions of the evidence, reports, and other documentary information which will best display the course of our inquiry, and the advance we have made to the attainmant of the object of your Majesty's commission. Several investigations are yet in progress, the results of which it is necessary for us to receive and to consider in connection with the facts already in our possession, before we can form a matured opinion upon the nature of the measures, which we may hereafter consider it to be our duty to recommend to your Majesty.

Having obtained the information, respecting the operation of the laws now in force, which had been collected under previous inquiries, and had been laid before parliament, or could be acquired from other sources, we proceeded to examine before the board such persons as were prepared from long experience or observation to give their testimony on the general subject, or upon specific topics of inquiry. The evidence referred to is appended to this report. Among the principal witnesses upon the general subject are physicians, whose attention had been specially directed on former occasions to the examination of the causes of disease among the poorer classes, and to the means of prevention, which come within the provisions of the existing law, or for the attainment of which further legislation is required.

We would refer, in the first instance, to the evidence of Dr. N. Arnott and Dr. Southwood Smith, who have stated to us the results of their continued and latest observations; and also to the evidence of Dr. Guy, Dr. Aldis, Dr. Rigby, and Mr. Toynbee, who have had extensive practice in hospitals and dispensaries. This evidence, with that of Mr. Ward, displays their opinion and experience, that defective drainage, neglect of house and street cleansing, ventilation, and imperfect supplies of water, contribute to produce atmospheric impurities, which affect the general health and physical condition of the population, generating acute, chronic, and ultimately organic disease, especially scrofulous affections and consumption, in addition to the fevers and other forms of disease, to which public attention has hitherto been chiefly directed by previous sanatory inquiries, and which are more distinctly noticed in the returns annually laid before parliament under the provisions of the Registration Act.

Our first investigations relating to drainage were directed to the condition of the metropolitan districts; we examined the chairmen and chief officers of the several Commissions of Sewers respecting their usages and regulations; and architects and builders as to the difficulties, which have hitherto interfered with the adoption of a better system of house drainage.

We then extended our investigations, and for that purpose we prepared a letter enclosing a series of questions, framed by the board, which, with a letter from your Majesty's Principal Secretary of State for the H me Department, we transmitted to the municipal and other public officers in fifty towns where the rate of mortality appeared by the returns of the registers of deaths, with a few exceptions, to be the highest. These include the largest manufacturing towns and the principal ports after London, and contain a population of more than three millions of persons.

Each of these towns was afterwards visited by one of the commissioners, who examined on the spot, the general condition of the town, and of the most crowded and the most unhealthy districts, making personal inquiries of the inhabitants, and hearing such statements as were made by them, or respecting them, by medical and other officers. Some of these investigations, both local and on specific subjects, are yet in progress.

We have great satisfaction in representing to your Majesty that in these local inquiries a lively and cordial interest was taken by the inhabitants; the Commissioners were everywhere well received, and obtained ready assistance from persons of every class and denomination.

In addition to these our investigations, we promoted renewed inquiries by others into the sanatory state of several towns and populous districts, more especially of those places where the growth of the population has been attended by a high rate of mortality. Some of these renewed inquiries have been of a closer and of a more comprehensive nature than those previously made, and have been conducted by persons of special qualifications from long attention to the subject, and acquaintance with the habits and condition of the population, thus possessing the best means of insuring approximation to accuracy.

As an example, of a town chiefly commercial, the report relating to Liverpool, by Dr. Duncan, physician to the Liverpool Dispensary, shows the great extent of mortality, of which the local authorities and the principal inhabitants appear to have been, up to a recent period, unaware, but which has been fully established by the returns in the registers of deaths. Competent witnesses concur in ascribing such an extent of mortality to the general want of drainage and cleansing, ill-conditioned dwellings, defective ventilation, scanty supplies of water, and to other causes capable of remedy.

As an instance of a population almost entirely engaged in manufactures, whose increasing numbers have also been accompanied by a progressive diminution of mean age at death, as appears from an examination of the parochial and other registers, we submit the Report upon the Sanatory State of Preston, by the Rev. Mr. Clay, and a committee of the inhabitants of that town.

The report of Mr. Hawksley, on the Condition of the Labouring Population of the Town of Nottingham, affords an example, of widely different rates of mortality, prevalent in different districts, and among different classes in the same town.

The returns obtained from the Ecclesall Bierlow Registration District of the mortality, as well as the rate of the births, which obtains amongst the artisans chiefly engaged in the manufacture of cutlery at Sheffield, exhibits the different rates of mortality prevalent among artisans of similar occupations, when resident in the closer parts of the towns, or in the more open suburbs.

To afford further information with respect to the extensive influence of one particular cause, namely, defective drainage, on another class of artizans engaged in one general occupation, we append the returns, which exhibit the results of a local inquiry, of the different rates of mortality prevalent, in the well and ill-drained streets, almost exclusively occupied by the manufacturers of stockings, at Leicester. The report of Mr. Holland, surgeon, of Chorlton-upon-Medlock, presents an instance of the decrease in the rates of mortality that may be effected by the proper drainage of streets.

A further advance made in the investigation of the causes of mortality, is displayed in the report of Dr. Laycock, tracing back, for upwards of two centuries, the operation of like physical causes, in the production of different forms of epidemic disease prevalent under similar conditions, always in the greatest intensity in the same quarters in the ancient metropolitan city and county town of York.—These reports present examples of causes of mortality capable of removal, and which were found to prevail in a greater or less degree in each of the towns and populous districts examined by the members of this commission.

THE DRAINAGE.

On an examination of the state of the existing law respecting drainage, it appears that the Statute of Sewers, 23 Henry VIII. c. 5, under the provisions of which the principal commissions of sewers for the metropolis are issued, chiefly contemplates the drainage of surface waters. This statute, with other general laws applicable to the drainage of parts of the metropolis, has given rise to a difference of opinion in regard to the powers conferred by them for the extension of new sewers. By some commissions it is considered that, even for the above limited purpose, the authority is restricted to the repair or diversion of drains and sewers already in existence.

The provisions of subsequent local Acts, even of a late date, which give the power of forming new sewers, both in the metropolis and other towns, still contemplate chiefly the construction of works for the drainage of surface waters. The evidence shows that of the works hitherto executed the greater part have been constructed only on demands for the removal of pressing inconveniences, and for the drainage of particular places.

The witnesses state that for the most part the usages at present prevailing, and the bye-laws in force under the authority of these statutes, have been (until two or three of the commissions in the metropolis adapted their sewerage to the house-drainage), framed with a view to the maintenance of the drainage of surface water only, and without reference to that system which is now admitted by all the medical witnesses to be of the greatest importance to the public health, to the condition of the poorer classes, and the salubrity of their dwellings, namely, house-drainage and sewerage, and the constant removal of all decomposing vegetable or animal refuse, much of which might be effected by means of the proper application of water.

In some of the larger and most crowded towns, all entrance into the sewers by house-drains, or drains from water-closets or cess-pools, is prohibited under a penalty. In other places, including a part of the metropolis, the entrance of house-drains is commonly deemed the concession of a privilege, subjected to regulations and separate proceedings, with attendant expenses, tending to restrict the use of the sewers for these most important purposes, or to confine the advantage to the wealthy.

In the local Acts we have examined, and in the bye-laws and usages in force under their authority, the use of the main drains is restricted under penalties from that which, if they were properly constructed and sufficiently supplied with water, it is stated, might be one of their most important services—namely, the rapid, efficient, and economical cleansing of a town of surface refuse, mud, and filth.

These local Acts are found to be incomplete in various respects; they do not contemplate, nor do they contain, any provision for a previous general survey of the whole extent of the area proper to be included for a perfect system of drainage, which engineers examined on the subject state, should be comprehended under the same authority, in order to carry out measures at once efficient and economical; neither do they embrace the consideration of the separate works which should be comprised within such area; and they do not provide securities for the proper qualifications of the paid officers, to construct and superintend the maintenance of such works economically as well as efficiently.

Several of the local Improvement Acts confer no jurisdiction beyond the public highways, and give the authorities no powers to drain or cleanse the courts, alleys, and closes inhabited by the poorer classes. In several important towns which possess no separate legislative provisions, it appears that the existing drainage, commonly most defective, has been carried out under the powers given by the general Highway Act. In many towns the powers given are neglected, and in most of them imperfectly exercised.

It appears from the unanimous statement of the visiting commissioners, in addition to an examination of the replies of the 50 towns on the subjects of drainage and cleansing, that in scarcely one place can the drainage or sewerage be pronounced to be complete and good, while in seven it is indifferent, and in 42 decidedly bad as regards the districts inhabited by the poorer classes. The investigations within the several towns of the arrangements for house as connected with street cleansing, present nearly the same results.

It appears that the local statements and opinions on what is deemed to be good, can only be received with reference to the imperfect standards known in those places. In the answers it is often stated that the drainage of a town is good, where it has been found that only the principal streets have main drains or sewers, and where the houses in those streets are but imperfectly provided with house or branch drains; while the most crowded portions of the town, those most densely inhabited by the poorer classes, are utterly neglected, and have no drainage, the refuse being allowed to accumulate and decompose in open channels and pools, or to run into open and stagnant ditches in the immediate vicinity of the houses.

The legislative measures more recently proposed for the sanatory improvement of towns have been directed chiefly to the extension of sewers into new districts. Competent witnesses have stated that these measures being unaccompanied by any securities for efficiency and economy of construction, would only lead to the extension of works under the present system, in many particulars defective, and entailing unnecessary expense.

The measures proposed for the formation of house-drains have been on a scale and principle of construction, which the evidence brought before us shows to be frequently erroneous; they have hitherto included no principle or provision for the distribution over a series of years of the rates for defraying the expense, which, if levied by one collection, would, as shown in evidence, often entirely absorb the immediate rents or profits of owners, and of the holders of short interests, who might derive but little benefit from the permanent works.

Evidence has been produced before us, demonstrating that drains, when in other respects properly constructed, would confer little comparative benefit, if no provision be made for the introduction of supplies of water sufficient to cleanse them. Instances are adduced where such drains have only extended existing evils.

In districts in which both house and main drains exist, or are in course of extension, on an imperfect system, we have received strong evidence, showing that as these sewers and drains are so formed as to allow decomposing refuse to accumulate, and to permit the escape of emanations into the streets or houses, the inhabitants do not derive a benefit in proportion to the expense incurred.

In the examination of the chairman of the Westminster division of sewers, will be found recited some of the medical testimony and complaints as to the effect of the emanations from the sewers which pass through the Strand, and other portions of that division of the metropolis. Mr. Dyce Guthrie, surgeon, who has paid great attention to the subject of house-drainage, and who has carefully examined the works of extensive districts, explains the action of any partial system, and suggests, in common with other witnesses—engineers, architects, builders, and others, the necessity of including the proper application of supplies of water, the private house-drainage, the subordinate as well as the main drains under one system of scientific construction and management. Dr. Rigby, physician to the General Lying-in Hospital, in York-road, adduces the example of an obstruction in a drain to show the evil effects that will ensue, unless the connection of the internal works for a complete house-drainage, and the works of external main drainage, be made necessary and component parts of an efficient measure.

The medical witnesses have brought before us facts in support of their strongly urged and unanimous opinion, that no population can be healthy which live amid cess-pools, or upon a soil permeated by decomposing animal or vegetable refuse, giving off impurities to the air in their houses and in the streets. They state the necessity of preventing all accumulations of stagnant refuse in or near houses, and of substituting a system of house-drainage and cleansing, aided by the introduction of better supplies of water into the houses. They have brought forward instances where the main drains or sewers were tolerably well formed, and subordinate or house-drains attached, but where from the want of properly directed supplies of water both house-drains and sewers only acted as extended cess-pools.

In consequence of these facts, and others brought before us, connecting personal and household uncleanliness, a low state of health, and extensive disease, with the deficiency and impurity of the supplies of water in the districts inhabited by the poorer classes, we directed our special inquiries to those existing arrangements, to which these defects were attributed.

The Supply of Water.

We find that the laws in force, and the usages at present prevailing with regard to the supply of water to the great majority of towns and districts investigated, provide only for carrying the mains through the principal streets. Upon an examination of the measures generally adopted and in force under the provisions of these laws, and the plans proposed to the legislature for their improvement, it appears that they all stop short of a most important point, namely, measures for carrying supplies under an economical and properly regulated system, into the habitations of the poorer consumers. In a large proportion of the poorer districts the inhabitants have only out-door supplies by means of stand-pipes or common tanks or wells. In many instances they are obliged to fetch water from considerable distances from their dwellings, at much inconvenience, delay, labour, and expense; in many towns they are dependent for supplies either on collections of rainwater, or on water taken from adjacent streams, or pumped from springs, frequently liable to be polluted.

Upon the examination of the statements and answers from the towns to which our inquiries have been directed, it appears that only in six instances could the arrangements and the supplies be deemed in any comprehensive sense good; while in thirteen they appear to be indifferent, and in thirty-one so deficient as to be pronounced bad, and, so far as yet examined, frequently inferior in purity.

The expense and various inconveniences entailed by the existing modes of supply, by common stand-pipes or tanks, and the frequent and increasing pollution of the springs supplying the wells in some densely peopled districts, are stated in the evidence of Mr. Quick, engineer, who has the management of the works of the Southwark Water Company.

The same witness describes a district in which, until a properly devised system of house-drainage be adopted, additional supplies of water, carried into houses would frequently only increase the damp of the house, and the causes of disease, as well as of the dilapidations of the premises. In the evidence of Mr. Toynbee, Mr. Liddle, Mr. Quick, and Dr. Aldis, facts are stated showing the impurities and deterioration in water comparatively pure at its source, caused by the common mode of intermittent supply, which renders necessary the use of butts or tanks, especially in the manufacturing districts, and in towns and densely populated neighbourhoods where there is much smoke, and other impurities.

The general facts disclosed in the course of our inquiry, led us to seek out and carefully examine all tried and successful measures of improvement that we could find in use.

The important advantages afforded by a constant supply of pure water kept on night and day, and superseding the necessity for the use and expense of water-butts and tanks, are stated in the evidence of Mr. Hawksley, engineer to the Trent Water Works in the town of Nottingham, founded on an experience during twelve years, of an improved mode of supply introduced by him into that town. The evidence of Mr. Anderton, manager of the Preston Water Works, gives the experience of a similar mode of supply during ten years in that town; and the evidence of Mr. Thom, engineer of the Shaws Water Works at Greenock, supports these views. From the cities of Philadelphia and New York, we have received information of much interest and importance in answer to the inquiries addressed by us, showing the successful operation of a system of a constant and ample supply of water adopted in those cities.

The evidence of Mr. Mylne, the experienced engineer of the New River Company, shows the improvements in principle and detail which he has proposed for new districts. Mr. Ashton of Hyde, and Mr. Smith of Preston, owners of tenements occupied by the labouring classes, state their experience of the advantages in household and personal cleanliness, in health and direct saving of money, derived from the improvements effected by the extension of the supplies of water into the houses of their tenants.

Statements are made in the evidence upon this particular branch of our inquiry recommending the improved system of a constant supply of water at high pressure, as the most efficient means that have been yet introduced for the arrangement of supplies of water for the extinction of fires. The very important information collected on this head is contained in the answers (which also show the reduction that has been effected in the rates of insurance) from the cities of Philadelphia and New York,—in Mr. Hawksley's statement of experience at Nottingham, in that of Mr. Anderton, at Preston, —and in that of Mr. Quick, in relation to the arrangements made for the protection of valuable warehouse property situated in the vicinity of those mains of the Southwark Water Company which are always kept charged at high pressure. Mr. Wicksteed states that he has recommended the adoption of similar arrangements for parts of the city of Cork.

Pecuniary Expences for Sewerage, Water, &c.

The witnesses have uniformly stated that the great obstacle to the extensive voluntary adoption of improvements and works of admitted necessity, such as tenants' communication pipes for supplies of water, or new drains for the drainage of houses, is the great expense of immediate outlay, which has been usually charged upon he owners or upon the occupiers, who are called upon to pay at once for permanent works (frequently imperfect and unnecessarily expensive), in which they have a very limited interest.

The cost of maintaining and extending such works, in many cases for distant districts, and the irregular manner in which the collections are made, often levied at uncertain intervals, are represented to have given rise to further objections.

The character of the evidence we have received of the oppressive effect of the immediate charges, and the obstructions they create to the improvement of the lower class of tenements, and the benefits anticipated from the adoption of an improved mode of defraying the expense, will be seen in the evidence of Mr. Jeremiah Little and Mr. Bratt, builders and owners of houses in the metropolis occupied by the labouring classes; in the evidence of Mr. Biers, a builder, and Mr. W. Hickson, an owner of tenements of a higher description, also in the metropolis, of Mr. Corbett, Mr. Wroe, and Mr. Hopkins, of Manchester, and Mr. Kaye, of Huddersfield.

We have inquired carefully as to the practicability of reducing the expenses of works for house and main drainage, and for carrying supplies of pure water into all houses, so as to bring them within the pecuniary means of the poorest class of inhabitants.

Mr. Anderton, manager of the Preston Water-works, shows that the cost of new supplies may be reduced to one-sixth of the former expense, if the use of water-butts be dispensed with in new districts, by the adoption of the principle of a constant instead of the present intermittent supply, and if the tenants' communication-pipes be comprehended in one contract for construction and maintenance. Mr. Quick, engineer of the Southwark Water Company, states in his evidence founded on data from experience in the metropolis, that the expense for the immediate outlay might be reduced to one-fourth of the existing charge. The evidence of Mr. Hawksley exhibits the nature of the data for his most important conclusion, that the result, accomplished in the town of Nottingham, is of possible attainment in many other extensive town districts in this country, and that an abundant supply of pure water may be carried into each of the lowest class of tenements, at a charge (giving a fair remuneration for the capital Invested) which might not exceed 5*s.* a year, or about one penny weekly for each tenement. The same witness states, the small additional cost at which the water may be filtered, when requisite, and describes the precautions necessary to insure its purity.

The same witnesses state, with reference to house-drainage, that a saving may be effected of from one-half to one-third of the existing charges by the substitution of impermeable tube tile-drains of a superior construction for the common brick drains, which allow the decomposing liquid refuse to permeate through the foundations. Other competent witnesses state that, in many cases, the inconvenience of carrying the house-drains under the front rooms of houses and across wide streets may be avoided, and the whole expense be greatly reduced by a better arrangement, by leading them into small barrel drains, carried along the back of the tenements.

It appears by the adoption of an improved form of sewer in the Holborn and Finsbury division, that, in what are termed first-class sewers, the expense of construction has been reduced from 21*s.* to 15*s.* per foot, and of the sewers for side streets from 15*s.* to 10*s.*, and in some cases to 8*s.* 6*d.* per foot; and, by an improved construction, the expense of traps to prevent the escape of foul air from gully-shoots into the streets, is reduced from 30*s.* to 10*s.* each, while in other metropolitan districts the charge for putting in each trap is still 3*l*. In the same division, by the adoption of a system of cleansing by flushing or flooding with water, the accumulation of deposits of decomposing substances has been prevented in a large proportion of the sewers; and by rendering unnecessary the mode of cleansing by hand labour and cartage (at once unhealthy and expensive), 50 per cent. of the former expense has been saved.

The investigation of such details has appeared to us to be of the highest practical importance, as affecting the question of expense and efficiency. The statements we have received, are subject to considerable modifications in different places, from the varying prices of labour and materials; but hitherto, at almost every step in the progress of this detailed inquiry, it appears that the practical course of efficient improvement is not incompatible with the reduction of existing pecuniary charges, independent of the vast gain in the public health, convenience, and comfort.

Mr. Foden, architect, in his evidence affords examples of works in use, and gives instances in support of similar conclusions advanced by other practical witnesses, that under appropriate arrangements water may be carried into houses, proper house drains and means of cleansing introduced, and branch sewers formed at nearly one-half the annual or weekly expense now incurred for the proper cleansing of the cesspools alone.

We have appended an estimate made by Mr. Coulthart, of Ashton-under-Lyne, of the expense of all the works deemed requisite for the sanatory improvement of that town, as contrasted with the pecuniary saving of the expenses attendant upon excessive sickness and mortality.

Value of the Refuse and Sewerage of Towns.

To the subject of the advantage to be derived from the sale and improved application of the refuse and sewage of towns, to the purposes of agriculture, we have directed and are directing our inquiries. In addition to the instance of the application of a part of the refuse of Edinburgh to agricultural production, which has already been made public, we append an account which we have obtained of a similar application in long and successful practice at Milan. Mr. James Dean states this system is adopted at Ashburton in Devonshire. This topic is illustrated by the evidence of Captain Vetch, who has paid much attention to this question and has had occasion to report upon it after the survey of two towns with a view to the adoption of measures for their sanatory improvement;—the subject is further elucidated by Mr. Roe, who was called upon to make surveys, for the drainage of Derby and Eton.

In the course of the investigation at Hull, an instance of a consolidated collection of all improvement rates, as well as of all general and local taxes, was met with, and has been recommended to our attention, as obviating some of the inconveniences of a separate and special rate for local improvements, and of preventing the vexation and expense incurred by separate collections of the different rates for existing works. The advantage of this consolidated collection is displayed in the evidence of Mr. Fox of Sculcoates.

The evidence recited generally recognizes that principle of legislation to be just and acceptable, which has been suggested for lightening the burthens of future improvements, by spreading the expense of the outlay over an extended period, so that the cost might be repaid within a reasonable time, with interest, by an annual rate, or by an addition to the rent, unless where the persons interested choose to perform the work themselves under proper regulations, or where they prefer liquidating the charge at once. But the application of this principle, which would in so many instances do away with objections to improvements on the ground of the immediate expense, and which would require to be accompanied by securities for the protection of absent parties, is a subject demanding further inquiry and consideration.

Defective Ventilation

We have directed our inquiries into the evils attendant on the over crowding of dwellings, and on the bad construction and imperfect ventilation of houses, and the defective regulations for the width of courts, alleys, and streets, causes which are represented as contributing largely to the extension of disease.

The evidence collected exhibits the great benefits derived from the introduction of ventilation, at an expense comparatively inconsiderable. Dr. Arnott explains the means which he has devised for that purpose, and which he represents to be cheap, simple, and efficient. Mr. Toynbee instances the successful application of one of those means to some of the over-crowded rooms, occupied both by artisans and by persons of the poorer class in the metropolis. The evidence of Dr. Rigby, already referred to, shows the importance of ventilation in rendering successful other means taken to prevent the recurrence of severe epidemics in the hospital to which he is attached. Dr. Guy furnishes examples of the improvement in the health of workmen, that may be anticipated from the introduction of ventilation to all workshops, in which large numbers are crowded, or in which processes are carried on injurious to health.

Measures of external ventilation, by arrangements for the proper width and direction of streets, open an extended field of inquiry. Mr. H. Austin, architect, presents an instance where better arrangements of houses now formed into courts, alleys, and streets, would secure a superior ventilation and afford a good return for the outlay.

Builders of the humbler as well as of the higher class of tenements, state in their evidence losses incurred, and injuries done to the inhabitants, and to the property, by the building of houses at wrong levels, which might have been obviated had there been an authentic survey, with the proper levels laid down, to which they could have had access. These witnesses have attested the utility of pre-arranged lines of drainage, as guiding the direction of new buildings, where no other circumstance governs their disposition.

Mr. Roe, surveyor to the Holborn and Finsbury Commission of Sewers, gives an instance of the evil that has arisen from the want of such a survey as the basis for a correct system of drainage, and he has adduced an estimate of the large outlay probably requisite to repair the defects thus occasioned.

With reference to this branch of our inquiry, we have examined engineers and competent witnesses as to the best description of surveys requisite for the gradual, efficient, and economical improvement of old districts, and for the proper regulation of new districts. We refer especially to the evidence of Mr. Butler Williams, Engineer and Professor of Geodesy to the College for Civil Engineers at Putney; of Captain Vetch and Captain Dawson, of the Royal Engineers; and of the Civil Engineers, Mr. Mylne and Mr. Hawksley.

We have obtained and appended to this report specimens of surveys upon the scale adopted for the survey of towns now in progress under the direction of the Board of Ordnance, with some estimates of their cost, made in compliance with our request, under the direction of Colonel Colby, R.E.

Among the subjects still requiring investigation, are the effects of manufactories which emit offensive and deleterious effluvia; and in what manner injury to the public arising from these causes, may be diminished or prevented.

In the course of our inquiries, evidence has been afforded of the pollution of wells, and the increased offensiveness of emanations from sewers caused by the infiltration of water passing through contiguous grave-yards. As the effects produced upon the public health by the practice of interments in towns have not been referred to this commission, and as at the time we entered upon our duties that subject was under separate investigation, we have not directed our special attention to it.

Among other important topics which we have before us is the subject of sanatory regulations for common lodging-houses, and the prevention of the filth and over-crowding, which often render them the seats of contagious diseases, a question which also involves local regulations of police.

Our attention has been invited to the means of giving facilities for providing public walks, baths, or other convenient bathing places in the vicinity of populous towns.

We have especially turned our attention to the means for improving the worst, and the most crowded districts, in large towns; a subject of great importance, and of very great difficulty. It may appear to be a comparatively easy task to provide against the occurrence, in new districts, of the evils which at present prevail in parts of old towns; but in the heart, and even in the immediate suburbs of towns, not only of ancient, but also of modern date, where these evils chiefly abound, the value of the property, the intricacy and variety of the interests involved, and the occupations and callings of the inhabitants, increase in a great degree the difficulty of devising measures which we may be able with confidence to recommend as effectual, and at the same time as capable of enforcement. In the recommendation of measures calculated to have a retrospective effect upon such masses of property, (the disposition of which has not hitherto been placed by the legislature under any control,) the greatest caution is necessary, lest, while seeking to afford a remedy, injustice might be done to the inhabitants or the owners. This subject is still engaging our most anxious attention.

In order to admit of the recommendation of systematic and comprehensive measures, adequate to the magnitude of the subject, many practical details are involved, which must be minutely examined and viewed equally in respect to accuracy of principle, economy of execution, and adequate provision for regulating and defraying the necessary expenses.

We anticipate that it will be necessary to have recourse to the aid of the legislature for further enactments, before the improvements so much to be desired can be fully accomplished; but at the same time it is our duty to state, that in many instances much might be effected, under the existing laws, to mitigate, if not to remove, many of the evils which now prevail.

In presenting this our first report to your Majesty, we are anxious to express our opinion that the information already elicited offers the reasonable prospect that great improvements may be made to the general benefit of all, especially the poorer classes of your Majesty's subjects. We entertain a confident hope that we shall be enabled to submit to your Majesty's recommendations adapted to carry out the object of your Majesty's commission within as short a period as may be compatible with the consideration due to so important a subject. To this end we are continuing our unremitting exertions.

(Signed)	Buccleuch.	Richard Owen.
	Lincoln.	W. Denison, Capt. Royal Engineers.
	Robert A Slaney.	J. R. Martin.
	George Graham.	James Smith.
	H. T. De La Beche.	Robert Stephenson.
	Lyon Playfair.	W. Cubitt.
	D. B. Reid.	

We purpose giving the Engineering evidence referred to in the report, which we shall slightly abridge, and in order to avoid giving both question and answer, we have condensed the two into one.

On the Supply of Water to Towns.

Mr. Robert Thom.—He has paid attention to the mechanical means of supplying towns with water for about 30 years. The towns of Greenock, Paisley, and Ayr have been supplied with water on his plans and superintendence. Plans and estimates for the supply of other towns, and of many other places, have been given by him, but the duties of his business of cotton spinning rendered it impossible for him to superintend the details of execution, except in the case of the Rothesay Spinning Mills, the first of his hydraulic operations on a large scale.

Mr. Thom explained to the Commissioners the principle of his plan, as distinguished from other modes of supplying towns, as follows: He imagined that, in answer to their question, it was enough to describe generally his own plan. The distinguishing features of which were, the obtaining some natural basin at a sufficient height, either in itself containing a large supply of water, or into which a great extent of surrounding surface can be drained. Thus a reservoir is formed, which he takes care shall be deep enough to maintain the water at a low temperature, and to prevent the breeding of insects and the growth of vegetables; and capacious enough to hold at least four months' supply of water. If it be not possible to obtain a large enough extent of drainage surface at one place, other basins are sought for and form auxiliary reservoirs, the waters of which are conducted into the main reservoir by aqueducts furnished with sluices of a pecularly simple contrivance. To facilitate the collecting of the water from the surfaces, catch water drains are made use of, and advantage, of course, is taken of any rivulet, spring, or collection of water which may be accessible. From the main reservoir the water is led by an aqueduct to some place near the town, where reservoirs can be formed, at such a height that the water from them will rise considerably above the highest houses. There, two reservoirs, or as I term them, regulating basins, are formed, each of them large enough to contain two days' supply of water. From these regulating basins the water is carried into two or more self-cleaning filters, and from the filters into two distributing basins; the regulating basins, filters, and distributing basins being in juxta-position, and so arranged that one of each of them may be connected together to form a set of apparatus. Two sets of apparatus are required, that the one may be in use while the other is cleaning or repairing. From the distributing basins the water is carried through the streets by supply of pipes of iron, placed in such a manner as that the water shall always flow in one direction, entering at the higher and wider end and flowing to the lower end; and always kept full of the water at high pressure, so that there may be a supply in readiness for every emergency. These are the principal features of his plan, but its efficiency depends so much on a host of minor details, that he has thought it right, in the subjoined note, to describe these more fully. It may be observed here, however, that although there is nothing remarkable in collecting surface water to fill reservoirs, and in carrying it from these by aqueducts, pipes, &c., for the supply of towns, yet there may be, and often are, in the modes of forming these reservoirs and aqueducts, and in the contrivances to ensure their permanent working condition, such difference as that while the expense of one method shall form a perfect bar to its adoption, another mode shall recommend itself by its simplicity and economy, and it has been his constant endeavour to unite *simplicity* and *strength,* so as to ensure *permanent durability* and prevent *future* expense.

In a letter Mr. Thom stated, "In every case where the distributary basin can be placed high enough, the pipes in the streets ought to be kept constantly full, so as to be always ready at a moment's notice to extinguish fires; and the distributary basin should be placed high enough to send the water over the tops of the highest houses, by merely putting the hose of a fire-engine on one of the fire-plugs, which should be attached to the pipes at short distances through all the streets. This I have done in Greenock, Paisley, and wherever I gave the plans; the advantage is immense; and were it properly and generally practised, there would be little need for insurances from fire. Provision should also be made for cleaning the streets, lanes, sewers, &c. by the water. When the cholera commenced at Greenock, the many dirty streets and lanes in that town were cleansed by a copious supply of water sent down from the Shaw's Water Aqueduct. Hence, in all probability, the few deaths which happened there, compared to those at Dundee, Dumfries, Musselburgh, and other places similarly low and dirty." Mr. Thom is of opinion that that which was done at Greenock would serve other towns, wherever there is head pressure enough to raise the water over the houses, whether that pressure is obtained by gravity or any power. By the gravitating system no additional expense is incurred; but where steam or any other power is used to raise the water the expense is very great. Hence the unwillingness of water companies, who have to maintain a mechanical power to keep their pipes full at high-pressure.

It is stated that in the city of Philadelphia a similar arrangement has been adopted of keeping the water always on at high pressure; and that for the cleansing of the streets a servant girl will put on the hose in the morning, and with this hose sweep the pavement, that once a week a stronger hose is used, and they sweep or cleanse the front of the house up to the highest windows; and that, on an occasion of fire, they immediately apply the hose, and introduce it into the interior of the house, and into the room where the fire takes place; is that an arrangement which you believe, from your experience at Greenock, is generally practicable?—It is perfectly practicable, under the conditions noticed in my answer to the foregoing query. It was practised by myself on a small scale 30 years ago.

With respect to the modes of laying the water-pipes for distribution, are there any defects common, which you think you have avoided in places where you have had occasion to superintend the supplies of water? One common defect is the permitting the water to flow along the pipes in either direction occasionally, thus stirring up the sediment, and sending a stream of turbid water into the houses.

Is that error in distribution a fault which might be prevented in very large supplies, or only in small towns?—It may be prevented in all supplies, whether for large or small towns, if proper arrangements be made at first.

With respect to the filtration of water, have you adopted any peculiar modes of filtration, to which you can speak as having been successful in any places where you had the superintendence of the supply?—At Greenock, Paisley, and Ayr, I erected *self-cleaning filters.*[1]

The cost of this filter was under 600*l.*, and the quantity of pure water produced *regularly* every 24 hours is, on the average, 106,632 cubic feet. The expense of a filter, therefore, to give a supply of water of the best quality *for family purposes*, to a town of 50,000 inhabitants, may be safely taken at 800*l.* From often finding pure spring-water in the moors, where the soil for many miles was composed of peat or moss, I suspected there was some substance in the earth which, by combining with the tannin or colouring matter, rendered the water pure, and this was proved to my entire satisfaction by a careful inspection of the minerals in the hills above Greenock. I there ascertained that the moss water, by flowing over or through a particular species of lava or trap-rock (amalgoiloid), became fine spring water. Since then, I have used the substance as a substitute for charcoal, with perfect success and much economy. A very large proportion of the hills above Greenock being composed of this substance, it may be had at a nominal price.

The filters are composed of very fine pure sand, mixed with animal charcoal for the purpose of decomposing any vegetable matter with which the water may be impregnated. The effect of such a filter, besides decomposing vegetable matter, is to render the water clear though previously turbid. Animal charcoal is the most powerful agent he knows of. He has contrasted its action with that of ordinary charcoal or a mixture of ordinary charcoal with other substances, and found it more powerful and to last longer than ordinary charcoal.—He has used ordinary charcoal with other substances; but finding that it lost its effect sooner than animal charcoal, he discontinued its use.—Some kinds will last several years. The sand did not contain any other earthy substances; it was clean from the sea-shore, of a lightish brown colour. The filter only had one stratum of coarse sand, the under part of which is gravel, next a fine gravel, and so on finer and finer to the depth of six or seven inches—and after that the fine sand above mentioned. He mixed the charcoal with the sand.—He has a small head of water of only one or two feet at most upon the filter; the purest water is produced with a small pressure.—A filter of 6000 feet area supplies a population approximating to 40,000 people; but it depends much on the previous purity of the water. It would be within bounds by taking half the proportion for a filter of that size.—He has no precise data as to the quantity of animal charcoal required for a given quantity of water. He uses the charcoal in about the proportion of one of charcoal to eight or ten of sand. The same charcoal might be used over again, after subjecting it to the purifying process, if it could be separated from the sand. He has not the power of separating it from the sand when it is used in the proportion stated; and, indeed, it would not be worth while, as the quantitity is so small and lasts so long. I have sometimes used charcoal in large layers by itself, and in such cases it might, with economy, be reburned and used again.

In a letter Mr. Thom has stated, "Where rivulets or lakes are not in the vicinity, the surface-water alone might, in most cases, be rendered sufficient, if artfully and economically diverted into reservoirs by small aqueducts, as at Rothesay Mills. The average annual depth of rain which falls in Great Britain is probably above three feet; in the west of Scotland it is greatly more; and at Paisley and at Greenock Waterworks, I have ascertained that about eight-tenths of the whole has been made available to the reservoirs. At Rothesay, where the declivity of the ground is less, and its surface more broken and porous, the proportion available is only about six-tenths of what falls there.

He considers that, by proper economy, the surface water in the vicinity of towns and places may be made available to a greater extent than is commonly supposed.

He had already stated that, in some cases, eight-tenths, and others only

[1] We shall give a drawing and description of the filter next month.—Editor.

six-tenths of what falls may be collected. It is easy, therefore, knowing the fall in any given place, and the nature of the surface and subsoil, to calculate what quantity a given extent of surface will produce.

The calculation must depend very greatly on the substratum of a portion of the ground, but more upon the smoothness and declivity of the surface. If the surface be smooth and steep, the water runs off so quickly that little sinks into the earth.

The smallest town which Mr. Thom has applied machinery to is Campbelltown, of 7000 inhabitants, which was supplied at a cost of about 2,500*l.* When he speaks of a supply, he always means two cubic feet, or about 13 gallons per diem for every individual of the population.

He is aware that that is very much below the consumption in London, but as a family supply merely, I rather think it will be found to exceed that of London.

He does not at the moment recollect the returns of consumption that have been made from the water-works in London; but he has seen them, and heard them explained. Judging from his knowledge of the facts in other towns, he should say that the quantities set down were rarely delivered. Some years ago, he had the means of ascertaining the quantity supplied to Glasgow, and found that it did not amount to 13 gallons for each, and of which nearly one-fourth was suffered to run waste, from the imperfect state of their works. In Perth, the quantity supplied to each individual was only 8 gallons. In Greenock and Paisley, where the pipes are kept constantly full, and there is nothing to prevent the people from using what they please, the quantity taken is less than 12 gallons for each. These facts lead me to question reports which state the family supply beyond 13 gallons per diem. In London, doubtless, the quantity used for watering the streets, for public works and the like, must be very great.—At Campbelltown, a family of five individuals will be supplied with water for about 1*s.* 4*d.* per annum. The cost at Ayr for the same quantity is 2*s.* 2*d.*; at Paisley it is 2*s.* 9*d.* In Greenock, I think, it is about 2*s.* 6*d.* Mr. Thom allows in this case 5 per cent. on the capital employed; the expense of wear and tear, charge of superintendence, and the like, being always included in his estimate. They are all high pressure services reaching to the tops of the houses; having all the advantages of being enabled to put out fires, and supply the cisterns at the tops of houses. He allows besides the 5 per cent. as much as will keep the machinery in complete order. In those towns there is an acclivity, a hill, which gives a high reservoir. He thinks it would in cases where a town is on a dead flat be possible profitably to raise the water by mechanical force for application to the several purposes of extinguishing fires, and washing streets and houses, and so on.

The supply of water for the different towns referred to has been from very different distances. The expense has been increased to a very small extent according to the distance. If you go farther from a town, land is generally cheaper, and there are fewer interruptions to the operations. The cost of making the reservoir is the same, or nearly the same, at whatever distance it be. The increase of expense, therefore, arises from the increased length of the aqueduct only, which is a trifling item in the calculation for the supply of a town. At Greenock, where the aqueduct passes through rugged and impracticable ground, and was a work of no ordinary difficulty, the cost of it was only about 400*l.* per mile, exclusive of the price of the land, and it is capable of passing a full supply for a city of 500,000 inhabitants.

Mr. Thom stated his practice in laying down water pipes, and in distributing water for the attainment of the object of keeping the water cool, to be as follows:—the situations for the reservoirs, basins, and filters, being obtained, as above described, he proceeds to notice some details of practice which are peculiar, and on which part of the success of his plan is dependent. In making the aqueducts for conveying the water from one reservoir to another, or from the reservoir to the basins, the ordinary practice is to take the most direct line between the extremes; crossing valleys by aqueduct bridges or embankments, and overcoming the many other difficulties which attend the method by equally expensive expedients. His method is to wind along the slopes, however far it requires to go about, descending only with such a fall as will allow the water to flow with a gentle current. He endeavours to select the course of the aqueduct, so that it may form the main drain of the farms, and be a fence between portions which it is advisable to keep separated,—possessing, too, the advantage of affording drinking places for the cattle, the aqueduct is, by the farmer, esteemed rather a benefit than otherwise. The details of the formation of the reservoirs, embankments, sluices, and regulating apparatus, cannot be well understood without illustrative figures. The filter he has described; he then noticed some peculiarities in in his manner of laying the service-pipes from the distribting basins. These pipes are of iron, and, as has been already noticed, are laid so that the water shall always flow along them in one direction, entering at the higher end and proceeding to the lower end. At the lower end of each range a cleansing cock is fixed, which is opened occasionally to clear out any rust or mud which may have accumulated in the pipe, and which, if allowed to remain, would of course, deteriorate the quality of the water. The pipes are constantly kept full; in addition to the advantages already detailed, as attendant on this, he mentions the following:—There is no limit to the quantity that the poorest inhabitant may take at all times. There is no risk of turbid water being carried into the houses by the water rushing along empty pipes every time it is set on. The pipes are laid underground to a minimum depth of three feet under the surface of the pavement; where they can conveniently be laid deeper it is done; the water is thus kept cooler and of finer quality, and risk of injury from frost is avoided. In some cases, in order to afford private houses very fine cold water, he sinks an iron cistern to hold about 20 gallons 8 or 10 feet below the bottom of their cellar, and supply it with water by a small lead pipe entering its top. Another small pipe is inserted at about four inches above the bottom of the cistern, and carried up to the cellar where the water is to be drawn off. Thus, for an expense of about 5*l.*, a family is supplied with one of the greatest luxuries which can be enjoyed—pure sparkling ice-cold water.

For the altitude necessary to give, for the supply of houses merely, it is enough that the water rises to the top of the highest; but for security against fires, the water should have a pressure sufficient to throw it with great force over the highest house. At Greenock, there is a pressure of 250 feet, which is 150 feet above the surface level of the highest street.

Supposing there was a dead level, and it was wished to send the water to such a height as to extinguish fire in houses, there should not be less than 20 feet head above the house; less might do, but more is better.

Mr. Thom explained the cause of an accident which occurred at Greenock—"An ill-constructed embankment gave way, and by the torrent of water let loose, 40 lives were lost, and damage done to property to the extent of 6000*l.* or 7000*l.* In this embankment the face next the water was very steep, and no care had been taked to made it impervious to water or vermin; the consequence was, that moles and water mice had perforated it like a riddle, during the drought in search of water; and when the flood came and raised the water above these holes, it rushed through them with such force as to sweep away the embankment to its base in a few minutes."

Mr. Thom concluded his evidence by observing—"I may repeat, that I am clearly of opinion that no town ought to be considered fully supplied with water, unless the pipes are kept constantly full, and arrangements made by which a powerful force of water can be taken from them at a moment's notice, to extinguish fire in any part of the town, high or low. But this, I fear will be found impracticable without the assistance of Government and the Legislature. So powerful are many of the present water companies, so strong the chain of interest which binds them together, and so large is the capital sunk in the present imperfect works, which the improved system would supersede, that I despair of ever seeing certain towns properly supplied with wholesome water, unless the powerful aid of Government and the Legislature are brought to bear down their selfish opposition. And it were clearly better, even to impose a local tax to compensate such companies, than that the health and comfort of the community should continue longer to suffer by withholding from them the first necessary of life—a copious supply of pure water."

To be continued.

ON THE CAUSES OF THE GENERAL FAILURE OF CANALS IN AMERICA.*

By W. R. CASEY, Civil Engineer.

It is obvious that some inherent defect must exist in American canals generally to have brought about the present deplorable results. It is true that nearly all these works have been constructed by the governments of the different States and Provinces, and under all the well known disadvantages of that system; and, we might argue with some reason, that in the hands of private companies they would have been more efficiently as well as more cheaply completed, owing to the superior sagacity, integrity and skill of the directors and engineers of works carried on by private enterprise. Thus it is no uncommon thing to see a president, board of directors and engineer at the head of a small private work, costing two or three hundred thousand dollars, in every respect—character, skill and wealth—incomparably above the government commissioners, boards of works and their engineers, entrusted with the disposal of millions. But admitting all this, it would merely show that the cost of the works had been too great, while in practice we find, that besides this obvious disadvantage, they labour under the still greater one of having—practically speaking—no income, as in the case of the Chenango canal, which has a gross income of about 13,000 dollars, on a cost of $2\frac{1}{2}$ millions.

The only canals which now yield a surplus are the Erie and Ohio canals, owned by the States of New York and Ohio, and the Delaware, and Hudson, and Schuylkill canals, owned by private companies in New York and Pennsylvania.† The Larchine canal in Canada was productive, but being now in the hands of a "board of works," is not likely to remain so much longer. Its "enlargement" has been already commenced. Volumes would not convey to the citizens of New York all which that single word conjures up.

Had the Erie and Ohio canals been left to their own resources their stock would never have been at par. The former received six millions from tolls during the first four years of its existence—nearly its entire cost—and the comptroller shows, doc. 40, p. 45, 1844, that, charging and allowing interest, the balance is 4,179,291 dollars 46 against the canal—omitting, of course,

* This article originally appeared in the "American Railroad Journal."

† The canal round the falls of the Ohio is of course omitted.

the enormous sums spent on the enlargement. The canals of Ohio have been, and continue to be supported by direct taxation, and that alternative has become necessary here for a few years at least. The two private canals above alluded to lead to the anthracite region of Pennsylvania; one, the Schuylkill canal *has* made immense dividends, but the stock has fallen greatly, and the toll has been reduced to three mills per ton per mile; the other is successful.

The Erie canal, though conferring considerable benefits on the country, has also exerted a powerful influence in a contrary direction, and for five months of each of the last four years it has been complained of—each succeeding year more bitterly—as an intolerable nuisance, injuring alike the western producer and eastern consumer by its hideous monopoly. Canals intended for the coal trade are comparatively little affected by the long winters of New York and northern Pennsylvania; but, canals drawing their main income from the country through which they pass, and, still more so, those depending on the trade of the lakes, have their usefulness greatly impaired by being closed during the winter months. This objection is insuperable, becomes stronger every year, and will, in my opinion, prevent the undertaking of any more canals in the country, north of Philadelphia at least.

Again, the grasping spirit in which many canals have been projected has been ruinous to their prospects for any reasonable period. The enlarged Erie and the Brobdignag canals of Canada were each to bear to the ocean *the* trade of the west; the Lehigh and Schuylkill canals were each to furnish the avenue for *the* coal trade of the country. But we find the coal as well as the western trade flowing through numerous channels already, and many more will soon be added. In England, canals are generally successful, but though doing an immense business they are very small, some of the most important having locks only eight or ten feet wide. Again, the capital invested in all the private canals in the kingdom is only 5,775,000*l*. sterling, about the sum expended on canals in New York, little more than the cost of the canals of Pennsylvania, and about twice the probable cost of the canals of Canada. What a contrast between the views of those investing their own money, and the conduct of those who expend the money of the public! Eighteen millions of people, with wealth, industry and enterprize unparalleled in the annals of mankind, expend in fifty or sixty years about thirty-four millions of dollars: six millions in Pennsylvania, New York and Canada, with wealth comparatively nominal, contrive to lay out about sixty millions of dollars in one fourth the time. The capacity of these little English canals is immense, their cost and management comparatively slight and easy.

A boat will carry about 30 tons, and as one of the old single locks of the Erie canal passes 116 boats in 15 hours, a lock little more than half the width will easily pass 200 boats per 24 hours, and is abundantly adequate to the trade of any canal likely to exist in this country. The English canals, with a small amount invested in their construction, accommodate an immense traffic, and are as valuable to their proprietors as they are useful and honorable to the country. Here the reverse is generally the case. For example, the Genesee valley canal will cost about 60,000 dollars per mile, the cost of the Lowell railway, the best in America; the income of the former is estimated by its friends at one-half of one per cent. per annum, the actual income of the latter is 15 per cent. Again, one mile of the Cornwall canal in Canada cost as much as fifteen miles of the Champlain and St. Lawrence railway, with cars, engines, buildings and wharfs, and it will be fortunate if the income from the twelve miles of canal equal half the revenue of the railway. The two private railways are adapted to the business of their respective localities; viewed in this light, the two government canals are monstrosities of the first order.

The Ohio canal is well worthy of the most serious attention. This work is above 300 miles long, is without a rival, cost only 4,000,000 dollars, traverses the heart of a superb country containing two millions of inhabitants, and connects the two greatest chains of inland navigation on the face of the globe—the Ohio with the lakes. Yet the gross income last year was only 322,754 dollars, 82, yielding, according to the commissioners, "$4\frac{1}{2}$ per cent. on the cost of the canal." Had not this canal been constructed at the moderate cost of 13,000 dollars per mile, it must have been supported by taxation, as is now the case with the other canals of that State, for some of which money has been borrowed within a few years at 7 per cent.! though their sources of income are far inferior to those of the Ohio canal, which, in fact, ranks next to the Erie canal. Ten years' experience on this canal demonstrate, in a manner admitting of no cavil, that the wealthy and—for America—populous region of Ohio barely supports one of the cheapest, if not the very cheapest canal in the country. The Erie canal has been a complete "ignis fatuus" to the other States, having been paraded before the country as a work which had cleared its prime cost, when in fact it was in arrears for interest. The singular advantages of the position of the Erie canal, its heavy grants and peculiar privileges render it a dangerous, a ruinous precedent.

The railways of the United States were undertaken, principally by individuals, after the canals, and though nearly one hundred millions of dollars have been invested in them, they yield about five per cent. The railways of England—the most extraordinary works the world has yet seen, and exclusively the results of private enterprize—have been constructed within fifteen years, at the enormous cost of 52,000,000*l*., and yield a fair return on the capital. It is obvious, therefore, that their sources of income differ materially from those of canals—in other words, that, though both may succeed, a railway may flourish where a canal cannot exist. For example, the Middlesex canal has been abandoned, and its place supplied by the Lowell railway.

The trade of the canal between Liverpool and Manchester has increased since the opening of the railway between those points. When the population and trade of this country shall approach those of England, it is not impossible that canals of reasonable dimensions, cheaply constructed, may succeed in some of the more southern States.

The public are just beginning to appreciate the losses sustained by the five months' annual sleep of the canals, and the papers from Boston to Detroit have, during the past winter, teemed with invectives against the law of New York which actually denies to the farmer that which the State of Maryland accords to the slave—the right to send his produce to market in any way he pleases—by turnpike, railroad or steamboat. But not only do the canals furnish a tedious route during a little more than half the year, but that very circumstance tends to raise the cost of that inferior accommodation, for the cost of maintaing them would be nearly the same were they open throughout the year, and the income would be greater; the same capital and annual expenditure would yield double the income.

The advantages of the Erie canal in a military point of view have been painfully dwelt on. Yet it can never be more than a very humble auxiliary of the private railways from Albany to Buffalo during the summer months, its opening being too late and its closing too early to render it of any value at the most important moments—the commencement and closing of a campaign. More than this, these very works have been built in spite of the canal interest which is still an incubus on the spirit of honest enterprise. Again, the Rideau canal is a truly military work, yet a railway from Montreal to Kingston, at a cost of four millions of dollars, would, in the event of war, save more than this sum annually, and would render that portion of the province impregnable to any force likely to be brought against it. It would also clear expenses, and three or four per cent. even now. So with regard to Buffalo, a force overwhelming from its numbers could be collected there in a few days. During the late insurrections in Canada the £40,000 sterling, invested by a few individuals in the Champlain and St. Lawrence railway, contributed materially to the defence of the province, while the millions spent on the Imperial and Colonial canals were absolutely useless. In case of a protracted contest the canals would of course come into play to some extent.

The main "causes of the general failure of the canals" of this country may be ascribed to their being closed nearly half the year; to the small amount of business their peculiar accommodation enables them to command in a thinly settled country; to their low rate of speed, and to their—with few exceptions—great cost. Whether these objections are likely to be overcome to any extent worthy of notice, the reader must decide for himself. For my own part, I doubt whether the canals, from the St. Lawrence to the Mississippi will, ten years hence, have yielded one per cent. on the capital invested in their construction; and omitting the Erie, Ohio and the two private canals referred to above, I do not believe the others will, during that time, clear repairs and renewals: in other words, that their failure will be complete and in some cases lead to their abandonment.

Since the above was written, I have seen the report of the canal committee to the senate, doc. 98, 1844, which, with that devotion to principle, so prominent a trait in the American politician, according to de Tocqueville, is very severe on those projects which have become decidedly unpopular—the lateral canals and the enlargement—but says not a word of a vastly greater evil, the canal monopoly. The arguments against any further expenditures are part of those used by others, myself among the rest, some years since, when 20 of the present debt of twenty-eight millions might have been saved. There is, however, a good illustration on page 15, where, speaking of the Chenango canal, it is said—"Thus it is seen, it would have been cheaper for the State to have made a road and hired teamsters at expensive rates to transport the produce of that country in ordinary wagons; and the community would have had the free use of the road for common purposes."

I made a similar calculation some years since. The expenses and interest on the cost of the Cornwall canal, twelve miles long, will be 8,000 dollars per mile, and we will assume that it will clear 1,000 dollars per mile per annum besides paying repairs and renewals—of which there is little probability. Then two years' interest or 16,000 dollars per mile, will build and equip a good railway, and three months' interest, or 2,000 dollars per mile will clear *all* the expenses of several times the total down as well as up-freight of the St. Lawrence, and of ten times the present number of passengers. In other words the entire trade and travel in both directions would be free, and the province would save 5,000 dollars per mile per annum, or 60,000 dollars on twelve miles of canal. The interest on the actual cost of the Cornwall canal, and on the estimated cost of the short canals round the rapids above, would pay all the expenses of a continuous railway carrying more freight and passengers than will probably be found on that route twenty years hence: that is, the mere interest on the cost of the canals would pay for free travel and transportation on a railway.

New York, May, 1844.

REGISTER OF NEW PATENTS.

(Under this head we propose giving abstracts of the specifications of all the most important patents as they are enrolled. If any additional information be required as to any patent, the same may be obtained by applying to Mr. LAXTON at the Office of this JOURNAL.)

COATING METALS WITH PAPER, &c.

BENJAMIN COOK, jun., of Birmingham, for "*his invention of certain improvements in coating or covering the surfaces of metals of various forms, and of applying the same to a variety of useful purposes.*"—Granted December 18, 1843; Enrolled June 18, 1844.

This invention consists in applying the same principles described in a former patent, dated May 23, 1842, to other purposes than those then contemplated, which consisted in covering the post or pillars of bedsteads made of metallic tubes, with paper, papier mâché, pasteboard, or such like material, and japanning or painting the same. For this purpose the inventor takes a thin sheet of metal of the form, or nearly so, of the article to be produced, and then covering it with several layers of paper, or paper pulp, as adopted in making articles of papier mâché, the articles are afterwards japanned or painted.

IMPROVEMENTS IN CALCINING METALS.

EDWARD BUDD, of Hafod Copper Works, near the town of Swansea, in the county of Glamorgan, copper merchant, and WILLIAM MORGAN, of the same place, refiner of copper, for "*Improvements in the treating and reducing of copper ores, and in the construction of furnaces for heating such ores, part of which improvements are applicable to other ores.*"—Granted Dec. 28th, 1843; Enrolled June 28th, 1844.

These improvements consist in the use or application of heated air to the furnaces employed in roasting, melting, and calcining ores, and also in the peculiar construction of furnaces for effecting the same.

The mode of introducing heated air into the melting and other furnaces employed in the smelting of copper ore will be seen by the annexed wood engraving, Fig. 1, which shows a longitudinal section of a melting furnace, in

Fig. 1.

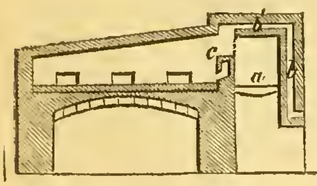
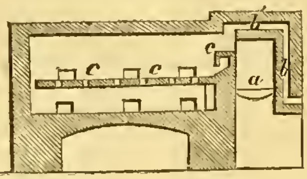


Fig. 2.



which *a* is the fireplace, *b* shows one of the air flues, there being several of them, separated from the fire and from each other by fire bricks. These flues commence at the back of the fireplace, and run in a vertical direction at the back of the fire and over the top, parallel to each other until they come to, or near the centre of the fireplace as at *b'*, at which place they branch off to the right and left, and down each side of the furnace, and communicate with each end of a flue formed in the bridge, *c*, this flue is provided with a number of outlets or openings at the top, of about 5 inches in length and one inch wide, and also a number of similar openings at the inside of the bridge leading into the furnace and just above the melted ore, the flues at the top of the bridge being for the purpose of supplying heated air to complete the combustion of the gases evolved from the fuel previously to entering the furnace; the second set of holes which are made in the inside of the bridge are for the purpose of allowing a current of heated air to pass over the surface of the melted mass under process, whereby a more perfect oxidization of the ore is obtained, which may be regulated according to the quantity and length of time the air is admitted, the supply being varied by a sliding door.

Another part of this invention has reference to a peculiar mode of constructing calcining furnaces, and consists of making a double furnace, both of which are heated by one fire; Fig. 2 is also a longitudinal or sectional elevation, which, together with the following description, will be sufficient to illustrate its principle; *a* is the fireplace, and *b b'* the air flues, arranged in a similar manner to those above described; *c c* is the upper or calcining furnace, which is divided from the lower by a fire brick partition supported upon arches, this partition has 36 holes through it, each being about 7 inches square; on each side of the furnace there are 12 sliding valves, each of which is made to cover or stop three of the holes. The charge of copper ore to be subjected to the process of calcination is placed upon the partition in the upper compartment, and subjected to the heat of the fire, which passes over the ore and down a flue or flues at the opposite end of the furnace, and through the lower compartment in the direction of the bridge, at which place it escapes through two flues leading to the chimney. When the charge is in a fit state it can be run into the lower compartment by withdrawing the valves, and another charge put upon the floor of the upper compartment, and in this manner the process can be continued until the lower compartment is nearly full, after which the metal can be tapped and run into water or moulds made in sand as will be understood.

The last part of the invention relates to a mode of constructing furnaces with iron bottoms; in carrying out this part of the invention, the patentee commences by forming an excavation the extreme size of the furnace and several feet deep: a wall is then built within the excavation and to a proper height, a number of cast iron plates are laid upon the wall and are joined together, the joints being made either by using clay, or by the application of a thin strip of metal laid upon the joint formed by two plates coming together. In order to form the bed of the furnace the cast iron bottom is to be covered with sand to a depth of about 15 inches, this sand is then to be subjected to the heat of the furnace and melted, and then left to cool, after that there is another thickness of sand of about 5 inches laid upon the other which is subjected to the same process, which completes the formation of the bed of the furnace, with the exception that it will be desirable to give it a small charge of copper ore in order to season it. And in order to keep the iron plates cool the inventor causes a very strong current of cold air to be continually passing underneath and in contact with the iron plates.

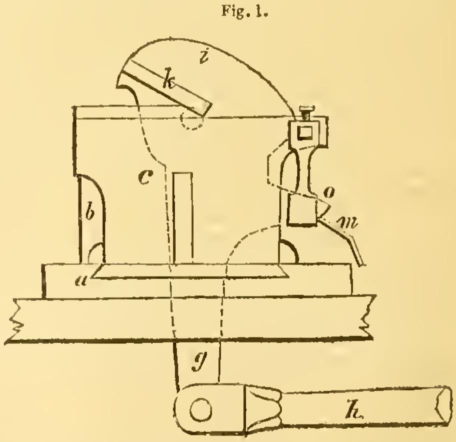
The claims are—1st, the application of air, heated before it enters the furnace, where ore is being roasted or calcined, by causing the air to pass in contact with the furnace or flues. 2nd, the calcining of copper or other ore in reverberatory furnaces, arranged in such manner as to be heated by flues formed in the bridge or other part of the furnace. 3rd, the mode of constructing calcining furnaces divided into two compartments, the upper one being heated by the fire, and the lower one by heated ore passing from the upper to the lower compartment. Lastly, the mode of constructing the bottoms of ore furnaces in such a manner that they may be kept cool by air or other fluid.

INPROVED SHEARS.

THOMAS MURREY GLADSTONE, of Swan Garden Iron Works, Wolverhampton, Iron master, for "*certain Improvements in machines for cutting or shearing iron and other metals, which improvements are applicable to other like purposes.*"—Granted Dec. 28, 1843; Enrolled June 28, 1844.

This invention consists principally in the peculiar construction of the shears, as will be seen by the accompanying drawings and the following description; fig. 1 being an end view of a double cutting machine, and fig. 2 an elevation of

Fig. 1.

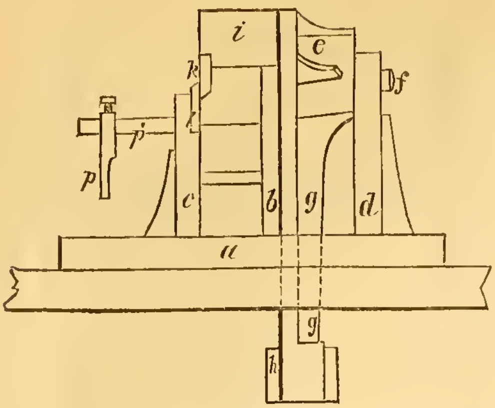


one side thereof; *a* is the foundation plate, and *b* a standard cast upon it, *c* and *d* are also two standards, dovetailed into the foundation plate and secured to the same by means of bolts, *e* is the shear, the form of which will be seen in fig. 2 partly shown in dotted lines; this shear moves upon an axis *f*, which axis is supported by the standards *b* and *d*; *g* is a projecting arm of the shear, to the end of which is attached one end of a connecting rod *h*, the opposite end being attached to some moving power; *i* is a piece of metal attached to the shear and forms part thereof; *k* and *l* are two steel cutters, the former being fixed to the piece *i*, and the latter to the standard *c*.

In cutting or shearing a plate of iron, the plate is inserted at the front of the machine, and the strip of metal cut off, instead of curling up as usual, is kept down and straight by that part of the shear marked *i* coming upon it;

and when the same is cut off it falls between the standards *c* and *b*, and upon an inclined plane *m*.

Fig. 2.



There is also another pair of steel cutters one of which is attached to that part of the shear marked *o* in fig. 2, the other cutter being fixed to the inner face of the standard *b*; these cutters are intended to cut up the strips of metal into pieces of any desired length, which may be regulated by the sliding stop *p*, which is made to fit upon a bar *p'*, fixed to the side of the machine, the strips of metal to be cut up being inserted into the machine crossways.

A NEW PIGMENT OR PAINT.

Henry Bessemer, of Baxter House, St. Pancras, London, Engineer, for "*A new pigment or paint, and the method of preparing the same, part of which method is also applicable to the preparing and treating of oils, turpentine, varnish, and gold size, when employed to fix metallic powders and metal leaf, or as a means of protecting the same.*"—Granted Jan. 13, 1844; Enrolled July 12, 1844.

This invention, which relates to a new pigment or paint, consists of certain mixtures of metallic powder (known by the name of bronze powder,) with gum, &c.; the treatment, as described in the specification, is as follows:—Having provided 8 lb. of gum copal, the same is to be put into a copper vessel and placed over a fire, the heat of which is to be of such intensity as to fuse the same in about 20 minutes, in the mean time boil in another vessel about 2½ gals. of drying linseed oil, and when the gum is in a state of fusion the oil must be added in small quantities, keeping the whole well stirred during the time of pouring it in; this mixture is then to be boiled for an hour, during which time the impurities as they rise to the surface are to be occasionally taken off, the operation having proceeded thus far, the mixture is to be left to cool down to about 50° Fah., after which 25 gals. of turpentine heated to 150° is to be added gradually, the whole being well mixed together; after which one gallon dry measure of slaked lime must be added, and the whole well incorporated together, when it may be allowed to stand for 3 or 4 days. The mixture may then be drawn off (the lime forming a sediment at the bottom); when the same is sufficiently cleared, it will be ready to mix with the bronze powder, which should be of a very fine and brilliant quality; for which the inventor claims the new pigment or paint, when made of bright metallic powder mixed with purified gums, oils, &c., in such manner as to form a painting fluid; also, the method of preparing a fluid for the purpose of mixing with a bronze powder in such manner as to form a pigment, together with the method of preparing and treating oils, turpentine, varnish, &c., for the purpose described.

FIRE PROOF ROOF.

Thomas Grimsley, of Oxford, Sculptor, for "*a new method of constructing a self-supporting fire-proof roof and other parts of buildings, with bricks and tiles formed from an improved machine.*"—Granted May 14, 1844; Enrolled July 13, 1844.

This invention consists in the construction of roofs and other parts of buildings, in such manner as to render the same self-supporting, and also fire proof, and consists in constructing or erecting upon the side walls, at a convenient distance from each other, arches composed of blocks of bricks, which blocks are made in moulds of a form suitable for the purpose for which they are intended, each block or brick being made with a tennon or projection at one end, and a mortice or groove at the other, in such manner as to fit within and bind each other together, and thereby form a self-supporting roof; the construction of which is as follows, fig. 1, shows a section of a portion of one of the side walls with the roof and one of the arches, *a* is the side wall, *b* one of the brick blocks made with a corbel head or other device, from which the arch springs; on the top of this block, which is firmly cemented within the side wall, there is a tennon or projection shown in dotted lines, which fits into a mortice or recess formed in the under side of the second block *c*, another block *d* is fitted upon the second block in like manner to the other; behind this block there is a block *e*, which forms part of the cornice, and is made with a projection on the under side which fits into a recess made in the side wall *a*, the block which is of larger dimensions than the others, and forms the gutter, is also fitted to them in the same manner as above described, and

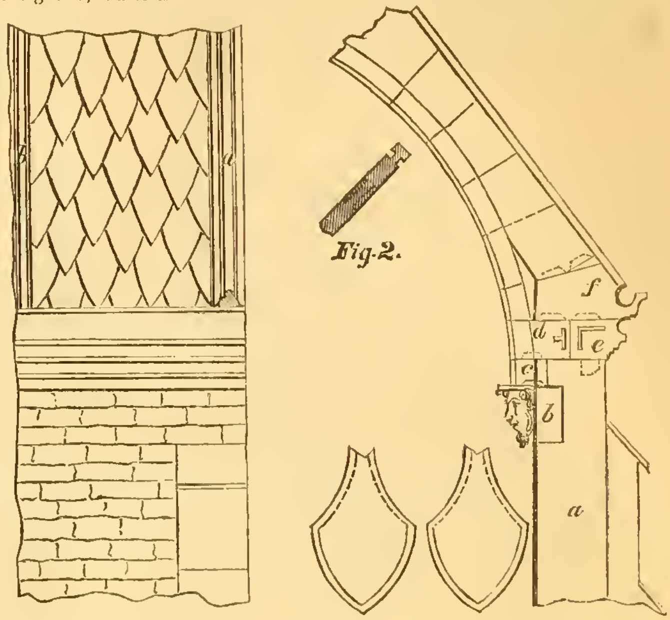


Fig. 4. Fig. 3. Fig. 1.

so on with the remainder of the blocks, all of which are firmly cemented together; upon the ends of each of the blocks *c* and *d*, there is a tennon which fit into grooves formed in the adjoining block, so that the whole forms one solid and compact mass. Fig. 2 shows a sectional plan of one of the blocks forming the arch, *g* being a groove formed on each side of the block for receiving the tiles, an enlarged view of which is shown at fig. 3, and the mode of fitting together at fig. 4, which is a side view of a portion of the wall and roof, *a* being the end, and *b* the next or adjoining arch, as described in fig. 1, one-half of each tile is made with a tennon or projection, which fits into a groove formed in the other half of the tile adjoining it, as will be seen by inspection. It will be evident that a roof constructed as above may be covered with any description of tile or covering, and when the same is to be underdrawn, the blocks as shown at fig. 2, may have another groove as shown in dotted lines for the purpose of receiving the ends of the timbers to which the laths are nailed.

The specification also shows a mode of constructing ornamental chimney pot, &c., upon the same principle, and lastly, in a mode of forming the clay for the blocks, which consists of a rectangular or oblong box with moveable sides; a frame is made to fit the exterior of the box, having a certain number of wires extending or stretched across it, each side of the box having slots cut in it to receive the wires. Thus when the box has been filled and tightly rammed with clay, the same may be divided into blocks by forcing the wires attached to the external frame through the clay, the sides of the box may then be removed, and the blocks of clay taken out for drying as is well understood.

FIRE EXTINGUISHER.

Charles Cameron, of Liverpool, Chemist, for "*Improvements in extinguishing fires in buildings.*"—Granted Jan. 16, 1844; Enrolled July 16, 1844.

This invention consists in the application of an incombustible substance in combination with water for the purpose above stated, the substances employed by the inventor are whiting or chalk, or, in place of these, aluminous clay such as white clay, blue clay, or red clay may be employed. In carrying out this invention, the patentee proposes that every fire engine should be provided with a tub or vessel capable of holding 100 gallons of water; this vessel is to be divided, by means of a perforated metal plate or other suitable partition, into two compartments, a small one and a large one.

In case of fire, the inventor proceeds as follows: the engine having arrived and being provided with a quantity of the incombustible substance before mentioned, which may be in a dry or damp state, but previously pulverized, the same is to be put into the large compartment of the vessel, which is to be placed at one end of the engine, and to which compartment is to be connected the supply pipe from the street mains or other source, the suction pipe of the engine being connected with the small compartment; the engine is then to be set to work, and during the time of working the substance in the large compartment is to be kept constantly agitated, by means of a broom or other instrument so as to keep the particles in suspension, and thereby form muddy water, which, the inventor observes, is well known to be better for extinguishing fires than clean water; for which he claims the materials above described, and the manner of forming them into muddy water of any degree of thickness that may be required, for smothering or extinguishing fires; also claims the application of the vessel above described, divided into two compartments.

MACHINERY FOR SAWING WOOD.

BENJAMIN CHEVERTON, of Pratt Street, Camden Town, Sculptor in Ivory, for "*Improvements in machinery for cutting wood and other materials.*"—Granted Jan. 16, 1844; Enrolled July 16, 1844.

This invention is for certain improvements in machinery for sawing, cutting, and slicing wood and other materials, and consists, in the first place, in arranging certain parts of the machinery of the saw-mill in such manner as to avoid the concussion or vibration to which the frame for holding the saws is subjected; and also in getting rid of the oblique strain to which such frames, of the present construction, are liable, in consequence of one end of the connecting rod being attached to the crank and the other end immediately to one end of the saw frame. This important improvement is effected by the application of an intermediate spring connecting rod as follows. Below the frame which contains the saws is placed the crank shaft, and to the crank is attached one end of the connecting rod, the other end being fixed to a cross head, the one end of the intermediate connecting rod (which consists of two bars of iron slighly bent or curved inward so as to approach each other in the middle,) is then connected to the cross-head, and the other to the lower end of the saw frame, by means of ball and socket joints, a space being left between the ball and socket of each joint which is filled tightly with some elastic material, such, for instance, as the material which Brockedon makes his stoppers for bottles, thereby cutting off all hard and unyielding metallic connection between the crank and the saw frame.

The second improvement consist in certain arrangements for avoiding the shaking and agitation caused by the unbalanced centrifugal force of the fly wheel, caused by the present practice of weighting one side of the same to act as a counterpoise to the saw frame. This is said to be effected by suspending the frame through the medium of springs of any description, or through the medium of elastic fluids such as gas or steam; the same is also shown as being accomplished by placing the cylinder of a working steam engine immediately above the saw frame with a single acting piston, and the fly wheel at the bottom and connected in the manner above described; but where it is required to have a double acting piston (we presume this means the steam acting on both sides of the piston,) the difference of resistance in the up and down stroke of the saw frame is equalized by wire-drawing the steam through the slide valve on one side of the piston.

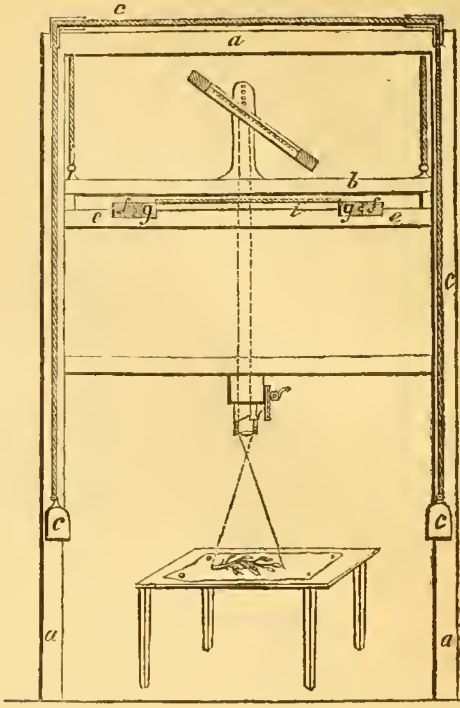
The third improvement consists in sawing or cutting several thicknesses of veneers at the same time, by arranging in one frame and parallel to each other a series of saws, at such a distance from each other as to allow of the thickness of the "saw rerf" and the intended thickness of the veneers to be cut.

Another improvement consists in making the teeth of saws described in the specification considerably deeper than hitherto practised, so as to allow of the sawdust constantly to pass away from the bottom of such spaces, and between the saw and veneers as they are separated from the block of wood they are being cut from.

A CAMERA OBSCURA COPYING MACHINE.

WILLIAM EDWARD NEWTON, of 66, Chancery Lane, London, Civil Engineer, for "*Improvements in machinery or apparatus for facilitating and copying of designs, drawings, and etchings of all kinds, either of the original size or upon an enlarged or reduced scale.*"—Granted Jan. 16, 1844; Enrolled July 16, 1844.

This invention is said to consist in a new application of the camera obscura, in the construction of which it will be necessary that the frame containing the camera obscura have a vertical movement, so as to be raised or lowered in order to adjust the focus, and that the frame containing the design to be copied should have a backward and forward and also a vertical and horizontal movement, and lastly, that part of the apparatus containing the lens should be capable of being raised or lowered; the annexed engraving, which is an elevation of one side of the machine, will suffice to give our readers a clear idea of the invention. *a a* shows the framework of the machine, which is about 9 feet high, this frame supports a horizontal frame *b*, which is suspended by cords and weights *c c*, in such manner as to be capable of being raised and lowered at pleasure; at *d* there are two standards, supporting a plate of glass *d'* placed at an angle, *e e* is also another rectangular frame supporting a frame *f f*, which has a movement in the direction from *e* to *e*, this frame is made with a feather or projection on the inside, which slides within a groove formed in another frame marked *g g*, which frame moves in an op-



posite direction to the frame *f f*, or at right angles to it; this frame, *g g*, also carries a plate of glass *i*, upon which the design to be copied is placed; the object of these moveable frames is to bring the various parts of the subject or design immediately below the rays of light which pass through the plate of glass in the manner shown by dotted lines, and also through a double convex lens fixed within a sliding tube supported by the cross frame *h h*, which frame can also be raised and lowered by weights attached to ropes passing over pullies, or by other mechanical means; the tube containing the lens is also capable of being adjusted by means of a rack and pinion, for the purpose of regulating the distance with greater nicety.

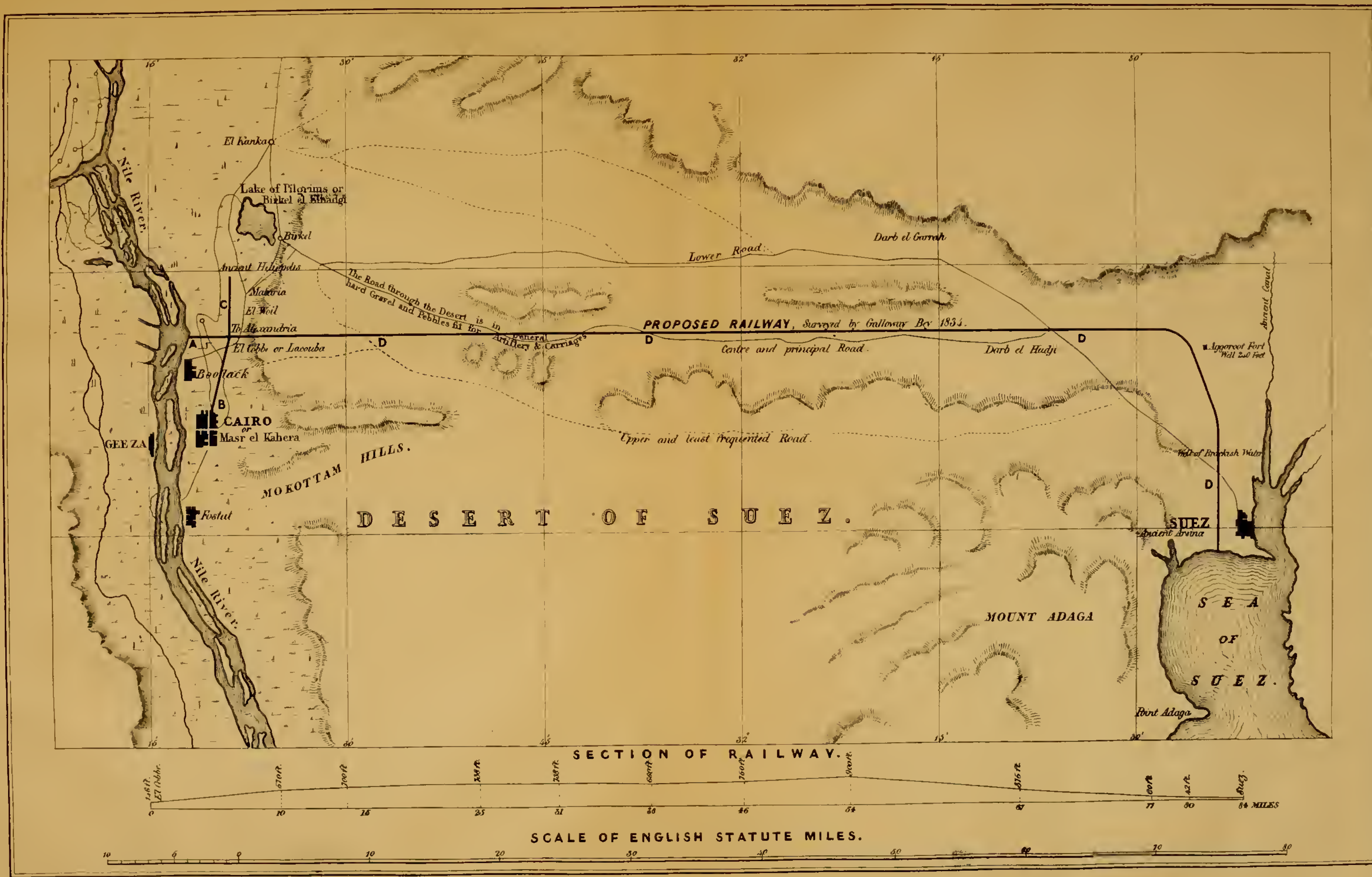
It will therefore be seen that the design to be copied must be on varnished or transparent paper, which on being placed upon the plate of glass *i*, the image or a portion of the image will be thrown upon the table *k k*, upon which there is a sheet of paper which receives the image of the design to be copied, the part surrounding the table being kept perfectly dark, so as to exclude all light but that which passes through the lens.

This machine may also be employed for copying designs drawn upon ordinary paper by making the frames which receive the designs capable of moving in such a manner that the design can be placed in a vertical position opposite a prism, and thereby made to pass through a lens, by which means the design can be altered to any size at pleasure. The specification also describes another machine constructed upon the same principles, the arrangement of some of the parts being somewhat altered, so as to admit the light at the side, the foregoing machine admits the light at the top.

OVERLAND COMMUNICATION WITH INDIA.

(With an Engraving, Plate XII.)

In the February number for the present year we directed the attention of our readers to the several plans for a ship canal from the Red Sea to the Mediterranean, when we gave a plan of the proposed routes, and ample details as to the various projects proposed. Since that period our interest in the communication with India remains undiminished, and we with pleasure avail ourselves of Mr. Galloway's observations on the line of railway suggested between Suez and Cairo. One thing is evident, we must by all means draw closer the ties between England and India, did no commercial motives actuate us, the fact avowed by Sir Robert Peel, in his celebrated speech on the Budget, of the ultimate connection between the finances of England and India, renders this measure imperative. We have, too, the vast responsibility of the administration of one hundred and fifty millions



C.F.Cheffins Lithog. 9, Southampton Buildings, Holborn

of people, requiring the constant and immediate attention of the home authorities. So far as to the necessity of future progress; when, however, we look to the benefits accruing from past measures, we see every encouragement for perseverance. No one we should think is prepared to exchange the present rapid transit of letters, despatches, and passengers to Bombay and Calcutta for the uncertain and tedious route by the Cape, though inconveniences attendant on the present overland route oppose considerable obstacles to its use by ladies and children, who are compelled for comfort to go round by the Cape. By accelerating the transit through Egypt, we shall obviate much of this inconvenience complained of, and we shall gain about a day in our communications. By the activity and enterprise of the Egyptian Overland Transit Company and of Mr. Waghorn, and in consequence of the competition in which they were engaged, the present means of transport in Egypt have been made to produce their greatest effect; but it is evident that even with improved roads, camels, horses, and asses, labouring under a tropical climate, and in a district where there is not a drop of water, cannot put forth the energy they could in this country. As to a ship canal, it is very evident that whatever facilities it might afford to trade it could do very little in accelerating mails and passengers. Only one means is available for doing that, and it is a railway, which will give increased speed, saving in time, greater comfort, and less expense, so as to enhance the advantages presented by the overland route, and bring a greater number of travellers. To the home Government then, the East India Company, the commercial body, to travellers, and to the Indo-English community, the saving of even a few hours would be of great importance, but a plan so replete with advantages as that of the Suez Railway demands on all hands the most earnest attention.

The nature of the Suez desert is pretty well known from the descriptions of Indo-English travellers. It is in general composed of hard gravel and pebbles, and has much the appearance of a dry sea beach, with an undulated surface, and occasional hills of stone and sand, and without a single well or a drop of water. It need scarcely be said without a plant. The desert is about seventy miles across, and its convenient passage has long been a matter of importance in Egypt. So much so, that in 1834 the celebrated Bey Galloway was authorized by His Highness Mehemet Ali to make a survey of the country, with the view of laying down a railway between Cairo and Suez. He found it perfectly practicable, and was authorized to proceed with it. It must at once be evident that in the construction of such a line much less difficulties have to be encountered than under ordinary circumstances, and much less expense to be incurred. In the deserts of Egypt there are no ravenous claimants for land purchase, severance, compensation, &c., no parliamentary expenses, no lawyers' fees. The country everywhere presents a good foundation, without expensive embankments or cuttings, and without tunnels, bridges, expensive stations or works of art. Under such circumstances a single line of railway can be laid down as cheaply as in any part of the United States, after allowing for any increased expense by having to convey all provisions and supplies into the deserts. The scheme was one, therefore, which promised many advantages to the Egyptian Government as an inducement, and Galloway Bey proceeded as far as making contracts in England for rails and locomotives, when his unfortunate death, and the disturbed state of political affairs in the East, gave opportunities for the intrigues of adverse diplomatists to obtain a suspension of the plan, the receipts from overland traffic, moreover, being then quite undeveloped. It must be observed, that in Egypt whatever is proposed is subjected to all kinds of chicane and intrigue from the French agents, ever anxious to meddle, and treating Egypt as their own province, and the other members of the foreign *corps diplomatique* are not behind them. Hence the plan of a railway has been strenuously decried by them, and that of a canal overlauded, for while a railway will chiefly advance English interests, and can do little for France, Austria or Italy, a canal promises to open to the merchants of Marseilles, Trieste and Syro, the commerce of the Red, Persian and Arabian seas, and to give them advantages in carrying on such traffic from the Mediterranean. The railway will carry passengers, despatches, letters and light goods, most of which are English and paid for by the English, consequently not presenting any very great temptations to foreign commerce, and in our opinion rendering their interference uncalled for and unnecessary.

In last year his highness renewed his authority to the house of Galloway, and Mr. John Alex. Galloway proceeded to put himself in communication with the home government, by whom he has been favourably received, although he has not yet succeeded in effecting the necessary arrangement. He was authorized to propose on the part of his highness that the railway should be constructed at once, provided the English government would consent to guarantee a postage on the letter. This proposition, from whatever reasons, seems not to have been acceded to in its details, though Mr. Galloway intimates that his highness would have been amply satisfied with a piastre ($2\frac{1}{2}d$) on each letter. That the public would willingly pay this charge we have no doubt, when we consider how ready they are to pay a much larger sum for the transit by Marseilles. Against this $2\frac{1}{2}d$ would, however, have to be set part of the present charge for transit through Egypt. We hope, however, that should there be any unwillingness on the part of our government to accede, that the Egyptian authorities will not delay on this account, for if government do not at once accede to the very moderate terms now proposed, they will be at the mercy of Mehemet Ali to submit to whatever higher charge may be proposed, for the force of public opinion will compel the use of the route when once made.

Mr. Galloway strongly opposes all the projects for a ship canal, and it seems to us with some show of reason, for of the three plans proposed here not one of them emanates from a party who has been on the spot, while the two French officers of his highness, Soliman Pasha and Galice Bey, who visited the remains of the ancient canal near Suez never examined the rest of the route. On the other hand, Mr. Galloway brings the adverse testimony of an engineer who has been on the spot, and the assistance of Capt. Glascock, of H.M.S. Tyne, and the master of the same ship, who state the Egyptian coast at Tineh to be almost impracticable for sailing vessels. In fact, being in an angle between two low coasts, it constitutes a most dangerous place, like the coast to the east of Ostend, and to the east of Hamburgh, where if a vessel misses the harbours it must go ashore and be irretrievably lost. Channels too have to be cut at each end to deep water, 4 miles one way and 6 miles another, and the engineering difficulties are of the most serious character. Capt. Vetch estimates the cost of a ship canal at two millions on hypothetical grounds. Mr. Galloway puts forward strong reasons for doubting whether even this high estimate would suffice. At any rate it is pretty evident that in the ordinary state of Egyptian finance the necesssary capital would not be forthcoming, while there are sufficient Egyptian interests to urge the construction of such a work. As Mr. Galloway says, if Egypt were an English province such a work might be attempted; but, at present, neither the Egyptian government nor the English government will undertake an enterprise uncertain in its expense, and still more uncertain as to the revenue it would produce. The railway is then the only practicable measure; it is the one in every sense the most beneficial to this country, and we trust it will be prosecuted with vigour. For a railway we must furnish the rails, the locomotives, the carriages, and the coals, for a canal we should supply nothing, while the interests of England and Egypt will be much better consulted by the railway than by the canal. We repeat, we cannot doubt that the government must accede to any reasonable contract for carrying the letters which may be proposed, they have had to give way in the case of steam mail contracts, and with the mail contract, the large and increased number of passengers, and the extent of goods traffic, the Suez and Cairo Railway must pay.

Before we conclude, we beg briefly to urge on our government the value of the Syrian route, as a resource in case of any difficulties in Egypt. The route through the valley of the Dead Sea and Jerusalem used originally, by the enterprise of the Phenicians and Solomon, to divert the Indian traffic by Egypt, will always be found available in case of any interruption of our political or commercial relations with Egypt.

Reference to the Plan and Section.—The intention of his highness is to make railroads from Alexandria to the vicinity of Cairo, as well as to Suez; and on that account, as from local circumstances, a branch-road from the city of Cairo to the grand depôt was made. The road marked A is the line to Alexandria; B to Cairo; and C a short road for the trial of engines, &c.; D D D D the Suez road, which runs in a right line for seventy-five miles, and branches round at Aggoroot Fort, and from thence to the sea at Suez, at which it is intended to erect a pier: the entire length is eighty-four miles. The profile of the ground shows very favourable gradients upon the greater part of the line—there are no tunnels, and the engineering difficulties are very slight.

METROPOLITAN RAILWAY STATION.

The unfounded fears and prejudices which dictated the exclusion of railways from the heart of the metropolis, has now begun to do its work. Instead of having the points of departure in accessible localities, we have to run to Euston Square, Paddington, Nine Elms, Shoreditch, or the Bricklayers' Arms. Now that the bugbear as to the nuisance, danger and annoyance of railways is satisfactorily exploded, the public begin to make a clamour on account of the inconvenient distance they are obliged to walk or ride by an omnibus, which occupies as much time as travelling by railway a distance of 20 miles. To what are called short passengers, this delay is a most serious inconvenience. Hence it will be observed that particular lines more favourably situated in populous localities, enjoy a quasi-monopoly of this class of traffic, persons will go to London Bridge or Fenchurch Street, who will not undertake the expedition to Paddington or Nine Elms, consequently these latter termini must in the end be extended into town. One of the circumstances most to be regretted in considering the subject is, that every year of delay enhances the difficulty of obtaining a clear line. Such is the rapidity with which house building in the metropolis extends, that what was lately a vacant space soon gets covered with brick and mortar. A very excellent plan is now before us for a Metropolitan junction railway, with a terminus at Waterloo Bridge. We understand that it is proposed to take the West London Railway which now communicates the Birmingham and Great Western, and terminates at Kensington, as part of the line, and then to carry the Railway to the Thames, opposite Battersea, thence across the river by a bridge, and join the South Western Railway near Battersea, afterwards to carry the line across the Vauxhall and Westminster Bridge roads by a viaduct, terminating at Waterloo Bridge, on a level with the roadway. Ultimately it is contemplated to carry the line to Southwark Bridge, and have a branch to Richmond. Waterloo Bridge may be considered as the centre of the metropolis, it has good roads to the south, and a road is now being made to give it as good access to the north by the continuation of Wellington Street, which runs in a line nearly straight across Holborn to the Hampstead Road. Thus from Waterloo Bridge will there be convenient access and good omnibus accommodation to every part of London. We trust there will be no difficulty in the question of feasibility or expense, while most certainly sooner or later something must be done to carry this or a similar line into effect. Such a line will be a great boon to those railways with which it may be connected, as it cannot fail to cause a great increase of passengers to such places as Richmond, Hampton Court, Windsor, Harrow, &c., and a great accommodation for conveying goods direct from the river Thames to all parts of the manufacturing districts.

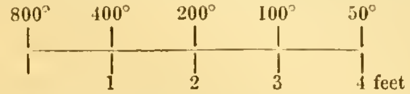
PROFESSOR FARADAY ON HEAT.

A course of six Lectures delivered at the Royal Institute.

LECTURE III., *May* 4, 1844.

(Specially reported for this Journal.)

When bodies are heated at one part, they gradually give up their heat to the other parts, till they are equally hot all over. This, which is called the power of conduction, exists to some extent in all substances, in solids to the greatest extent, in gases to the least. The law of conduction, or the rate at which heat travels through the substance, is found to be uniform with all solid bodies, and is expressed by saying that as the distances increase in arithmetical progression, the heat decreases in geometrical progression; thus, a bar heated to 800° at one end, if at one foot distance it was reduced to 400°, would at 2 feet be at 200°, at 3 feet 100°, at 4 feet 50°, and so on, as in the diagram.



But bodies differ from each other very greatly in their degree of conductibility, some being excellent conductors, others very bad conductors. A rod of metal will serve best to illustrate this travelling of heat. A series of balls fixed on the under side of a bar of copper heated at one end, by their falling one after the other, indicate its progress. If a bar of iron be heated under the same circumstances, it will be seen that three balls will fall from the copper to one on the iron, showing the great conducting power of the former. This point is of great importance in many arts, particularly in building, as on a hot day all the materials employed expand in different proportions, or contract with cold. A frequent mode of illustrating this is to have a series of cylinders of copper, iron, glass, wood, and brick, and to place them on a hot plate of metal, and a paper indicator fixed on the top of each by means of a little wax; the indicators will be found to fall in the order in which they are named. German silver, which is being so much used for domestic purposes, is not nearly so good a conductor as silver, therefore hot substances can be eaten with it without fear of burning. The relative conducting power of various substances is shown in the following table:—

Gold	1000	Tin	304
Silver	973	Lead	180
Copper	891	Porcelain	27
Platinum	381	Marble	14
Iron	374	Brick	11
Zinc	363		

Bad conductors are frequently employed to stop conduction. Thus the smith who punches a hole through red hot iron, protects his hand from the heat his tool acquires, by fixing it in a wooden handle. The handles of domestic articles, such as curling tongs, are for this purpose covered with string. In the manufacture of coal gas, the men in the retort house are exposed to an intense heat; at first they wore canvass shirts, but they soon found that it was more judicious to work in flannel shirts, flannel being a much worse conductor than canvas, and therefore better suited to the purpose. It is true, it was not philosophy that pointed it out to these men, but practice. The accumulation of badly conducting matter is occasionally very injurious. Fur should never be allowed to accumulate in kettles or boilers, as the heat then has to penetrate a thin stratum of stone, and not being rapidly enough absorbed, destroys the metal of the boiler. From salt water the accumulation is much more abundant than from fresh, and instances have been known where, owing to the deposit in the boiler, holes have been burnt, during one journey, large enough for a man to crawl through.

Want of continuity lessens very much the conducting power of substances. Owing to this, hot metal may be carried on chains with impunity. At Gibraltar advantage was taken of this property of non-continuous bodies, for it is said that red-hot balls were carried in wheelbarrows merely by interposing a layer of sand between the wood and the ball. The hand, even, can support a red-hot ball for a short time, by laying some sand on it, taking care to protect the other parts of the hand from the heat of radiation. Aldini, Galvani's nephew, introduced into this country the use of the filamentous substance asbestos, as a protection against heat, a person clothed in a dress of this kind being able to withstand for a short time the action of flames. Obsidian, which is lava in a state of glass, is a tolerable conductor of heat, but when frothed up into pumice, it is one of the worst conductors known. If continuity is broken by the interposition of a bad conductor, the effect is very great, as may be shown by a metallic vessel with three handles, one continuous, the second in two pieces fitting on to each other, the third the same as the second but with a piece of paper interposed. Phosphorus being placed on each handle, and boiling water poured into the vessel, it will be found that that on the continuous handle will soon fire, that on the handle in two pieces will be some little time after, and that with the paper interposed perhaps will not light at all.

All bodies conduct heat, but fluids do so with difficulty. A red-hot ball may be brought to touch the surface of a small vessel full of water, and yet a delicate air thermometer at the bottom of the liquid will not be affected. Count Rumford showed that water may be kept boiling at the surface, whilst ice remained at the bottom. Indeed so slightly does it conduct, that philosophers once thought that fluids did not conduct at all. But the effect of the mixture of hot and cold water, shows that they do. Food frequently surprizes us by its conducting power; whilst one kind cools very quickly, another maintains its heat for a long time. In the water foot bath, heat can be borne by keeping the feet still which cannot if they are moved about. This is because the feet abstract the heat from the water next to it, but the remainder of the water gives up its heat but slowly and therefore it can be borne. The same thing takes place with porridge, one part becoming cool whilst the other parts are hot. This may be shown strikingly by substituting a copper tube with ether in it, for the spoon. When first put into the porridge the ether is vaporized and may be lighted, but the flame soon lessens and is nearly extinguished, because it has deprived the surrounding part of its heat; but move it to another part, and the flame of the ether is vastly increased, indicating greater heat.

Air is almost a non-conductor. The flame of a spirit lamp communicates great heat to air, but owing to its being so bad a conductor, gunpowder may be dropped through the flame without inflaming, whilst iron filings, which require much more heat to burn, are consumed in this manner; but here the effect is increased by the good conduction of the iron. The warm of wadding or eider down arises from its non-conduction, but this is not due to the substance of the material, but to the air which is enclosed. Count Rumford showed that if these porous substances are twisted tight, they become far better conductors. The small quantity of solid matter that many of these textures contain is truly surprising. If a jar be filled with alcohol, wool may be gradually inserted till several times the bulk of the jar, without the level of the alcohol being materially affected.

Metals are said to be colder than wood, but they are not so. To the hand they feel colder, but that arises from their conduction, as they carry away the heat much more quickly than wood does. When heated, on the contrary, they are said to be hotter than wood, because they give up the heat they have acquired, more quickly. This is well illustrated by rolling a slip of paper round a rod of wood, and another round one of copper; that on the wood is soon charred, whilst that on the copper remains unhurt, because the heat is conducted away so quickly. Effects exemplifying these facts are often seen in daily life. A very hot cinder falling on to water, causes but little steam until it has become somewhat cooler, when its action is violent; this is because it forms, when very hot, a vapour of steam all around it, which by its non-conduction protects the water from actual contact, until, by its cooling down, its atmosphere of steam is removed. Exactly similar to this is the curious phenomena attending the pouring a drop of water on a very hot silver basin; the water runs over the surface like a beautiful pearl, with no perceptible evolution of steam, until the basin becoming cooler, the water touches the surface, and is suddenly converted into steam. Potassium, thrown on the surface of water, acts in a similar manner; for after combustion, the bead of potassa formed runs over the water for a short time, but at last is dissolved, evolving at the moment much steam.

Lecture 4. May 11.

The effect of heat in causing the passage of bodies through the states of solid, liquid, and vapour, is exceedingly interesting, and in nothing more beautiful than in water; it is interesting in water, not only on account of its importance, but because it comes within the range of every one's observation. The change from the solid to the liquid state, and *vice versâ*, is the subject of the present lecture. The terms fusing, melting, or liquifying, are indifferently applied when a solid becomes a liquid; and freezing, congealing, crystallizing, or solidifying, expresses a liquid becoming solid. A piece of ice when heated becomes water, and if the heat is continued the water will boil and be converted into steam. Thus we have the same substance as solid, liquid, and vapour, and by abstracting the heat it will return through the same stages in the same order. These changes take place with great regularity; there is a fixed point of heat at which they take place, and at no other. Water can, by expedients, be reduced a few degrees below the usual freezing temperature without becoming solid, but under ordinary circumstances it ceases to be liquid when it is lowered to the temperature marked as 32° of Fahrenheit's thermometer. Solutions of several salts will serve to illustrate this to an audience, perhaps better than water. Sulphate of soda dissolved in hot water till the latter is saturated, may be cooled below its crystallizing point if kept without agitation, but the moment it is touched, crystals will shoot rapidly through the fluid till nearly the whole is solid. The same can be effected with water, especially if the surface is covered with oil. But though, when heat is abstracted, the strict changing point may slightly vary, it is not so when heat is added; ice cannot be made warmer than 32° without becoming water, nor can water be heated above 212° without becoming steam. A list of the temperatures at which various substances become solid, is here given:—

Congealing Points.

Sulphuric ether	−46° Fah.	Tallow	92° Fah.
Mercury	−39	Spermaceti	112
Sulphuric acid	+ 1	Yellow wax	142
Vinegar	28	Sodium	194
Water	32	Tin	442
Olive oil	36	Lead	612
Acetic acid	50	Zinc	680

When heat is applied to ice, the temperature of which is 32°, it is seen to melt, and if a thermometer be inserted into the mixture of ice and water, it will be found to remain at 32° so long as any ice remains undissolved. Now how is it that the ice, which is continually absorbing the heat, does not form water warmer than it was before the heat was applied. Ice, which has been gathering heat for several hours, has only been converted from ice-cold ice, to ice-cold water. All the heat which has been received by it has been absorbed, is not sensible to the thermometer, and is called latent heat. Boiling water may be poured upon ice, and yet, until all the ice is dissolved, the thermometer will not indicate a greater heat than 32°, or the freezing point. The amount of heat thus rendered latent has been found to be 140°, which may be shown in the following manner. Take equal weights of water at 33° and ice at 32°, and apply the same heat to both, and it will be found that the heat required to raise the water 7°, must be continued 21 times as long with the ice to get the same temperature. Thus,

Water at 33° took ½ hour to gain 7°.
Ice .. 10½ hours „
$7° \times 21 = 147°$
Deduct the 7° gained 7°

140°

It may be shown also to be this number by pouring equal weights of water at 172° on ice at 32°, and the resulting water will be found to be at 32°, giving 140° absorbed. That solids when passing to the state of liquids abstract heat, is readily proved by dissolving some sal-ammoniac in water. At the tea table, the act of dissolving sugar in the cup cools the tea. On this principle frigerific mixtures may be made, a few of which are here given:—

Mixtures.	Parts.	Thermometer Sinks.
Muriate of ammonia	5	From 50° to 10°
Nitre	5	
Water	16	
Nitrate of ammonia	1	From 50° to 4°
Water	1	
Sulphate of soda	5	From 50° to 3°
Dilute sulphuric acid	4	
Snow	1	From 32° to 0°
Common salt	1	
Muriate of lime	3	From 32° to −50°
Snow	2	

Owing to this property, water may be readily frozen by substances as warm as the room. A common juggling amusement is to undertake to freeze a saucepan to a stool before the fire. And it is to be done, by spilling a little water on the stool, putting the saucepan in it, and then stirring in a mixture of ice and snow. In a few minutes they are completely fixed together, and the stool may be lifted by the saucepan.

This latent heat, however, disappears only for a time, to re-appear when wanted. For when liquids solidify they give up exactly the same amount of heat that they had before absorbed, which now becomes perceptible. Freezing, therefore, is a warming process, because the water gives up the 140 degrees of heat which it had rendered latent. An uncrystallized saturated solution of sulphate of soda poured on the bulb of an air thermometer shows an evident evolution of heat. These effects are general, and in many instances very curious, but sometimes it is increased or diminished by the interference of chemical affinity. The fluid alloy of potassium and sodium when added to mercury, becomes fixed, a solid amalgam being left. Here the effect is increased by chemical affinity. Occasionally chemical affinity seems to contradict the general laws of solution; for a solid, caustic potash, when dissolving in water, evolves heat enough to fire phosphorus. In this case there is cold produced by solution, but the heat caused by combination is so great as to more than neutralize it. But sometimes these two effects can be separated. Thus sulphuric acid and ice produce great heat when mixed until the appetite of the acid for water is satisfied, but after that they produce cold enough to freeze water.

When water freezes, it expands considerably, 9 volumes becoming 10, and is consequently lighter and floats on the surface, a small portion of the ice remaining out of the water. It is this which accounts for the mountains of ice which stand up in the sea, at the same time the size of these enormous icebergs gives some idea of the immense quantity of ice which must be in the water. This expansion takes place with great force. Experiments were made on this point, by some officers in Quebec, by filling bomb shells with water, and plugging them with iron, exposing them to the air to freeze. The iron plugs were forcibly expelled, being shot to the distance of 50, 60, and 100 feet, the ice protruding from the holes. When the plugs were thoroughly secured in their places, the bombs burst. Indeed, no mechanical force is sufficient to control the chemical force of solidification. Small cast iron bottles may be burst by filling them with water, and immersing them in a freezing mixture, bursting with a considerable report. Rocks are in this manner split in nature, till crumbled down into a powder fit for agricultural purposes. An old method, in the country, of freeing a kettle of the fur which has accumulated, is to expose it wet to frost. The force of crystallization has been ingeniously proposed as a test of the strength and durability of building stones. A piece of a certain size is dipped in a solution of a salt, and hung up in the air; crystallization takes place, which represents the freezing of water, thus imitating the weathering of stones, and according to the effect so is it judged.

The heat which is absorbed in summer by the melting of the snows and glaciers is very great, as may be gathered by the torrents of water which flow from them, and considering that every 3½ cubic feet absorbs the heat given off by a pound of coals.

The facility with which ice adheres together is remarkable. If two pieces rest together for a short time, they become frozen together. Ice adheres also very strongly to flannel, but not to linen, or to metal. No doubt this power of adhesion of two surfaces of ice assists very much in the formation of icebergs.

In the next lecture the phenomena of vaporization of liquids, and liquefaction of vapours, will be considered.

OXFORD ARCHITECTURAL SOCIETY.

The fifth annual meeting was held June 17, the Rev. the Rector of Exeter College in the chair.

After a few preliminary observations, the chairman read the annual report of the committee. He congratulated the society on the steady progress of the "Study of Gothic Architecture," which is daily becoming more general: the good effects of this are already visible on all sides, and still greater effects may yet be looked for. He rejoiced to observe the formation and successful progress of similar societies in various parts of the kingdom, and mentioned particularly the Cambridge and the Exeter Societies as very flourishing and efficient. The mutilation and destruction of the remains of Gothic architecture has been checked and well-nigh stopped, although a few more instances may still be heard of occasionally, as at Newcastle, where an ancient church has been wantonly destroyed within the last few weeks; the general indignation with which such acts are now viewed, by all persons who have any pretensions to the rank of educated or enlightened men, is a guarantee that they will not be frequent. There is, however, another just ground of alarm in the mischief which is daily perpetrated under the *name of restoration*, which, when conducted without sufficient knowledge, is often productive of more injury than benefit, and should be very closely watched. Irreparable injury is often done by ignorant persons, under the plausible pretext of merely *scraping* off the whitewash, and still more when the decayed surface of the stone has also to be scraped.

In this university and city, there have been four instances of restoration within the past year, which are deserving of praise. At St. John's College the chapel has been restored in a very elaborate manner, and with good taste. At Merton, the roof of the ante-chapel, which was in a decayed state, has been renewed, and the floor for the ringers in the tower removed, throwing open a fine groined wooden ceiling, which is a great improvement; but the gallery for the ringers, which has been introduced in the place of the old floor, would have been better omitted. In St. Aldgate's Church the general effect of the exterior is pleasing, but there might have been more accuracy in the details; and we cannot but regret the loss of the old library. At Holywell, though the exterior is less striking, all the detail is admirable, and in the interior the good effect of open seats is fairly seen, and the manner in which this restoration and enlargement have been executed is worthy not only of praise, but of imitation. The restoration of St. Peter's in the East is now also in progress, and it is hoped that the most scrupulous care will be taken to preserve entire the character of the building, even in its most minute details, and that no attempts at *improvement* will be allowed to interfere with the designs of the original architects of this interesting and valuable relic of antiquity.

The publications of the society during the year have been: the second part of the "Guide to the Architectural Antiquities in the neighbourhood of Oxford," of which a third part is now in preparation; several sheets of working drawings of ancient pews and pulpits, which are found very generally useful, and are readily purchased. Two new sheets were laid on the table, containing the details of the pulpits of Beaulieu, Hants, of stone, very early, in the Decorated style. St. Giles's, Oxford, of wood, also in the Decorated style, but late; and Coombe, Oxfordshire, of stone, in the Perpendicular style. The drawings of Shottesbroke Church, a well-known and very perfect specimen of the Decorated style, have been engraved, and will be ready for publication in a few days; for these drawings the society is indebted to W. Butterfield, Esq. The drawings of Minster Lovell Church, a good specimen of the Perpendicular style, promised at the two last annual meetings, are still not ready, the architect who undertook to furnish them having failed to fulfil his engagement. The drawings of Wilcote Church, presented by C. Buckler, Esq., were laid on the table, and will be engraved immediately; this is a small church in the Decorated style. Also those of St. Bartholemew's Chapel, presented by C. Cranston, Esq.; this is a small but elegant building of the period of transition from Decorated to Perpendicular. New editions are preparing of Stanton Harcourt and Haseley: to the series in 8vo. it is proposed to add the papers on Ewelme and Dorchester, lately read by Mr. Addington, for which the drawings are ready.

A paper was read on *Dorchester Church*, Oxfordshire, by Henry Addington, Esq., of Lincoln College, illustrated by a large number of drawings of all parts of the building, including the original drawings by Mackenzie, for "Skelton's Oxfordshire," which were kindly lent for the occasion by the Rev. H. Wellesley. Mr. A. gave an outline of the early history of Dorchester, with its bishopric and abbey, showing clearly that there was a Saxon church on this site, but considers no part of the existing building earlier than the middle of the twelfth century (unless it is a small portion of the masonry of the tower), and the greater part is of the time of Edward I. The two semicircular arches, which have been sometimes considered as Saxon, are evidently cut through the Norman walls, and are probably of the time of Charles II., when the church was repaired after the injury it had sustained in the civil wars.

THE NEW HOUSES OF PARLIAMENT.

The Select Committee of the House of Commons appointed to inquire into the present state of the building of the New Houses of Parliament, and to report thereon to the House, have, pursuant to the order of the House, examined the matters to them referred, and have agreed to the following report:—

Your Committee have examined Mr. Barry as to the progress already made in the building of the New Houses of Parliament, and have endeavoured to ascertain from him the probable time that will elapse before the whole of the works can be completed, and the period at which the two Houses may be occupied for the transaction of public business.

He has stated to them, that, were it urgently required, the Houses, and a certain number of committee-rooms, and other offices, might be prepared for occupation at the commencement of the year 1846; but your Committee do not feel themselves justified in affirming that such occupation could take place without inconvenience to the members, or impediment to the further progress and satisfactory completion of the building; and they think it right to observe, that the general arrangements for ventilation cannot be completed until the commencement of the year 1847.

Your Committee have examined the Speaker, the Clerk of the House, and the Serjeant-at-Arms, as to various alterations which have been lately proposed in the interior arrangements of the House of Commons, and of some portions of the building immediately adjoining, and have to report that Mr. Barry will be able to adopt several valuable suggestions which the experience of the officers of the House has enabled them to offer, without any increase of the expenditure already authorized.

Your Committee have examined various parties as to the course hitherto adopted by Mr. Barry, with reference to alterations of the interior arrangements shown in the plan approved by Committees of both Houses in 1836. They impute no blame to Mr. Barry for that course, and have every reason to believe that all the alterations hitherto made have conduced to the convenience and general effect of the building; but looking to the misapprehension that appears to have prevailed as to these proceedings hitherto, they are prepared to recommend that in future Mr. Barry should make a half-yearly report of the progress of the works to the Commissioners of Woods and Forests; and should also submit to that board any alterations which may hereafter be deemed advisable, and accompany such report with plans of the alterations proposed.

Your Committee further recommend, that as several alterations, entailing more or less expense, have recently been sanctioned by the Government, the Chief Commissioner of Woods shall, at the commencement of the next session of Parliament, lay upon the table of the House of Commons a statement of the total estimated cost of the building, according to the latest plan approved.

Your Committee also suggest that a plan, prepared by Mr. Barry under their direction, and exhibiting the present state of the building, and the alterations adopted up to the present time, shall be signed by the Chief Commissioner of Woods, and deposited in the libraries of both Houses.

July 4, 1844.

THE WOOD-PAVING PATENTS.

The Judgment of Lord Chief Justice Tindal in re *Stead* v. *Williams. June* 29, 1844. *Taken from the short-hand writer's notes, reported in the Mechanic's Magazine.*

LORD CHIEF JUSTICE TINDAL.—This was an action for the infringement of a patent granted for an invention for making or paving public streets and highways, and public and private roads, courts, and bridges, with timber or wooden blocks. The defendant pleaded that the plaintiff was not the first and true inventor of the said invention in the letters patent and specification mentioned, besides various other pleas which it is not necessary to particularize with reference to the present motion. Upon the trial at the last summer assizes at Liverpool, before my brother Cresswell, a verdict was found for the plaintiff, and a rule *nisi* was afterwards granted for a new trial; and upon the report of the learned judge it appeared that, before the granting of the letters patent to the plaintiff, there had been published in a scientific work in England a letter from a gentleman of the name of Heard, containing such a description of a mode of paving with blocks as made it fit to be submitted to the consideration of the jury as not differing substantially from the invention for which the patent was granted. It appears also that, in summing up the evidence with reference to the letter above adverted to, the jury were told in substance that, if they thought the patentee had borrowed his invention from the publication which had been proved, he could not be considered as the first inventor. So also that, if the letter had been so far communicated to the public as to have become a part of the public stock of information, and he had thus obtained his knowledge indirectly from the publication, that he was not to be considered as the first inventor within the meaning of the statute. Upon the discussion before us it was contended that this mode of summing up, although undoubtedly correct as far as it went, yet did not present the entire view of the case to the consideration of the jury; for it was argued that if the invention had been communicated to the English public, although it had never directly or indirectly come to the knowledge of the patentee, still he could not be considered as the inventor. It was admitted on the part of the defendant that no case could be cited in which the point had been expressly decided; but it was contended that, in point of reason and principle, such must be held to be the case; for if the invention had already been communicated to the public, it would be unreasonable that they should lose the benefit of it, and be restricted from making use of it by a patent taken out by one whose claim to such patent could only be supported on the ground, of his being ignorant of that which had been already communicated to the rest of the world; and though no decided case was cited, various dicta of various judges were referred to in support of the view as contended for by the defendant, particularly what was said by Mr. Baron Alderson, in Carpenter and Smith, 9 *Meesom* and *Welsby*, 902, and the observation made by Lord Lyndhurst, and other Lords of the Privy Council, as reported in 1st vol. *Webster*, 718. Lord Lyndhurst says, "If the machine is published in a book, distinctly and clearly described, corresponding with the description in the specification of the patent, though it has never been actually worked, is not that an answer to the patent? It is continually the practice on trials for patents, to read out of printed books, without reference to anything that has been done." Again he says, "If the invention is in use at the time the patent is granted, the man cannot have a patent, although he is the original inventor; if it is not in use he cannot obtain a patent if he is not the original inventor. He is not called the inventor who has in his closet invented it, but who does not communicate; the first person who discloses that invention to the public is considered as the inventor." Upon a full consideration of this subject we have come to the conclusion that the view taken by the defendant's counsel is substantially correct; for we think if the invention has been already made public by any description contained in a work whether written or printed, which has been publicly circulated, in such case the patentee is not the first and true inventor within the meaning of the statute, whether he has himself borrowed his invention from such publication or not, because we think the public cannot be precluded from the right of using such information as they were already possessed of at the time the patent was granted. It is obvious that the application of this principle must depend upon the particular circumstances which are brought to bear upon each particular case. The existence of a single copy of the work, though printed, if brought from a depository where it has long been kept in a state of obscurity, would afford a very different inference from the production of an Encyclopædia, or other work in general circulation. The question will be, whether, upon the whole evidence, there has been such a publication as to make the description a part of the public stock of information? We think, therefore, as this question has not been submitted to the jury, there ought to be a new trial in this case.

COAL-BREAKING MACHINES.

Among the many improvements which have lately taken place in the business operations of this region, there is none more striking than the saving of expense in breaking and screening coal. A few years since every ton of coal which was broken for shipment cost from 30c. to 37½c. to reduce it to proper sizes, while now the expense will not much exceed one-fifth of this amount. This truly surprising result, as many others of a similar kind is the effect of machinery, and has been brought about by successive experiments and improvements. The attempt to break coal by machinery, we believe, was first made by Mr. Sabbaton, and afterwards by Mr. Larer, but not proving as successful as was anticipated, they were afterwards abandoned. Improvements were then made upon the old system of breaking with the hammer, and instead of breaking in the pile, cast-iron plates, with holes sufficiently large to allow coal of proper size to pass through were used. This was found to diminish the expense considerably, making the cost of breaking about 20c. or 25c. per ton. A further improvement was then made by turning the screens by steam instead of hand, which caused a still further reduction in the expense of preparing the coal for market, the cost being from 12c. to 18c. per ton. But satisfactory as these results were, and greatly reduced as the expenses have been by these improvements, Mr. Battin, of Philadelphia, has improved upon them, and invented a coal-breaking machine, which will, in all probability, supersede every other invention of the kind, and eventually enrich its ingenious inventor. One of these machines was first erected at Mr. Bast's mines, for the purpose of breaking white ash coal, and found to answer every purpose intended; but, at the same time, fears were expressed that it could not be used to advantage in breaking the red ash. Subsequent events have shown that these fears were groundless, and a machine is now in operation at Milnes and Spencer's mines, by which the red ash is broken with no greater loss than on the cast-iron platform. Encouraged by these successful experiments, other machines are now in the course of erection at the collieries of Andrew B. White, and also at the Delaware Coal Co.'s works, the latter of which will, probably, go into operation during the present week, and the former the ensuing week. These machines, to work advantageously, require engines of about 20-horse power, and will break the coal at an expense of from 8c. to 10c. per ton, according to location, including 3c. per ton, which is paid the patentee. Another machine for the same purpose, but constructed upon an entirely different principle, we learn has been put in operation by the Beaver Meadow Coal Company. This machine consists of a square box, in which are several iron bars placed longitudinally at such distances apart as will make the coal of proper size, while a roller is so situated as to pass over and force the coal through the openings. The invention is favourably spoken of, and will no doubt answer a good purpose in breaking the white ash, although we learn the waste is much greater than that caused by Mr. Battin's machine.—*Miners' Journal (of America).*

CAPTAIN WARNER'S EXPLOSIVE POWER.

It has long been known to the public that Captain Warner was in possession of an explosive power with which he had already experimented upon privately.—Negociations have been going on with Government for some time, but without coming to any successful issue, it was therefore determined by the friends of Captain Warner, to try the experiment without the aid of Government, for this purpose Mr. Soames the eminent ship owner, liberally offered a vessel for the occasion, and some private friends of the Captain raised the sum requisite for the attendant expenses.—The vessel selected was the "John o'Gaunt," a barque of 300 tons burthen, three masted, full bowed, strongly built and seaworthy, she was given up to the Captain early in the present month, and towed round to Brighton, where the experiment was to take place.

The vessel was taken in tow by the "Sir William Wallace" steamer, on board of which was Captain Warner, accompanied by another steamer, "The Tees," and was brought round shortly before six o'clock in the afternoon to the position she was appointed to occupy, about a mile and a quarter from the Brighton shore, opposite the Old Ship Hotel and the Battery. It was previously arranged that from the signal-staff of the battery on the west cliff, a flag was to be hoisted, by the command of Lord Ingestre and Captains Dickenson and Henderson, to indicate to Captain Warner when the ship, the subject of his operations, was to be destroyed. The reason of this arrangement was to remove any doubt as to the bonâ fide nature of Captain Warner's power of destroying a pursuing vessel, without having any communication with that vessel at the moment of her destruction.

As soon as the "John o'Gaunt" had been towed to her position, the most intense anxiety prevailed among the spectators on shore, and every movement of those on board the tug-boat was watched with the greatest interest. Captain Warner was himself on board the tug, and it had been previously arranged that when the signal was given from the battery the crew of that vessel should go below, leaving no other persons on deck but the captain and the mate. This arrangement was observed; and immediately afterwards, the steamer, which had hitherto been towing the ship by a hawser, put back, and came abreast of her—a position which she maintained for a very few moments, and then again proceeded to her former situation, about a quarter of a mile eastward of the John o' Gaunt.

Captain Warner now hoisted a Union Jack at the mast-head of the steamer, denoting that he was ready to operate, and only awaited the hoisting of the Union Jack from the flagstaff on the battery, to be replied to by Captain Warner hauling down his signal. This had been flying some time before it was answered from the battery; and then arose another delay, in consequence of some adventurous persons in a small cutter, in spite of the presence of the Tees, and of two armed revenue cutters besides, to keep off intruders, going close alongside the ship. Captain Warner hauled the Union Jack half-way down only until the cutter and its occupants were out of danger. The Union Jack was then hauled down entirely. The grand crisis had now arrived; and we may say, without exaggeration, that the suspense of all present was painful; the silence was deep and unbroken. At six o'clock, precisely, the devoted vessel appeared to be struck midships, at which point shot up a huge column of water, intermingled with the shingle of her ballast, which was mistaken by most persons for a cloud of smoke. Then a low booming and gurgling noise, indicating a submarine explosion, but not approaching a loud report. "The vessel is struck!" was uttered by a thousand voices, and the next thing to be seen was the falling of the mainmast and the mizen mast. In less than a minute, the vessel was riven almost from stem to stern, and in less than two minutes and a half the vessel literally tumbled to pieces as if by magic. Her mizen went by the board, her mainmast, a new one, was shot clean out of her; she heeled over to port to an angle of 45 degrees, and her main hatchway being open, daylight was visible through her bottom timbers on her starboard side, and probably her larboard also, having been blown away, and she seemed to part asunder as she went down, in about 35 feet water, leaving nothing perceptible but the top of her foremast. The time which passed from her being struck and her sinking could not have exceeded 2½ minutes. Some few of the more enthusiastic spectators, chiefly professional men, raised a cheer, but with the mass all was mute astonishment. The eyes were rivetted on the last observable fragment of the large object that but the moment before floated gallant on the waters "like a thing of life." A work of destruction so sudden, so frightful, so stupendous, appeared impossible for a moment even to the thousands and tens of thousands that witnessed it. It was like an awful mystery. There were none of the ordinary circumstances which accompany similar catastrophes. There was no smoke, there was no fire, there was no noise, save the low groan of the rending timbers, and the succeeding hush of the waters as they rolled over the instantaneous wreck, and then arose a melancholy feeling, for it was impossible to prevent the imagination depicting the terrific effects of such an explosion upon a peopled ship, thus silently and suddenly perishing. The success of the experiment is admitted to have been perfect and entire: and the wonderfully destructive power of its agency is universally admired. The 'modus operandi' is kept secret; and, so long as this is the case, it will be impossible to say how far, under all circumstances, it would prove efficacious against an enemy's fleet, or safe for our own fleet to carry.

The following certificate has been issued:—

July 21.

We, the undersigned, hereby certify that the operations against the John o'Gaunt, of 300 tons, conducted by Captain Warner, off Brighton, on Saturday the 20th instant, were under our management and control. We further certify that the explosion did not take place from any combustible matter either on board or alongside the ship, but was caused by Captain Warner, who was on board the William Wallace steamer, having the ship in tow at a distance of about 300 yards, and that the explosion took place in consequence of a signal made by us from the shore, the time of which was not previously known by Captain Warner.

We further declare our belief that Captain Warner has never been on board the ship since she left Gravesend.—Ingestre, Captain, R.N., C.B.; T. Dickenson, Captain, R.N.; W. H. Henderson, Captain, R.N., C.B.—Abridged from the Times.

It is stated that Captain J. Norton has invented a most formidable percussion shell, to explode at the bottom of the sea. An iron tube, like the barrel of a musket, is screwed into a shell of any size, water-tight. A rod of iron, about ½ lb. weight, and one foot in length, is suspended within the tube, by means of a split quill passing through a hole in the upper end of the rod, the other end being armed with a percussion cap. The mouth of the tube is closed with a screw lid, almost water-tight. Tin or brass wings being attached to the upper end of the tube, will keep it in a vertical position during its descent to the bottom of the sea; and the shock, on its striking the bottom, will cause the bar of iron within the tube to fall and produce the percussion and explosion. Should it be found difficult to make the shell water-proof, Captain Norton is satisfied that percussion powder, made from silver, will explode by friction or percussion, even when "mixed with water." These shells have been also adapted to field artillery, and have been pronounced "simple, safe, and efficacious."

The properties of explosive compounds are interesting at this moment, in their assumed connexion with Captain Warner's secret. Two of the most formidable compounds known are said to be the chloride of nitrogen, or azote; and its brother compound the iodide of ammonium, or nitrogen. The mechanical force of the chloride of azote in detonation, is superior to that of any other known, not even excepting the ammoniacal fulminating silver. Dulong was the first to investigate the iodide of ammonium, and exchanged for his knowledge in one experiment three fingers, and in a succeeding experiment, an eye.

"THE CITY OF LONDON" IRON STEAM-SHIP.

This magnificent iron steamer has just been constructed in the Clyde, by Mr. Robert Napier, at the expense of 40,000*l*., for the Aberdeen and London Steam Navigation Company, for steaming regularly between Aberdeen and the metropolis. She has just made her first voyage from Aberdeen to Wapping, in an unusually short space of time; though the wind was adverse, and she had on board, besides passengers and a cargo of goods, 210 head of cattle, and 700 boxes of salmon. On her return from the Thames to Aberdeen, she accomplished the passage in 38 hours.

The City of London is of admirable symmetry, and nice proportion of length, breadth, and height; which detract from her apparent magnitude. She is, however, a stupendous vessel, and commodiously planned; her large dimensions giving scope for every accommodation. Her actual measurement is as follows:—

	Feet.	In.
Length between perpendiculars	215	0
Length over all	231	0
Breadth of beam between paddle-boxes	31	0
Extreme breadth across paddle-boxes	52	6
Depth of hold	20	0

Her two engines together are rated at 430-horse power, and her registered tonnage is 732 tons—her measurement, 1110 tons. The poop stands 4 feet above the main deck, and is 65 feet long, and nearly 40 feet broad. The cabins are spacious and comfortable, and the ornaments are much more chaste than usual. In a pleasure trip, this superb vessel, it is reported, accomplished the voyage from Greenock to Aberdeen, a distance of 540 miles, in 42 hours, or at the rate of about 13 miles an hour. Captain Cargill, by whom she is commanded, speaks highly of the ease with which she may be managed. With the exception of the Great Britain, which has not yet been to sea, she is the largest iron steam ship afloat.

Marine Glue.—The naval correspondent of the *Times* at Sheerness says that the Speedwell, tender to the Blazer, is in dock having her bottom cleaned and coppered, the marine glue with which she was sized about four months since having proved a failure as a substitute for copper in keeping clean and free from animal and vegetable excrescences the bottoms of the vessels to which it has been applied.

The Waterman Steamer No. 12.—An extraordinary instance of despatch and facility in the construction and completion of steamers was exemplified in the build of this iron steam-boat, one of which class so boldly, a short time since, made the passage to Ostend. The Waterman No. 12 was built by Messrs. Ditchburn & Mare, from new drawings, in five and a half weeks, and directly after the launch taken to Deptford, where in 47 hours after, Messrs. Penn and Son had completely shipped her engines, steam got up for trial, and without delay the vessel loosed her mooring and proceeded up the river.

Her Majesty's Steam-frigate Retribution.—This vessel, which has just been launched at Chatham, is the largest steam-frigate and the finest vessel of her class in the service. She is longer by 5 feet than the Penelope, which ship it will be recollected was originally a sailing frigate of the 38-gun class. The Retribution is one of the most perfect specimens of naval architecture we have seen, and has been turned off the stocks in a manner highly creditable to her constructor. Her frame is of Italian oak, her planking and decks are of teak, and her beams are of African teak. She is frigate built, with ports fore and aft on her main deck, and has very superior accommodation, not only for her own crew, but for troops, as, in addition to her own ship's company, which is to consist of 200 men, she can convey a full regiment of soldiers a thousand or eleven hundred strong. She is constructed upon the Surveyor of the Navy's improved system, with iron diagonal riders at reverse angles, with wood trussing in the frame and shelf pieces fore and aft. Although longer than the Penelope, she is not so broad as that vessel by three inches, but she carries 25 tons more, and has engines of 150 h. p. greater; the comparative dimensions of the two ships being as follows:—

	The Retribution.	The Penelope.
Length	220 feet.	216 feet.
Breadth	40 ft. 6 inches.	40 ft. 9 inches.
Tonnage	1,641 tons.	1,616 tons.
Engines	800 horse power	650 horse power.

The draught of water of the Retribution when she is fully equipped, and has her water, provisions, stores, and 500 tons of coal on board, will be 18 feet. She is not to be ship rigged, but will have two masts, like the present men-of-war steamers, which have only two masts, with the exception of the Penelope, which has a mizen as well as a fore and main mast. The armament of the Retribution will consist of six 8 inch pivot guns, and four 32-pounders, besides two smaller guns for boat and other purposes, making altogether 12 guns. By this it will be perceived that she is not so powerfully armed as the Penelope, as that vessel carries 24 guns—namely, ten 8-inch pivot guns, two 42-pounders (pivots), ten 42-pounders, carronades, and two boat guns. The machinery for this splendid vessel, made by Messrs. Maudslay, Son, and Field, is quite ready to be put on board. There are two engines, each having two cylinders of six feet diameter and seven feet length of stroke. The paddle-wheels are 34 feet in diameter and 13 wide; the shafts which carry them are of wrought iron, each nearly 30 feet long and 1 foot 10 inches in diameter in the middle. We believe they are the largest shafts which have ever been made for any purpose. The boilers are four in number, and so constructed that they may be worked separately or altogether. The entire weight of the machinery, including water in the boiler, is 600 tons. The Retribution is to be taken into dock and coppered, and brought forward for commissioning immediately.

The Telephone.—At the last levee-day at the Admiralty amongst the numerous models in the waiting-room was Captain J. N Tayler's telephone instrument, which was exhibited to the Lords Commissioners. The chief object of this powerful wind instrument is to convey signals during foggy weather, when no other means present itself, by sounds produced by means of compressed air forced through trumpets, which can be heard at the distance of six miles. This important instrument will tend to prevent collision at sea and on railways, and will lessen the horrors of shipwreck and capture, and give notice of fire. Vessels in the offing will be by it directed into harbour, and the time to enter tide harbours made known from the pier-head. The four notes are played by opening the valves of the recipient, and the intensity of sound is proportioned to the compression of the internal air. The small-sized telephone instrument, which is portable, was tried on the river, and the signal notes were distinctly heard four miles off.—Times.

Screw Propellers on Canals.—Steam tugs with screw propellers have been successfully introduced on the Union Canal. An experiment with one of these steamers took place a few days ago. The boats are the first of the kind introduced into Scotland. They are built of iron by Messrs. John Reid and Co., Port Glasgow; and the engines, screw propellers, &c., are fitted up by Mr. William Napier, sen., engineer, Glasgow. The engines are on the upright principle. They communicate their power to the screws placed on each side of the bow; and by a very nice arrangement of wheels with wooden and iron teeth (in order to prevent noise and vibration) they are driven at a great speed without creating any of that surge or wash on the banks which has hitherto formed the chief objection to the use of steamers on canals. The result of the experiment gave great satisfaction to all present; and, independently of the gain in point of speed, it is calculated that there will be a considerable saving in expense, compared with the ordinary mode of tracking by horses. The steam-boat had attached to her six very large scows deeply laden, but it is capable of towing double the number without material diminution of speed. The scows to be tracked are connected together by rods having a parallel movement, and all under the control of the steersman on board the steamer, so that the necessity of a separate rudder and steersman for each scow is avoided—the whole train moving along with a steady and uniform motion.—'Glasgow Citizen.'

The Tagus Steamer has undergone a complete refit at the factory of Messrs. Miller and Ravenhill. Her former boilers have been removed, and new ones on the double-storied tubular plan substituted, by which the following advantages are stated to have been realized:—A saving in space of about one-fifth as compared with the old; a less displacement by about 6 inches, the vessel floating that much lighter; an economy of weight of nearly 50 tons, the former boilers and water being nearly 130 tons, and the present 80 tons; an increase of power, by using a greater pressure on the steam valve with perfect safety, the present boilers working up to 25 per cent. of what they are proved capable of sustaining, and those of the old construction to 75 per cent. Nor are the boilers themselves the only improvement that has been made in the machinery department. A simple and very effective arrangement of the cut-off valves by Mr. Lamb has been adopted, and the supply of the oil to the bearers has been regulated by the adoption of Allen's lubricators, by which the consumption of oil is reduced to 30 per cent. of its former waste. The excellent blow-off valves of Mr. Kingston have also been brought to bear in their fullest extent, and to great advantage.

The Channel Steam Packets.—The report of General Paixhans on a credit of 1,682,000 francs for the construction of three steamers between Calais and England, was distributed last week in the Chamber of Deputies. The Débats, in mentioning this fact, says—"The English have at present, for Calais and Ostend, eight steamers, which altogether have 650 horse-power. They have given to some of these packets engines of a very superior description, and have placed them under the direction of the Admiralty. The Princess Alice, of 140 horse-power, crosses the Channel in 130 minutes, with wind and tide against her. France has on this line but three steamers, together of 160 horse-power. They are crazy vessels, often obliged to demand the assistance of the steamers, when the sea is high, to take over our despatches."

Enlargement of the Bristol Docks.—At a special meeting of the Town Council of Bristol, on Monday, a report from Mr. Brunel, relative to the contemplated enlargement of the South entrance lock of Cumberland Basin, was submitted. Mr. Brunel is of opinion that to commence a thorough repair of the lock would be the same thing as its re-construction. The expense of widening it will only, he thinks, entail an extra cost of about 5,000*l*. The expense of a lock 52 feet wide and 240 feet in length will be 22,000*l*., and this will be amply sufficient for all the ordinary steam boats employed in the Irish trade. It was stated that the masonry is in a very defective state, both as to the banking and facing, and also that the fronting had been separated from the banking nearly 18 inches. Some discussion occurred as to the impropriety of limiting the increase to 52 feet. Most of the Royal Navy steamers, it was contended by the objectors, were 60, 61, or 62 feet wide, and all those were now thought to be rather too narrow. Fifty-two feet would not admit such a vessel as the Great Western in sea-going trim. Ultimately, however, the recommendation of Mr. Brunel was agreed to.—Railway Magazine.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM JULY 3, TO JULY 24, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

Guy Carlton Coffin, of Lunaford, Wilts, esquire, for "certain Improvements applicable to locomotive, marine, and stationary engines."—Sealed July 3.

Anthony Lorimer, of Clerkenwell Close, Middlesex, bookbinder, for "certain Improvements in the apparatus and means of facilitating drawing from nature or models."—July 3.

Henry Smith, of Stamford, Lincolnshire, agricultural implement maker, for "certain Improvements in the construction and arrangement of hand-rakes and horse-rakes, and in machinery for cutting vegetable substances."—July 3.

Charles Nossiter, of Linden End, near Birmingham, tanner, for "Improvements in tanning hides and skins."—July 3.

John George Bodmer, of Manchester, engineer, for "certain Improvements in locomotive steam-engines, and in carriages to be used upon railways, in marine engines and vessels, and in the apparatus for propelling the same, and also in stationary engines, and in apparatus to be connected therewith."—July 3.

Christopher Dunkin Hays, of Bermondsey, Surrey, wharfinger, "for Improvements in propelling vessels."—July 3.

Octavius Henry Smith, of Wimbledon, Surrey, esquire, for certain "Improvements in steam engines, boilers, and condensers."—July 3.

Stephen Bencraft, of Barnstable, esquire, for "Improvements in the construction and fitting up of harness for the prevention and cure of galled shoulders to draught horses."—July 3.

James George Newey, of Birmingham, hook and eye manufacturer, and James Newman, of the same place, jeweller, for "Improvements in fastenings for wearing apparel."—July 3.

Thomas Syson Cundy, of Cutler-street, builder, for "certain Improvements in the construction and arrangement of stoves and fire-places."—July 3.

Willoughby Theobold Monzani, of Wellington-terrace, Ramsgate, gentleman, for "certain Improvements in the construction of boats for the preservation of life and property, and in apparatus applicable thereto."—July 3.

Daniel Stafford, of Grantham, gentleman, for "Improvements in apparatus for preventing what is termed smoky chimneys or dues, and for the extinction of fire in chimneys or flues."—July 3.

Timothy Fisher, of Liverpool, mechanic, for "Improvements in locomotive engines."—July 10.

Moses Pole, of Serle-street, gentleman, for "Improvements in the manufacture of paper." (Being a communication.)—July 10.

Moses Poole, of Serle-street, gentlemen, for "Improvements in the manufacture of oils by using a material not hitherto employed, and in obtaining stearine therefrom, applicable in the making of candles, and also in the manufacture of manure from the residuum of such oils with other matters." (Being a communication.)—July 10.

William Bedington, jun., of Birmingham, manufacturer, for "Improvements in the construction of furnaces."—July 10.

Charles Henry Capper, of Birmingham, engineer, for "a certain Improvement or certain improvements, in the manufacture of palisades, gates, and fences, the whole or part of which improvements may be applied to other purposes."—July 10.

William Newton, of Chancery-lane, Middlesex, civil engineer, for "certain Improvements in the manufacture of wire from zink, and the application of the same to various useful purposes."—July 10.

Henry Highton, of Rugby, Warwick, master of arts, clerk, for "certain Improvements in electric telegraphs."—July 10.

Robert Beart, of Godmanchester, Huntingdon, gentleman, for "Improvements in apparatus for boring in the earth and in stone."—July 10.

John McBride, manager of the Nursery spinning and weaving mills, Hutchesontown, Glasgow, for "certain Improvements in the machinery and apparatus for weaving by hand, steam, or other power."—July 15.

James Harrison, of Irwell House, Bury, Lancaster, manufacturer, for "certain Improvements in machinery or apparatus for spinning cotton and other fibrous substances."—July 15.

Henry Davies, of Norbury, Stafford, engineer, for "Improvements in the construction of certain steam-engines, also in the application of steam to such engines."—July 15.

William Taylor, of Regent-street, Middlesex, gentleman, F.L.S., for "Improvements in the manufacture of oil from a vegetable, not hitherto so used."—July 15.

Jacques Bidault, of Paris, merchant, for "Improvements in applying heat for generating steam, and for other purposes, which improvements may be employed to obtain power." (Being a communication.)—July 17.

Charles Armengaud, of Paris, engineer, for "Improvements in apparatus for heating apartments, and other places, and in apparatus for cooking. (Being a communication.)—July 18.

Henry Bewley, of Lower Sackville-street, Dublin, apothecary and chemist, and George Owen, of the same place, chemist, for "Improvements in the mode of confining corks, or substitutes for corks in bottles and other vessels, whether made of glass, earthen, or stone ware, containing liquids charged or not charged with gas."—July 20.

James Nield, of Taunton, in the State of Massachusetts, North America, for "certain Improvements in looms."—July 24.

Sarah Coote, of Clifton, near Bristol, Gloucester, for "Improvements in caulking ships, boats, and other vessels."—July 24.

Charles Humfrey, of Cross-lane, St. Mary at Hill, London, for "Improvements in the manufacture of candles."—July 24.

General George Wilson, of Cross-street, Islington, machinist, for "certain Improvements in the construction of chimneys and flues, and in furnaces, stoves, grates, or fire-places generally."—July 24.

William Brockedon, of Devonshire-place, Queen-square, gentleman, for "Improvements in covering the roofs of houses and other buildings, in covering the valves used when propelling by atmospheric pressure, in covering the sleepers of railways, and in covering parts of stringed and keyed musical instruments."—July 24.

Joseph Hall, of Bloomfield, iron works, Tipton, Stafford, ironmaster, for "Improvements in the manufacture of horse-shoe nails."—July 24.

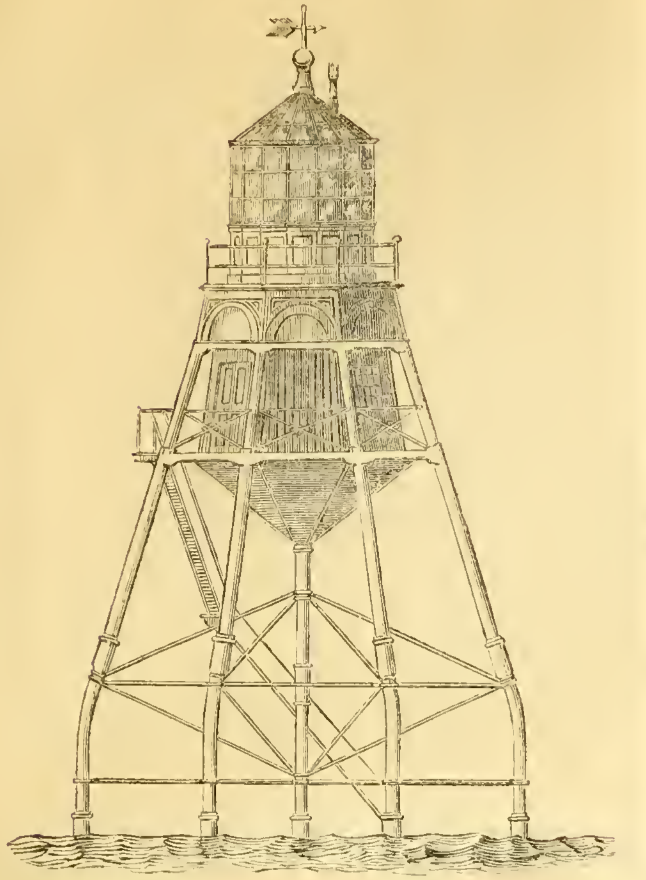
John James Russell, and Thomas Henry Russell, both of Wednesbury, Stafford, tube manufacturers, for "Improvements in the manufacture of welded iron tubes."—July 24.

James Kite, of Hoxton, coal-merchant, for "certain Improvements in constructing chimneys, and in the means used for sweeping the same, parts of which improvements are applicable to other like useful purposes."—July 24.

Edmund Pace, of the firm of Messrs. Taylor and Pace, of Hackney, in the county of Middlesex, gentleman, for "Improvements in the machinery for figure weaving in silk, and other fabrics."—July 24.

THE RIVER DEE LIGHTHOUSE.

Fig. 1.

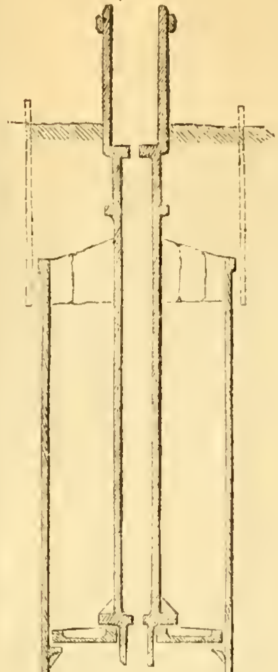


We are glad that the ingenious inventions for constructing lighthouses on sands, which we were among the first to recognize, may now be considered as fully established in the catalogue of engineering resources. It is by such applications of science to the useful arts that engineering acquires and extends the strong hold, which it is evidently taking on the public mind, and the importance which is being communicated to its professors. We are fortunately a very practical people, and nothing can be more welcome than those exertions of ability conformable to our disposition, while it need scarcely be said that he who invents a new machine adds to the power and wealth of our common country. Thus in the instance before us, property is to be secured, life preserved, and commerce extended by the improvement of our harbours, and by the detection and prevention of marine risks.

The construction of Lighthouses on sand-banks is a modern invention, and has already been successfully adopted, as shown by drawings in our Journal, at Fleetwood, and the Maplin Sands in the Thames. Both these constructions were erected by the aid of Mitchell's Patent Screw Piles, to form the foundation. We have now to record another lighthouse erected under the direction of Messrs. Walker and Burgess, for the Corporation of the Trinity House, at the point of Air, in the county of Flint, at the mouth of the River Dee, a short account of which was given in the Journal for last May, page 208; the foundations are upon a different plan to those before erected, as instead of screw piles, cylinders were sunk in the sands to form the foundations, as we shall proceed to explain.

At low water the sands are dry, when the workmen were enabled to proceed in their operations, by first sinking a slight cylinder of plate iron 4ft. 6in. diameter through the sands to the depth of 4ft.; within this cylinder another cylinder of cast iron 3ft. 9in. diameter and 9ft. long was gradually lowered through the sands by excavating the sand from the inside by the aid of an instrument well known to well-sinkers, called "A Miser;" great precaution was taken to keep the cylinder perfectly perpendicular as it was lowered; within a few inches of the bottom of the cylinder a cast iron flange, 3 inches wide, is cast upon the inside for the purpose of receiving the cast iron disc shown in fig. 3; when the cylinder was sunk to the depth of 12 feet, a hollow cast iron pillar 13 feet high and 1 foot external diameter below, was set in the centre of the cylinder, the foot resting upon the disc at the bottom, as shown in fig. 2; when the pillar was placed in its proper position the surrounding space was filled in with concrete, and on the top were laid large stones about a foot thick, the whole forming an immoveable foundation of 10 tons in weight. There were nine of these cylinders, eight at the angles and one in the centre, sunk through the sand, making together a total weight of 90 tons to receive the lighthouse. On the top of the pillars are cast sockets for the purpose of receiving the bent or curved pillars, as shown in fig. 1, and which were also cast hollow with sockets to receive the inclined pillars upon which the building was erected. The piles are firmly tied together by two tiers of horizontal ties all round the eight sides, and again by diagonal ties from the centre post to each of the angular posts. The upper part of the edifice is inclosed with Palmer's patent corrugated iron plates, with a space on the inside, and lining boards, which form a living room for the attendants: and the conical part below a small kitchen and water closet. The lanthorn above is constructed of gun metal in a very superior manner. The whole of the iron work was prepared by Messrs. Gordon and Co., engineers of Deptford, under the immediate direction and superintendence of Messrs. Walker and Burgess.

Fig. 2.
Section of Cylinder and Pillar.



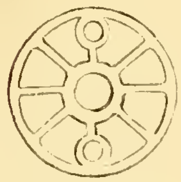


Fig. 3.

During the construction of the lighthouse, and since it has been finished, it has been exposed to some severe gales, which it has withstood with remarkable firmness.

ARTESIAN WELLS AT SOUTHAMPTON.

During the meeting of the Royal Agricultural Society, Dr. Buckland delivered a lecture on Artesian Wells, and in particular on that which is now in progression at Southampton. Though uncompleted, it is a work of immense magnitude, vying with the great well at Grenelle, by which Paris has been lately supplied. The depth of the Southampton well is at present 1,300 feet. The shaft descends through 78 feet of alluvium, 300 feet of clay similar to the London clay (which is a general substratum in the Southampton basin), and through another 100 feet of plastic clay, before it reaches the chalk, through which it descends 100 feet still further. Thus from the surface a well has absolutely been built downwards nearly 570 feet, and under such difficulties from irregularities in the strata that four iron cylinders have been placed in points where no attempt at masonry could have proved successful. Not the least singular part of this work is the manner in which this underground well has been built from the summit level downwards "into the very bowels of the land." This is a matter, however, which it would be tedious to describe; suffice it, therefore, that after reaching a depth of nearly 600 feet, the operations of the masons were suspended, and the boring-rods were brought into operation, and employed until, through their instrumentality, the contractors have reached a depth of 1,300 feet. As might be expected, the supply of water is already abundant. It now rises within 40 feet of the surface, and by the aid of powerful steam-engines no less than 55,000 gallons a day are literally poured into the town of Southampton. It is expected that the water will soon rise to the surface, when the supply will be immensely larger than even this.—*Hull Packet.*

CANDIDUS'S NOTE-BOOK.
FASCICULUS LVII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. Dr. Fulton, I perceive, imputes to me something like indiscretion for urging architects to exercise their invention rather more than they do, and give us something new. He says that the cry should rather be for '*something good*,' 'good:'—of course; but that condition was, I conceived, so evidently implied that there was no necessity whatever for mentioning it. Mere novelty, without any other quality to recommend it may be achieved by any one, and may be had any day; consequently in speaking of novelty or originality as a merit in productions of art or literature, it is naturally presumed that by such term is understood what so far from excluding other excellences, superadds to them a fresh attraction. Dr. Fulton, however, is less *exigeant* than myself, since he, it appears, is content to abide by what is established as 'good,' and would rather dissuade us from aiming at aught better—at least different, lest instead of 'better,' we should obtain 'worse.' It has been urged by many others beside him that a love of novelty has always been a symptom and forerunner of the decline of architectural taste. But then it is because novelty has been valued for its own sake only, and has been made the chief aim irrespective of all other æsthetic merits.

The *toujours perdrix* system is sure to fail even in matters of art; nor does it avail at all to preach against the love of novelty, and say there ought to be no such passion in the constitution of the human mind, since there it *is*, and how is it to be got rid of? To think of eradicating it is hopeless; still we need not wholly despair, since it is possible to *manage* it. This, however, is not to be done by reining it too tightly; not by tying ourselves down to certain approved models, and saying to Art "thus far shalt thou attempt to go and no further!" for in that case Art either degenerates into drowsy, spiritless, plodding routine, or else breaking from all trammels, runs wild and wilful equally unguided and unchecked.

II. The excessive economy in regard to frontage, which the enormous price of ground in the metropolis compels builders to observe, is anything but favourable to the character of our street architecture. Even where several houses are united together into one general façade the narrowness of the individual dwellings interferes more or less with design and with nobleness of style. Very rarely can the appearance of a single large mansion be kept up, if only on account of the windows being put so closely together, and there being such a disproportionate number of doors on the ground floor. If the houses are only two windows in breadth—and a frontage of from twenty to five-and-twenty feet will hardly admit of more, where regard is to be had to expression of solidity and dignity of character,—there will be just as many doors as windows on the ground floor, unless, as is sometimes done, additional windows are put there in order that each front parlour may have two. Yet, instead of at all-mending matters, this only makes them worse, not only destroying all symmetry but causing the whole of the lower part of the building to show itself less solid than the rest, and to appear mean and squeezed up, and cut up, and to be upon a smaller scale. Neither is it much better, if instead of two windows in front below to each house, a single window of larger dimensions be given to the front parlours. In either case—whether there be three openings below to two above, or the same number, but a wider and narrower one,—there is this additional defect, that the lower openings are not in the same line or axis as those over them; consequently, however good the general elevation may be in other respects it is marred by that of the ground floor. Such is the case with the newly erected range of houses in Maddox Street, which is nevertheless by very far the best specimen of street architecture anywhere in town; and to point out what must be an exceedingly great merit in Dr. Fulton's eyes, it has no *cocked hats!* Where the houses are three windows in breadth, the inconvenience here spoken of is, of course, got rid of, but there unless the frontages be proportionably increased, the design suffers in consequence of the windows being too much crowded together. Observation, if not books, may furnish us with a tolerably good general rule in regard to the distance between windows in astylar composition, or where it is not regulated by pilasters or columns, viz., the clear space between the window dressings ought to be equal, or nearly so, to the width of the windows including their dressings. Such we find to be the case in the Travellers' and Reform Clubhouses.

To imagine that grandeur or even importance can be given to street architecture by merely continuing along the same design to an immoderate extent, is a very great error. In such case the idea of unity—of a single façade or mass of building is lost sight of. The eye is offended by a provoking sameness and repetition, where there was opportunity for variety and contrast. The sort of deception to which the spectator would readily lend himself, if practised more modestly and with greater regard to vraisemblance, is altogether frustrated. What was meant to be palace-looking becomes barrack-looking, for the more the design is drawn out the more insignificant do its features and character appear. In a façade composed of several houses, some sort of ratio between height and breadth ought to be observed, so as to produce a well-proportioned mass; which is the more desirable in street architecture, because the sameness of a very extended line of front cannot be relieved or broken up by projecting or receding parts in the plan.

III. There is one tolerably safe mode of experimentalizing with regard to the effect of colours in decoration, which is, to make several drawings of the room or interior which is to be embellished, colouring them differently in order to judge what harmonies or contrasts would best suit the design, or the particular character intended to be given it. Unless this be done, the result must be left more or less to conjecture; excepting indeed nothing more is wished for than what has done over and over again before, in which case there is no experiment to be made. Where colouring is to be employed *architecturally*, some previous general scheme or design of it is almost as necessary as an *outline* one for the forms and surfaces to which it is to be applied, and which it is intended to relieve. Nevertheless, although the study of colours and colouring is one of great interest in itself, and of great artistic importance, it forms no branch of architectural study. There is no system—no principles laid down for it; the subject is not even so much as glanced at by any writers upon architecture; consequently in regard to it, every one is left to become—if he thinks it worth while to do so—his own instructor,—to proceed empirically, picking up what hints and ideas he can for his own information and guidance. People seem to have got a notion that colouring is what they call "*mere matter of taste*," and therefore, according to the well-known rule "*de gustibus*," no matter for criticism to interfere with: as if decoration itself of every kind, and all that constitutes architectural design, were not entirely matter of taste—either good or bad; therefore, to say that it is merely such, is a more easy than satisfactory way of settling "the matter."

IV. At the present day it will not do to talk disparagingly of "mere taste," now that it is made "matter" of public importance, and we have Royal Commissions of Art, who are endeavouring to inoculate us all with Taste—with what success may be more safely predicted some twenty years hence. The "mere-matter-of-taste" folks must hold their tongues, or perhaps, they may talk as much as they please, since their voices are likely to be drowned in the general acclamation and outcry for "Taste." Where the public must pay for Taste whether they will or no, it is better that they should have to pay for good instead of bad, and experience ought by this time to have convinced them that if the good is apt to be expensive, the bad has seldom anything to reconcile us to it on the score of cheapness, as is proved by those samples of it Buckingham Palace, the Post Office, and the British Museum.

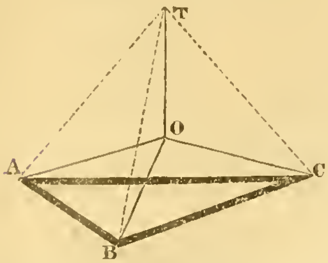
V. Ere very long, it is to be hoped, some engravings will be brought out, affording us faithful delineations of those portions and details of the New Palace of Westminster which are actually executed, leaving others to follow from time to time accordingly as the respective works shall be completed. By that means the living generation of professional men and artists, those abroad as well as here at home, might be put in possession of studies which they cannot hope for, if no architectural work of the kind is to be commenced until after the whole edifice shall have been thoroughly completed. Besides, the time that would be required for bringing out a full series of adequate illustrations of such an extensive pile of building would greatly delay a work of the kind, if it is not to be commenced before the edifice itself is finished. Some may be of opinion that illustrations would be superfluous altogether; since what necessity, they will ask, can there be for showing upon paper what may be as well or better seen in the building itself? According to such argument, no drawings whatever are required of actually existing buildings; whereas, it may be presumed that those in Britton's Cathedrals, and similar works, have very greatly facilitated the study of the originals. Without actual inspection, it is hardly possible to judge truly of a building, but even the most careful inspection, unless repeated again and again, will not enable any one to study it thoroughly in all its circumstances without the aid of drawings, which submit every part of it to close examination. He must be furnished with a most excellent memory indeed—must be able to recollect every particular far better than the architect himself, who could dispense with such assistance.

ORIGINAL PRACTICAL SOLUTION OF AN IMPORTANT PROBLEM.

By Oliver Byrne, Mathematician.

Given the angles of elevation of any distant object, taken at any three stations in the same horizontal plane, and the distances between the stations, or data sufficient to determine them; to find the height of the object, and its distance from any of the stations.

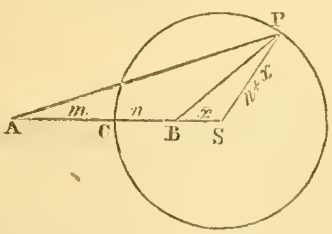
Let A, B, C, be the three stations in the same horizontal plane, T any distant object, T O the perpendicular let fall from T to the horizontal plane passing through A, B, C; the distances A B, B C, C A, and the angles of elevation T A O, T B O, T C O, are given. As A O, B O, C O, are in the same horizontal plane each is perpendicular to T O.



The right angled triangles O A T, O B T, O C T, having a common perpendicular, their bases A O, B O, C O, are in the ratio of the cotangents of the angles of elevation at A, B, C, respectively. Consequently, in the figure A O C B, we have given the lengths of the lines A B, B C, C A, which we shall call a, b, c, respectively, and the ratios of O A to O B to O C, which we shall call $m : n : p$. It is evident, if we find any of the lines O A, O B, O C, we can then readily find the altitude O T, or any other line in the figure; for this purpose we shall first give the following lemma:—

If a straight line A B, be divided in a given ratio in the point C, and A B be produced to S, so that, C S : C A as C B : A C—C B, then if a circle be described with S as a a centre and S C as radius: lines drawn from A and B to any point P in the circumference of this circle will be in the ratio of A C : C B, *i.e.*,

$$AC : CB :: AP : BP.$$



This lemma is proved by that celebrated mathematician Thomas Simpson nearly as follows:—let $AC = m$, $CB = n$, $BS = x$; m is supposed to be greater than n.

$$n + x : m :: n : m - n$$
$$\therefore n + x : m + n + x :: n : m \text{ (Q)}$$
$$\therefore n + x : n :: m + n + x : m$$
$$\therefore n + x : x :: m + n + x : n + x,$$

that is, $SP : BS :: AS : SP$.

$\therefore$ because the angle A S P is common to the two triangles A P S, B P S, they are similar; consequently,

$$BP : AP :: n + x : m + n + x,$$

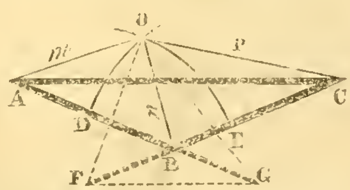
but by (Q)

$$n + x : m + n + x :: n : m$$
$$\therefore BP : AP :: n : m;$$

$\therefore AP : BP :: m : n$ which was to be demonstrated.

S C or $SP = n + x =$ the radius of the circle, is evidently equal $\frac{mn}{m-n}$; and BS or $x = \frac{mn}{m-n} - n = \frac{n^2}{m-n}$.

Now to return to the original horizontal figure A B C O.



Suppose O B to be less than either O A or O C, or suppose n, not greater than m, or p: at B the above construction is to be made: A B, or a is to be divided in the point D, so that $AD : DB :: m : n$;

$$\therefore AD = \frac{ma}{m+n}, \text{ and } DB = \frac{na}{m+n}.$$

BC or b is to be divided in the point E, so that, $CE : EB :: p : n$;

$\therefore CE = \frac{bp}{n+p}$, and $EB = \frac{nb}{n+P}$. Produce A B to G, so that, according to the foregoing lemma, if a circle be described from G as a centre and G D as a distance, all lines as A O, B O, drawn from A and B, to any point O in the circumference may be in the ratio of $m : n$. Again produce C B to F, so that if a circle be described with F as a centre, and F E as a distance, all lines drawn from B and C, to any point O, in the circumference, will be in the ratio of $n : p$.

$$\text{Therefore, } DG = OG = \frac{mna}{m^2 - n^2} = \frac{mna}{(m+n)(m-n)}.$$

$$BG = \frac{n^2 a}{m^2 - n^2} = \frac{n^2 a}{(m+n)(m-n)}.$$

$$FE = FO = \frac{npb}{P^2 - n^2} = \frac{npb}{(P+n)(p-n)}.$$

$$FB = \frac{n^2 b}{P^2 - n^2} = \frac{n^2 b}{(p+n)\ (p-n)}.$$

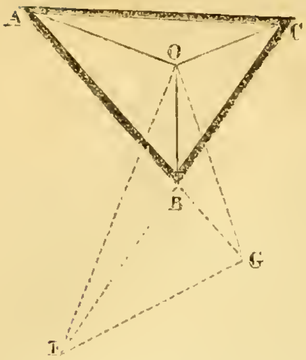
The four lines F O, F B, G O, G B, are readily found, as the expressions for them are suited to logarithmic calculation. Then as the three sides of the triangle A B C are given, the angle A B C = F B C, is readily found; next, in the triangle B F G, there are given F B, B G, and their contained angle F B G, therefore F G and the remaining angles B F G, B G F, may be found; also, in the triangle O F G the three sides are given, consequently the three angles can be determined. The difference of the angles O F G and B F G, is the angle O F B. Now in the triangle B F O we have given O F, F B, and the contained angle O F B, hence O B becomes known. When O B is found, the height of the object T, and its distance from any of the stations are easily obtained. The whole of this detail of execution may be briefly expressed thus:—The four sides F O, F B, G O, G B, of two triangles on the same base F G, being known to find O B, the distance of their vertices. The following rule gives the method of calculation.

Rule.

The station at which the angle of elevation is the greatest, is the vertex of one of the triangles, and the foot of the perpendicular height of the object is the vertex of the other triangle, having the same base as the former, all the sides of which are unknown but may be calculated thus:—add the natural cotangent of the angle of greatest elevation to the natural cotangents of each of the other elevations, and then subtract it from them: find the sub. logs. of these sums and differences. Then find the radii of the circles that determine the point at the foot of the perpendicular height of the object, or two sides of one of the triangles: add together the log. of either of the sides which meet at the station where the greatest angle of elevation is observed, the log. cotangents of the angles observed at the extremities of that side, and the sub. logs. of the sum and difference of the same natural cotangents; this sum will be the log. of the radius on that side produced. The part produced is found by adding together twice the log. cot. of the greatest angle of elevation, the log. of the side produced, and the sub. logs. of the sum and difference of the natural cotangents of the angles of elevation taken at the extremities of that side. Thus we may determine the parts of the sides produced at the station where the greatest angle of elevation is observed, and as the angle contained by them is the angle contained by the horizontal lines meeting at that station which can be readily found, as the three lines joining the stations are given, the common base is readily determined. Hence having all the sides of the two triangles on this common base the distance of their vertices may be found by the rules of plane trigonometry, and therefore the altitude of the distant object and its distance from any of the stations.

Examples.

I. At three stations, A, B, C, in the same plane, whose distances A B, B C, C A, are 462, 429, and 495 feet respectively, the angles of elevation of an object standing perpendicularly over O, are 36° 22′ 07″·93, 48° 45′ 50″·53 and 39° 0′ 26″·91. Required the perpendicular height of the object and the distance from station **B** to O.



The greatest angle of elevation being at B, we shall according to the foregoing directions produce A B and C B.

Elevation at A = 36° 22′ 07″·93 nat. cot. = 1·3579110
„ B = 48° 45′ 50″·53 „ = 0·8765432
„ C = 39° 0′ 26″·91 „ = 1·2345678

So that the lines A O, B O, C O, are respectively to each other
As 1·3579110 : 0.8765432 : : 1.2345678.

As the three sides of the triangle A B C are given, the angle A B C = F B G is found to be 67° 22′ 48″·5.

1·3579110 + ·8765432 = 2.2344542, log. = 0·3491714
1.3579110 — .8765432 = 0·4813678, log. = $\bar{1}$·6824770

* 9·9683516, sub. log. to .... 0·0316484

1·2345678 + ·8765432 = 2·1111110, log. = 0.3245111
1.2345678 + .8765432 = 0·3580246, log. = $\bar{1}$.5539128

† 0·1215761, sub. log. to .... $\bar{1}$·8784239

To find G O.

Log. A B = log. 462 = ... 2·6646420
(A O); log. 1·3579110 = ... 0·1328713
(O B); log. 0·8765432 = ... $\bar{1}$·9427733
* sub. log. found above ...... 9·9683516

G O = 511·2557 ... log. = 2·7086382

To find G B.

Log. A B = log. 462 .... = 2·6646420
Twice log. of ·8765432 .... = 1·8855466
Sub. log. before used .... = 9·9683516

G B = 330·02.... log. .... = 2·5185402

To find F O.

Log. C B = log. 429 .... = 2·6324573
(O C); log. 1·2345678 .... = 0·0915150
(O B); log. 0·8765432 .... = 1·9427733
† sub. log. found above .... = 0·1215761

F O = 614·2167.... log. .... = 2·7883217

To find F B.

Log. C B = log. 429 .... = 2·6324573
Twice log. of 0·8765432 .... = $\bar{1}$·8855466
† sub. log. .... = 0·1215761

F B = 436.091 .... log. .... = 2·6395800

To find the angles B G F and B F G.

B F = 436·094 .... 436·094
B G = 330·020 .... 330·020

Sum = 766·114 Difference = 106.074
F B G = 67° 22′ 48″·5.

As 766·114 .... sub. log. = 7·1157066
: 106·074 .... log. = 2·0256090
: : tan. 56° 18′ 35″$\frac{3}{4}$ .... log. tan. = 10·1760912

: tan. 11° 43′ 57″$\frac{3}{4}$ .... log. tan. = 9·3174068

∴ 56° 18′ 35″$\frac{3}{4}$ + 11° 43′ 57″$\frac{3}{4}$ = 68° 2′ 33″$\frac{1}{2}$ = B G F,
and 56° 18′ 35″$\frac{3}{4}$ — 11° 43′ 57″$\frac{3}{4}$ = 44° 34′ 38″ = B F G.

Since all the parts of the triangle B F G are known except the side F G, it is readily found to be 434·0318.

To find the angle O F G.

614·2167	779·7521	779.7521
434.0318	434.0318	614·2167
511·2557		
	345·7203	165·5354
2) 1559·5042		
779·7521		

sub. log. 614·2167 .... = 7.2116783
sub. log. 434·0318 .... = 7·3624785
log. 345·7203 .... = 2·5387249
log. 165·5354 .... = 2·2188909

2) 19·3317726

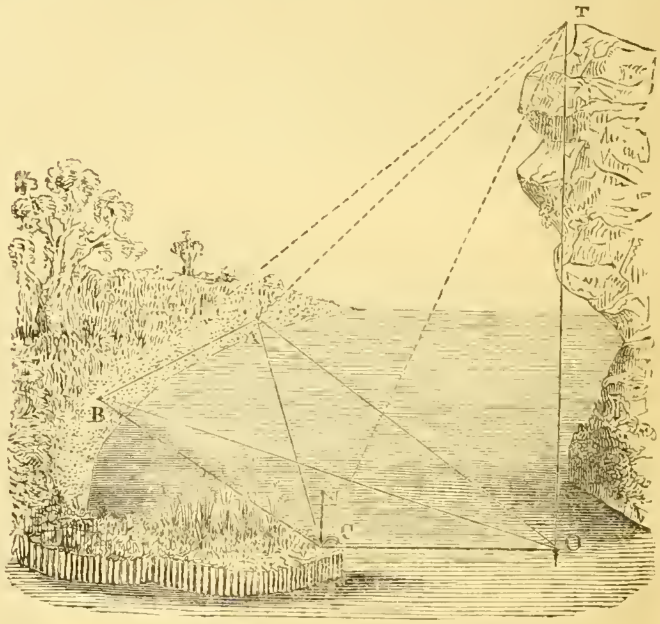
log. sin. 27° 36′ 06″·88 = 9·6658863
2

55° 13′ 13″·76 = angle O F G.
44° 34′ 38″ = „ B F G.

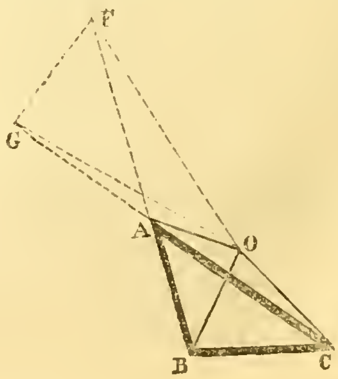
10° 37′ 35″·76 = „ O F B.

Hence, in the triangle B F O, there are given two sides and their included angle, from which the angle F B O is found to be 145° 56′ 48″·81; the angle F O B = 23° 25′ 35″·43; and the side O B = 202.2753. Then with the elevation at B, (48° 45′ 50″·53) and base O B, the perpendicular height of the object is found to be 230·7615.

II. On a sandy beach a horizontal line A B is measured and found



to be 136 yards; a flagstaff is set up at C, or a headland in the same horizontal plane with A B, the angles C A B, C B A, are observed to be 41° and 102° respectively. The angles of elevation of the top of a rock T, at the three stations A, B, C, are observed to be 38°, 31°, and 27° respectively. Required the distance from A to the summit of the rock T, the perpendicular height O T, and the distance from A to O, at the foot of the perpendicular.

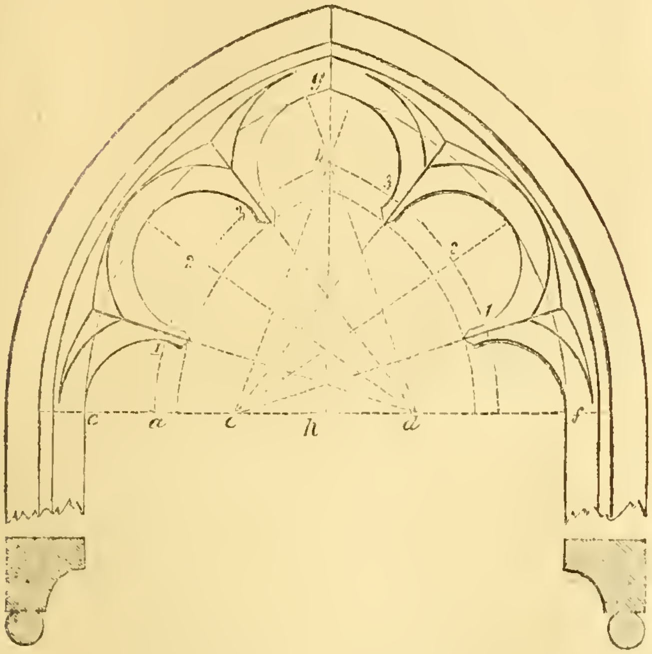


Yards.		Yards.	
A F =	196·8954	A G =	163·5924
F O =	256·0187	G O =	250·8460
A C =	221·0447	A O =	89·7677
B C =	148·2582	A T =	113·9160
F G =	130·0280	O T =	70·1312

∠ O A F = 121° 58′ 31″·2
∠ A O F = 40° 43′ 16″·8
∠ A G F = 83° 22′ 12″
∠ A F G = 55° 37′ 48″
∠ A F O = 17° 18′ 12″

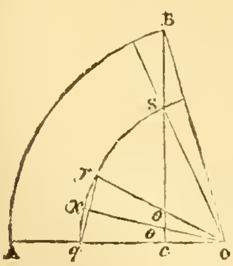
DIAGRAM FOR DRAWING GOTHIC ARCHES.

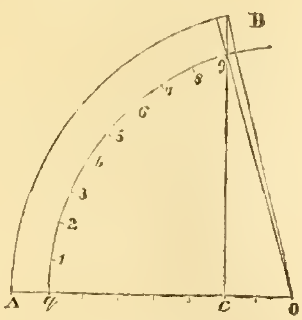
By Peter Nicholson.



To find the radius of an arc $q\,s$, concentric with a given arc A B, to meet the sine B C, so that the difference of the radii A q, may divide $q\,s$, the arc to be found into a given number of equal parts.

(We are indebted to our valuable correspondent O. T. for the above method of drawing a cinquefoil head; it is copied from a diagram made by Peter Nicholson, in whose handwriting is also the problem annexed. It will be observed that the diagram does not suggest any method of solving the problem, we therefore referred it to Mr. Oliver Byrne, who has favoured us with the following solution.)





Let A O $= r$, $q\,o = x$, C $o = c$, and the angle $q\,o\,r = 2\,\theta$.

$\therefore$ A $q = q\,r = 2x \sin\theta = r - x$; and $x = \dfrac{r}{1 + 2\sin\theta}$. Again C $s = \sqrt{x^2 - c^2} = x \sin 2n\theta$, ($n$ being the number of equal parts into which the arc $q\,s$ has to be divided);

$$x^2 - c^2 = x^2 \sin^2 2n\theta$$

$$x^2 (1 - \sin^2 2n\theta) = c^2$$

$$\therefore x^2 = \frac{c^2}{1 - \sin^2 2n\theta} = \frac{c^2}{\cos^2 2n\theta}$$

$$\therefore x = \frac{c}{\cos 2n\theta} = \frac{r}{1 + 2\sin\theta},$$

$$\text{And} \therefore \frac{r}{c} \cos 2n\theta - 2\sin\theta = 1. \qquad \text{(A.)}$$

Although the general solution of the equation involves some difficulty, yet the value of θ or of $2\,n\,\theta$, and therefore of x, may be readily determined in all cases, to any required degree of exactness, by proportion; for from the near approach of A O S to A O B, which is known, two values of θ may be readily selected, which when substituted in (A), will give results respectively less and greater than unity. One or two examples will show the certainty and simplicity of this mode of proceeding.

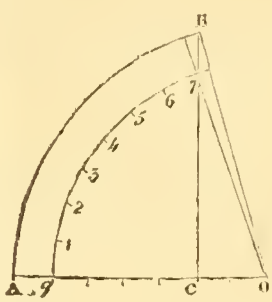
I. Let $r = 4$, $c = 1$, and $n = 9$, $\frac{1}{4} = {\cdot}2500000 = \cos$ A O B $= 75°\ 31'$ nearly. Equation (A) becomes $4 \cos 18\,\theta - 2 \sin\theta = 1$ $\dfrac{75°\ 31'}{18} = 4°\ 11' = \theta$ nearly.

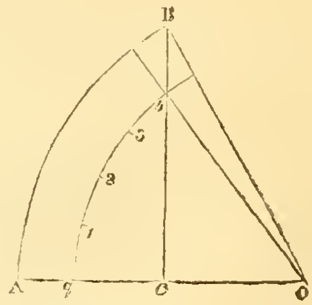
Let us substitute 4° 10′, and 4° for θ in (A.) then we have

$$4 \cos 72 - 2 \sin 4°\ 0' = 1{\cdot}0965550\ (a)$$
$$4 \cos 18\theta - 2 \sin\theta = 1{\cdot}0000000\ (b)$$
$$4 \cos 75° - 2 \sin 4°\ 10' = {\cdot}8899600\ (c)$$

$$75° - 72° = 3° = 180' \begin{cases} {\cdot}2065950 = (a - c) \\ {\cdot}0965550 = (a - b) \end{cases}$$

As 206595 : 96555 : : 180′ : 84′·125 = 1° 24′·125, which, when added to 72° = 73° : 24′·125 = 18 θ $\therefore$ $\theta = 4°:4'{\cdot}673$ $x = \dfrac{c}{\cos 2n\theta} = \dfrac{1}{\cos 73° : 24'{\cdot}125} = 3{\cdot}5008$ nearly, so that if A O be divided into 8 equal parts, A q one of them, will divide the arc q, 1, 2, 3, &c., into 9 equal parts.





II. Let $r = 7$, $c = 2$, and $n = 7$, $\frac{2}{7} = {\cdot}2857142 = \cos$ A O B $=$ cos 73° 24′ nearly, $\dfrac{73°\ 24'}{14} = 5°\ 14 = \theta$ nearly.

Let us substitute 5° and 5° 10′ for θ in equation (A,) which becomes $\frac{7}{2} \cos 14\,\theta - 2 \sin\theta = 1$, and we have

$$\tfrac{7}{2} \cos 70° : 0' - 2 \sin 5\ 0' = 1{\cdot}0227589\ (a)$$
$$\tfrac{7}{2} \cos 14\,\theta - 2 \sin\theta = 1{\cdot}0000000\ (b)$$
$$\tfrac{7}{2} \cos 72°\ 20' - 2 \sin 5°\ 10' = {\cdot}8820694\ (c)$$

$$72° : 20' - 70° = 2°\ 20' = 140' \begin{cases} {\cdot}1406895 = (a) - (c) \\ {\cdot}0227589 = (a) - (c) \end{cases}$$

As 1406895 : 227589 : : 140′ : 22′·647.

$\therefore$ 70° : 22′·647 = 14 θ and $\theta = 5° : 1'\ 617$ $x = \dfrac{c}{\cos 2n\theta} = \dfrac{2}{\cos 14\,\theta} = \dfrac{2}{\cos 70°\ 22'{\cdot}647} = 5{\cdot}9572$ nearly $= o\,q$.

III. Let $r = 2$, $c = 1$, and $n = 4$. $\frac{1}{2} = {\cdot}5000000 = \cos$ A O B $=$ cos 60°. $\dfrac{60°}{8} = 7°\ 30' = \theta$ nearly.

If 6° and 7° be substituted for θ in equation (A,) which in this example becomes $2 \cos 8\,\theta - 2 \sin\theta = 1$, we shall have

$$2 \cos 48^\circ - 2 \sin 6^\circ = 1{\cdot}1292042 \ (a)$$
$$2 \cos 8\theta - 2 \sin \theta = 1{\cdot}0000000 \ (b)$$
$$2 \cos 56^\circ - 2 \sin 7^\circ = {\cdot}8746472 \ (c)$$
$$7^\circ - 6^\circ = 1^\circ = 60' \begin{cases} {\cdot}2545570 \ (a) - (c) \\ {\cdot}1292042 \ (a) - (b) \end{cases}$$

$$2545570 : 1202042 :: 60' : 31' \therefore \theta = 6^\circ\, 31', \text{ and } 8\theta = 52^\circ\, 8'.$$

Since $q\,O = x = \frac{c}{\cos 8\theta} = \frac{1}{\cos 52^\circ\, 8'} = 1{\cdot}6291 = \frac{13}{8}$ nearly. This last example shows that great nicety is not required in selecting the angle q O 4, even when the number of parts are few and the angle A O B small; for in one instance we have supposed q O 4 to be 56° and in the other 48°, and yet we have arrived at the value of θ to a minute of a degree, which at once shows the certainty of this plan of proceeding.

ON THE RELATIVE COST OF MASONRY

In Freestone, Sandstone, or Gritstone, in proportion to the Quality and Quantity of Workmanship thereon, and Observations on Prices to Contractors.

The investigation into the quality of the building stone, in reference to the Houses of Parliament, having brought this subject prominently before the public, and the deficiency of knowledge, as regards the technicalities of masonry, exhibited by those who are supposed to be well versed in such matters, has induced me to send you this paper with the above heading. In the account given of the squabble of the Midland Counties Railway in Herapath's Railway Journal, for 1843, page 153, "The answer of the Committee of Inquiry to the reply of the Directors to their report, with the rejoinder of the Directors," the following occurs in reference to the uncertainty of the knowledge of technicalities. Answer of Committee, C—Observe, referring to the weir across the Trent, that the litigation mentioned by the Directors in their reply, was caused by allowing the words 'Ashlar Stone Weir' to be inserted in the agreement with the Navigation Company. Rejoinder, D—States that Mr. M. pointed out to Mr. J. the words 'Ashlar Stone" being a term which he did not understand, and he asked him what it meant, Mr. J. answered that it was quite right; upon these words the litigation afterwards arose. The Trent Navigation Company endeavouring to enforce a weir of such construction as the Directors were advised would cost at least £20,000." Finally, a weir was constructed at a cost of 5000*l*. or 6000*l*., and of less workmanship.

Now the question whether "Ashlar" is dressed stone or stone as it came from the quarry, is very difficult to decide by reference to dictionaries, whether general or architectural. In the schedule of the contracts on the North Midland Railway, we have the following terms, "Ashlar, tool-dressed and laid in mortar, Hammer-dressed walling stone, coursed rubble and random rubble; and in the schedule of the Manchester and Leeds Railway, we find the term, "Ashlar backing, or bastard Ashlar work," from which it may be inferred that the term Ashlar means dressed stone. On consulting Bailey's Dictionary, 1759, he says—"Ashlar: Freestone as it comes out of the quarry." And on reference to "Mechanical Exercises," by Peter Nicholson, 1812, page 275, he says—"Walls faced with squared stones, hewn or rubbed, and backed with rubble stone, are called Ashlar." From this latter quotation I am inclined to think that, from the term "hewn," that Ashlar is stone as hewn from the quarry or quarry dressed, being level on both beds, and that the term bastard Ashlar, to denote this description of stone work, as used in the schedule of the Manchester and Leeds Railway, in contra-distinction to tooled or dressed Ashlar, is improper. I have also seen in a specification the term "Ashlar or cut stone work;" yet I contend the term Ashlar does not include other dressing than that at the quarry. Any stone of a wall has 6 sides, a face or front, upper and lower beds, two end joints, and back.

The term faced is used in connection with the tools used in working the stone, to denote the description of work—as chiseled stone, or chisel-dressed stone; drafted and troached; chiseled after the pick; hammer-dressed; all in allusion to the quality of the facing or work put upon the front or face of the stone. As regards the strength of masonry, it is usual to specify the height of each course, the frequency of thorough stones or bond stones, and the average thickness of the stretchers, as an example—the Ashlar stone each course to be 18 in. high, the bed of stretchers to average two feet, and the bonders to form one-fourth of the whole face, and to be 3½ feet deep on the bed. The quality of workmanship of the beds and end joints of the stone is inferior to the face, and is usually roughly chiseled after the pick. An inferior description is called hammer-dressed, in allusion to the stone being so dressed on the face; and in the specifications the same allusion is made to the height of the courses as noticed above in reference to Ashlar, the courses being less, and beds narrower, no course to be less than 9 or more than 15 inches in height. Bed of stretchers to be 12 in., headers two feet on the bed, with intervals not exceeding four feet.

The Commissioners of Inquiry into the quality of building stones have assumed "plain work" on Portland stone as unity, which I suppose is rubbed work including labour only, and may be fairly taken to represent one shilling as regards cost; and by reference to the report it will be seen that the hardest sandstone is represented by 1·25, and the softest by ·9. The cost of the stone depends on the cost of getting, royalty, waste, &c., and the relative size of the blocks, as under or above a certain cubic content, or weight in tons, taking 16 feet to the ton; but this is not altogether the right or proper plan, as there are certain relative dimensions in the length, and proportion between bed and face or depth of the course, which give an increased value. First as to the royalty, it is usual to charge from £5 to £10 per annum for each man at the face actually hewing stone, not labourers clearing away rubbish, but exclusive of them entirely, which may amount to about 1*d*. per cubic foot, so that any offer of stone by any landowner gratis to any building, provided the quarry is not "bared," or opened, will be evidently more generous in appearance than in reality. By reference to the Commissioners' report, it will be found that the price of the sandstone in the county of Durham is from 8*d*. to 9*d*. and as low as 5*d*. per cubic foot at the quarry, and that fine-tooled face, including joints and beds, is 4*d*. per cubic foot, and if rubbed 2*d*. in addition. But for ordinary purposes the price of ashlar may be called 6*d*. one mile from the quarry, and workmanship 6*d*., and mortar and scaffolding 2*d*., or a total of 14*d*. per cubic foot. But to divide even more minutely the price per cubic foot of labour, chiseled after pick is 1½*d*. to 1¾*d*.; setting 1¼*d*. to 1½*d*.; stone lime, two of sand to one of lime, ¾*d*.; and if the whole of each course of interior masonry be dressed the same as exterior, the cost will be increased from 2*d*. to 2¼*d*. per cubic foot. The question of cost is further involved when the face of the stone is sunk, or panelled, or rubbed, or moulded—and the following is a schedule for Mansfield stone. Stone 1*s*. 9*d*.; labour, bed and joint 4*d*., tooled 7*d*., sunk 10½*d*., rubbed 8*d*., picked 5*d*., rubbed and sunk 1*s*., ditto moulded 1*s*. 8*d*., boasted and tooled 4*d*. In the building for which these latter prices were used the Darley Dale stone was substituted, and the cost was 9*d*. per cubic foot more for the stone, and the labour was double in consequence of its not being able to be sawn; the cost of Mansfield being 1*s*. 9*d*. for the stone and 7*d*. for labour, and of Darley Dale 2*s*. for stone and 1*s*. for labour, both exclusive of setting. In the *Journal*, vol I., page 188, a correspondent, C. L. O., writing on stone, states that Darley Dale stone from Derbyshire, was to be used for the termini of the London and Birmingham Railway, and supposes it to be limestone, which it is not, being a very fine grit. The terminus at Birmingham was built with the stone, and although then little known and its workableness not tested, the competition was so close that in twelve competitors in an amount of £40,000 the difference was only £200. Another correspondent, Vol. V. page 297, and I believe one of the Commission to inquire into the stone for building the Parliament Houses, in a paper read before the Institution of British Architects, observes, that architects are wanting in attention to the quality of stone known by one name and obtained from different beds, and of their being satisfied with the generic term good; and that, from competition, builders are not studious of quality, but what kind of stone can be most expeditiously wrought, and that merchants in consequence cannot find a market for a better quality if they were so inclined, and that quarries of good quality are laid aside and inferior substituted. He combats the idea of its being a recommendation to a stone that of hardening by exposure; and that no wonder need be excited if a bad stone should be conspicuously placed in a building, otherwise in excellent condition, from the mere circumstance of its being of the requisite size, and concludes by holding cheaply the test of disintegration as a proof of durability, but offers no better test as a mode of adoption. Before making any remark on the above observation, let me call attention to another correspondent, A Lover of Fair Play, Vol. III. page 309, who states that the stone used for the Houses of Parliament is from Steetly Quarry, and not reported upon by the Commissioners at all. The stone selected, Bolsover Moor, being stated by another correspondent, Amicus, Vol III. page 189, to be deficient in size, form, and quantity, as was also the Mansfield Woodhinge stone, the magnesio calciferous sandstone, as it is called, which, by-the-bye, is not very intelligible to the uneducated or uninitiated student either of architecture or geology; but to return to the paper of the Institute of British Architects.

I think the competition of builders for the Birmingham termini previously related is a sufficient answer to the inattention to quality by architects, and the study of builders to find out an easily wrought stone, and also the inability of merchants to find a market for stone of better quality than now supplied. The latter gentlemen are the only ones who escape censure; and let me inform your readers that they have a complete monopoly of the London market, and that Bath and Portland are almost the only oolitic, and Park Spring Bramley Fall stone the only grit now known in the market, exclusive of the Flat York paving. The commission charged on sale ofstone is as much as the royalty, or 1*d.* per cubic foot, and fully fifty per cent. of the profits of the most calculating and persevering of the provincial suppliers of the London market. But to return to the object first contemplated in the paper, viz., the relative cost of masonry, which will vary as the size of stones and quantity of workmanship; and for the purpose of fixing the price of stone, there is appended a table of prices of stone proportionate to the size, and by reference to the schedule of prices enumerated in the body of this paper in the case of Mansfield stone, any party at all conversant with this subject can calculate the work on the bed, face, superficially, &c.; and if any size of stone is assumed for a cornice or architrave, and any figured section or profile assumed, no difficulty will be found in apportioning the labour to the cubic contents, and then arriving at the value of any such architrave or cornice per lineal foot, or as a summary. With reference to cubic content only, the price of labour for the whole may be taken at 2*d.* per cubic foot for tooled work; 4*d.* for moulded work, and 2*d.* for rubbed work. The inferior sorts of masonry to Ashlar are—rubble work, as the stone comes from the quarry of all manner of shapes; coursed rubble, in courses of accidental thickness; block in course, with courses 7 to 9 in., which is usually dressed with the hammer, and goes by the name of hammer-dressed work, and is generally backed with common walling or rubble. These sorts of masonry are generally measured in bridge work, not by feet but cubic yards, and the price may be taken as follows—random rubble 5*s.* 9*d.* per cubic yard, coursed ditto 7*s.* 9*d.*, hammer-dressed 16*s.* 6*d.*, or as generalization, Ashlar as unity, the prices of the others would diminish by thirds as the descent in quality of workmanship; and as a further view of the cost, as regards different degrees of hardness of material, it is stated in the Journal that granite Gothic moulding is treble the price of that of Portland stone.

The different customs as to the modes of measurement of stone in the various localities likewise have some influence on the cost or price of stone work; and Railway Companies have been careful to insert that only the net measurement will be allowed, notwithstanding any custom to the contrary, &c., and so rigidly have I known this rule followed out in estimating the cubic content of masonry, that in coping, whether simply weathered or saddle-backed, an average or mean, in the first instance of two and the latter of three, dimensions has been taken. Under such rigid rule no ordinary contractor can obtain fair play, and it has been the means of having two schedules of prices appended to contracts, the first by which the tender is computed, and the second containing a list of prices of the extra works. This is much fairer to the contractor than having the value of all additions or deductions from the specific work computed from one schedule, as in the case of excessive competition the contractor is induced to shave close, and not be remunerated for his trouble; and the dishonest contractor resorts to the feint of pricing his schedule different from the body of his tender, in the hope that the excess of alterations will be on the side of additions; when it is otherwise, and the excess is in the deductions, the consequences are obvious that he must be ruined. Many parties have a great dislike for the price of work becoming known out of the trade, but I think this is founded in error, as when the real value is known to those who have work to let, it prevents them giving it to parties tendering who are not able to complete the work; and the trouble, litigation, and the dislike of third parties to enter upon broken work, is one of the most perplexing positions for an engineer to be placed in, and causes immense difficulty in closing accounts for works done. In conclusion, I beg to draw attention to the Appendix No. 1, of the prime cost of stone proportionate to the size of the blocks; and to Appendix No. 2, which is a copy of instructions for stone to the quarry, so that they can be worked there and marked, and only have to be fixed when sent to the work; the order is first, length, then underneath the breadth, and again underneath the thickness, and the little figures on the left the number of times the dimension is required to be repeated, and the marginal notes of the kind of work.

St. Anne's,
Newcastle-on-Tyne. O. T.

Appendix, No. 1.

Tables of Prime Cost of Stone proportionate to Size.

From Painsher Quarry delivered at Weir.

12 in. Ashlar, 12 in to 18 in. bed 5 feet long and under 12 cubic feet . .		7*s.* per ton of 16 feet.
ditto	ditto 30 ditto . . .	9*s.* ditto.
ditto	ditto 100 ditto . . .	11*s.* ditto.

From White Hinge Quarry.

12 in. Ashlar, 12 in. to 18 in. bed, per cubic foot 5*d.*
5 feet long and under 12 cubic feet, per cubic foot, 6*d.* to 7*d.*
Ditto, under 30, 7*d.* to 8*d.*
Ditto, under 100, 10*d.* to 12*d.*

From Church Quarry.

Common Ashlar—2 0 × 1 3 × 1 0, not exceeding 3 0 × 1 6 × 1 3, 7*d.* per cubic foot; not exceeding 4 0 × 2 0 × 1 6, 9*d.* per cubic foot.

Square Blocks—1 to 2 tons, 19*s.* per ton, or 1*s.* 2½*d.* per cubic foot; 2 to 4 tons, 24*s.* per ton, or 1*s.* 6*d.* per cubic foot; 4 to 6 tons, 28s. per ton, or 1*s.* 9*d.* per cubic foot.

Scantling of different lengths—
2 0 × 1 0 × 1 0, 5½*d.*
5·0 × 1 3 × 1 2, 9*d.*
5 0 × 1 6 × 9, 7½*d.*
7 0 × 1 8 × 1·0, 7½*d.*
5· × 4 0 × 1 3, 12*d.* per cubic foot.

Appendix, No. 2.

Stone Marked. Drawing No. 5, C.

Ft.	In.	
3	0	
2	0	prepared two beds and one face
1	3	two feet faceway and 1 3 high
5	0	
3	0	5 feet face and 1 3 high, stringcourse
1	3	
8)4	2½	
1	8	× 7½. 6½ caps to piers, one quoin end to each
82	6	
1	5	string
	9	
4)8	9	
1	6	× 6½ weathered coping
61	6	
2	0	× 7 saddle backed coping, weathered to 6 in.
118	0	
2	6	coping 6 in. front edge, 7 in. back edge
99	0	
1	6	12 in. capping, two fair sides, circular edge.

O. T.

MEMOIR OF M. PUISSANT.

From the Eloge of M. Arago, delivered at his Funeral, Jan. 12, 1843.

M. Puissant, a member of the Academy, was in the enjoyment of excellent health a short time previously to his death, the result of sudden illness, which cut him off at the advanced age of upwards of seventy. M. Puissant made his *debût* as a teacher of Geometry, and the writer of an useful work as analysis. He was soon afterwards employed as geographical engineer or surveyor in the trigonometrisation of Corsica and Elba, amid the wild and desolate mountains. On his return from this mission he was employed in the Depot de la Guerre or Ordnance Map Department, and devoted his leisure to the conpilation of a celebrated Treatise on Geodosy, and another Treatise, not less valuable, on Surveying and Levelling. M. Puissant took a very active part in the organization and promotion of the corps of Geographical Engineers, and was honoured with admission into the Academy of Sciences. On the retirement of the Colonel Chief of the General Staff, Puissant became the head of the department, and distinguished himself by the arrangement of the immense net work of triangulation, on which the new map of France is founded, one of the vastest operations, and most useful, says Arago, of which we have any record.

MEMOIR OF M. BOUVARD.

Extracted from the Eloge delivered by M. Arago at the Funeral, June 11, 1843.

M. Bouvard, one of the seniors of the Academy of Sciences, and the oldest member of the Board of Longitude, was born in 1767, in a small village of the Alps, near St. Gervais and Chamouny. His parents were absolutely without fortune. At eighteen years of age, Bouvard had only the tail of the plough before him, or a musket in the Sardinian service, when he was luckily tempted to go to Paris. After some objections and misgivings, prompted by natural affection, a small purse was made up for him, and he walked up to Paris. It would be superfluous to enumerate the difficulties to be encountered by a young man without patrons, relations, or decided pursuit, and those feeble resources were rapidly exhausted. It is enough to say that if Bouvard did not get a dinner every day, no day did he fail to attend the gratuitous and public lectures at the College de France. During several months he hesitated between Mathematics and Surgery—Mathematics carried the day, his progress was rapid, and becoming an assiduous auditor of Manduit and Cousin, he soon had private pupils of his own, among whom he was pleased to reckon M. de St. Aulaire, the French Ambassador in London, and General Demarçay. Chance made M. Bouvard a witness of the operations in the Observatory, and thenceforth sprang up a complete passion for astronomy, (neither is this term of passion inappropriate,) at a later period he was in an evidently feverish state on the approach of any celestial phenomena, and the cloud which at the time of the eclipse of a star or satellite threatened to deprive him of the sight of the Moon or of Jupiter, threw him into despair. To the end of his life he related, with *naïve* regret, the circumstances which forty years ago had prevented him from making certain observations; at other times he would occupy himself with a task of logarithims in his head for weeks and months, trying to discover any faults of calculations which such or such assistant in the observatory might have committed. In 1794 took place a memorable event to him, an introduction to Laplace, who employed him in the calculations for the *Mécanique Celeste*. He was thus successively introduced as an assistant and member of the Board of Longitude, and member of the Academy of Sciences. It may be observed that the fortune of the astronomer did not, however, much advance, as the liberality of M. Bouvard towards a poor and numerous family kept pace with his advancements; of the pleasures of society M. Bouvard saw little, an experienced and able observer, he spent for many years every clear night by the side of the instruments in the Observatory. The General Table of Comets exhibits several of those stars the discovery of which belongs to him. Bouvard was a surprising calculator, he went through frightful masses of figures on many occasions, as when occupied with the Theory of the Moon, in contending for a prize of the first class of the Institute, which he divided with the celebrated Burg of Vienna; as when engaged in constructing new tables of Jupiter, Saturn, and Herschel; or, finally and principally, when obliged to supply Lapiace with the means of inserting in the *Mécanique Celeste* anything more than pure algebraic formulæ. His love of calculation was indeed great, being occupied even of the evening before his death in writing figures with a failing hand.

A GATE HINGE.

Description of a hinge for a coach-road gate; communicated by T. N. Parker, Esq., A.M.

This old fashioned manner of constructing the lower hinge of a swing gate, if carefully managed, is as good a plan, if not better than any other. The only objection that I am aware of is, that if the circular inclined plane is too steep, upon which the wheel or roller under the heel of the gate is made to descend, the gate will shut with too much violence, from an uniformly accelerated motion. I find that one inch in six gives the proper fall on this inclined plane, for an entrance gate to a carriage road, and where there is no lodge, with attendance.

This diagram shows that the upright round iron (A) of 1¼ inch diameter is to be placed about 3 inches in the clear from the heel of the gate (B), and an equal distance from the hanging post (C); and that the distance from the centre of motion to the centre of the wheel (D) on the heel of the gate is full 6 inches. The inclined plane (E) is rivetted on a plate of ¼ inch iron, and 14 inches diameter, of which 3 inches are cut away in fitting it to the square face of the hanging post (C); it is secured on the ground by two screw-pins (G) of ⅝ diameter fitting into the square holes shown in the diagram, and the pins are leaded into limestone or freestone blocks.

A straight vertical outline of one side or half the bar, or inclined plane is given, fig. 2, which shows its length to be 15½ inches, the two asterisks marking the quarter circle at 11½ inches, but the inclination of the plane extends 1½ inch beyond the quarter circle, and the horizontal plane (F) also extends three inches beyond that.

Fig. 1.

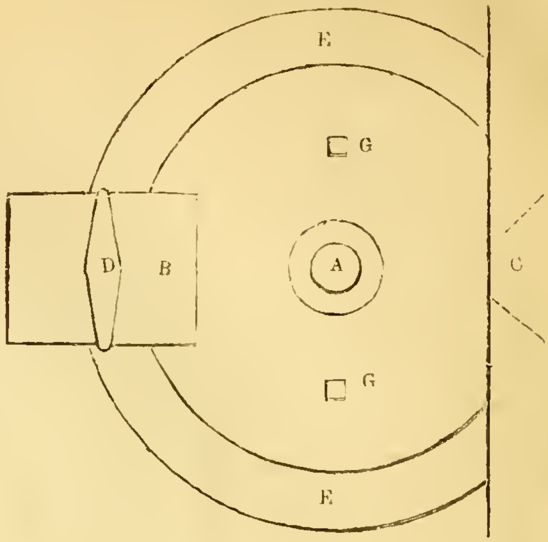
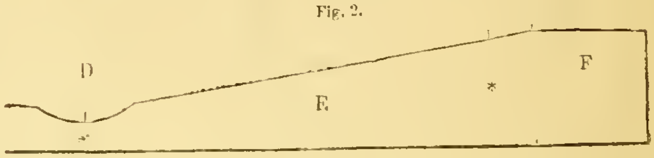


Fig. 2.



As the inclined plane extends one inch beyond the quarter circle, at 6 inches distance from the centre of motion, a gate 10 feet long will fall of itself, till the head of it is opened to about 20 inches beyond the quarter circle, because as 6 : 1 : : 120 : 20; but beyond that it will be at rest, which is more safe than when a gate is held open by a man, on an unsteady horse perhaps. The bar or rail being thus prepared, and about 1 inch in thickness, must be bent to the circular disc and rivetted thereto.

A short post, to prevent any strain on the hinges, should be placed in the ground, near the head of the gate, at 3 or 4 feet beyond the quarter circle. It is reasonably to be expected that any one opening the gate will have the grace to put the gate in motion that it may close itself, the same having been so constructed as to stand open a little beyond the quarter circle, without being held open. The outline of the sections of the heel of the gate, and the wheel, and the holes for screw pins are given in the diagram. The weight and estimate of this iron work may be fairly put down as follows:—

	s.	d.
Wheel and sockets, 8 lb. at 1s.	8s.	d.
Rail and disc of wrought iron, 31½ lb. at 4½*d*. (or of cast iron at less than half that price)	11	9
	——	——
Or the whole of wrought iron, 39½ lb. at 6*d*.	19	9

I have set up my own entrance gate in this manner, which answers particularly well. The gate weighs about 300 lb.; it will not fasten of itself when the wind is strongly opposed to it, but the construction of the iron work is excellent and substantial though necessarily heavy and expensive.

On this plan, the whole perpendicular weight of the gate rests on the ground instead of on the hooks; only the lateral strains of extension and compression are sustained for the most part where the two thimbles attach. At my entrance gate, I have had the posts a little tapered, from 1 to 2 inches in the diameters, and they are put up corner-ways, as represented by dotted lines at (C) in the diagram.

If less fall should be preferred, the dip in the place of fastening might remain the same, and 3 inches of the rail might also be as at present, then for 3, 4 or 5 inches there might be a less fall, 1 in 12 instead of 1 in 6, and the upper part of the inclined plane might still a fall 1 in 6.

The two thimbles of ⅝ iron move up and down on a perpendicular bar of iron 1¼ inch thick, nearly as long as the gate heel; and my thimbles are fastened to the hanging post by hoops or straps of iron fitting round the post, and at least one of the thimbles which belong to the gate heel is moveable.

The diagrams are drawn one-fourth the full size.

Sweeney Hall, July 17th, 1844.

ROYAL ACADEMY. No. I.

Sir,—The two best friends the Royal Academy have are Joseph Hume and the Right Hon. Sir R. Peel; the one is always on the *qui vive* to defend it where it is not attacked, and the other to attack it where it can be defended, and by this most ingenious system at the end of each session, the President and Members perch on the top of their dome, clap their wings and crow their glory, as if victory was assured and inevitable.

Sir Robert Peel takes his stand *on the charitable distribution of their funds*, which every body acknowledges; whilst Hume insists upon seeing their accounts, which they have never refused; for surely nothing could be more frank, more straightforward, or more reasonable than the accounts they have already furnished to the House at the time of the Committee. But all this childish attack and defence are entirely beside the real question, viz.—*What has been their influence on the art, what is their influence, and what will it be in future?*

As far as the student goes it has so far been a most valuable school, but it does not keep pace with the demands of the country, and it requires and is capable of immense improvement and amelioration, and it may be made, and it must be made, more available and more in unison with the wants of the nation. Sir Robert Peel says, the members are men of honour in private life, but is this proof they conduct the Institution as it is their duty to do, where the art is concerned?—surely not, and it may be fairly inferred, that when any man defends a friend's *public* conduct by dwelling on his *private* virtues, there is something in the public conduct not altogether defensible. There can be no question, that for years, the paternal care of the Academy for the student of genius in high art, ceased with his education, and that the moment he gave evidence of being the genius they affected to wish, they assailed him by persecution and neglect to prevent his development, and force him to get his living, as they did, by the ordinary drudgery of the profession.

Sir David Wilkie contested the assertion that there existed a prejudice against High Art in the Academy for years, and was always in a passion when it was mentioned—but in 1813 he was on his first Hanging Committee, and then it was so palpable that he acknowledged it could be no longer denied—he called on me on his way home, and said "there certainly exists a prejudice against High Art." I asked why—he replied Northcote had sent a picture with a request if it could not have a centre to send it back. The Committee were delighted at such an excuse, and were for sending it back at once, and it was by Wilkie's repeated persuasion and convincing them of the importance of High Art to the Academy, that he induced them to hang it up. Wilkie never altered his opinion after so gross an instance as this.

There can be no question at all that the good or evil of the Academy in effect on the Art, is very much influenced by the election of officers and members. If an incompetent member be elected, though great injury is done, yet an incompetent officer is much more injurious; it may be replied, no incompetent officer could have been so elected if he had not been member first, and, therefore, the one is as injurious as the other in the Art—and the great security then is in the proper election of proper members, and to this end, all the energy and power of the Institution should be warily kept in train. If any accusation is made of incompetent elections the reply is,—that is very true, but that was 20 years ago; very true also—but when was John Chalon made member? was that 20 years ago? Thirty-five years ago, two distinguished young artists were at a ball at Ridgway, Devonshire, at Mrs. Pym's the lady of the present admiral. During the evening, a militia officer found of sketching was introduced to them. Two years after, a noble lord asked them if they had heard of an extraordinary militia officer, who had taken to the art, *self-taught*, because he was an extraordinary genius, and would be a great man. Is this our militia officer? said one of these young men to the other. Indeed it is, was the answer. In a short time, the gallant Ensign became Associate, and in a shorter time Academician! and soon got two public orders for 500 gs. each, and other orders for Greenwich Hospital! whilst Haydon was in prison and Hilton without a single commission! The Keeper dies, and the gallant Ensign is enshrined in his place, without knowing one single marking of the human body, and thus by one continued line of corrupt influence, this incompetent, gentlemanly weak man is placed over the next generation of British students, at a time when the government has been roused into action, when public money is voting, when a grand opportunity has burst on the country, and when draughtsmen will be wanted, and must be had, to carry out the plans in contemplation.

Now see the fatal effect of incompetent and unjust elections, and reply if the Academy which obliged Reynolds to resign, expelled Barry, insulted Wilkie, disdained Hayter, scorned Martin, rejected Sir Charles Bell, and persecuted Haydon is not, in 1844, the same Academy it was at the beginning 1768, in the middle 1790, and will be at the end, without doubt, question or refutation.

The moment after election, Wilkie, astonished, went up to Sir ****** ********* and said, "I don't approve this." "Nor I neither," was the reply, "but it was to please Lord Farnborough," said Sir ****** *********; and he, Sir ****** *********, will remember it well. The fatal effects on the Art of the country by this most honourable of all honourable elections will be shocking.

The very first exercise of his power, which this amiable man was guilty of, was changing the whole system of drawing in the Academy, established so beautifully by Sir Joshua Reynolds, and which must be considered as the very basis on which the school had obtained its celebrity for imitation. When a student draws on tinted paper, and touches in the lights and touches in the darks, and leaves the paper for the half tint, he acquires a power of using the brush whilst he is handling the port-crayon only in his early days. Sir Joshua felt this, and made it the law of practice; whereas on the Continent they draw on white paper, leave it for the lights, stipple all over like an engraving, and in power of touch and execution, bear no comparison to the British painter. Will it be believed, this man obliged the whole body of students to leave off the admirable system of Reynolds, to substitute white paper, to banish all back grounds, saying "show us an *outline*, never *mind how hard!*

The worthy President (*arcades ambo*) held forth at the distribution of prizes on the infallibility of the new system, and there sat the keeper the tears filling his eyes, to find his immortality secured, in the sublime language of Sir Martin! What an Exhibition; of the 74 which had taken place in the Academy, this was without question the most touching of all.

But "let the Academy go on," says Sir Robert, "in its even and honourable course." Ay, in Heaven's name let the Academy go on! Let it go on; let the great Keeper and the greater President go on till the manly touch, gemmy and rich, is superseded by the icy and hot stipple, flat and tasteless. Let them go on, till the hideous and hot half tint brick and mud has triumphed over the pearly grey and peachy rosiness. Let them go on, till the vanishing rotundity of nature, without edge and yet defined, succumb to the glorious and cutting outline, copper or brass. Let the illustrious and immortal couple go on, till the delicious background, glittering with azure sky and creamy cloud, be vanquished by the gilt flatness of the brutal Byzantines and bewitched Germans.

If this be the detestable art which this illustrious pair wish to introduce, at the expense of the masculine vigour of Michael Angelo's or Velasquez's touch, God help the Art of Britain for the next 50 years, may the promoters of such Bedlam filthiness perish in their own abominations. Luckily for the Art of Britain, the next Council ordered the restoration of back grounds and tinted paper, and the illustrious Ensign was obliged to reconcile his former detestable theory with his present orders from his superiors, with what degree of grace and consistency it is not for me to detail, to the students.

Flu.—If you can *mock* a leek, you can *eat* a leek.
Pistol.—Must I bite?
Flu.—I say,—Pite I pray you; it is good for your green wound!
Pistol.—Thou dost see I eat.
Flu.—I have another leek in my pocket.

I warn the rising youth that it is the Italian frescos and cartoons, and not the German, which must be their guide, but my warning will be in vain. With the only perfect examples in the world, viz. the Cartoons of Raffaelle and Elgin Marbles, the youth of the country are running wild after the temporary insanities of the Germans. Good God! what would Sir George Beaumont and Sir Joshua have said could they have walked into Westminster Hall this season? Fancy their ghosts floating arm-in-arm down the frescos: they would have gone through the great window screeching with fright!

By the gift of God, the British have been the only inheritors living of the power of imitation by touch, which is the great code of Titian, Velasquez, Rubens, Raffaelle in his cartoons, and Michael Angelo in his Prophets—they are the only nation now alive who see the true optical delusion of objects, and feel the comprehension of touching their leading points, leaving atmosphere to unite the abstraction. They only want (which in Edwin Landseer, Charles Landseer, Lance and Eastlake was added) a knowledge of construction to guide their hand, as a component part, not a substitution for what they are justly celebrated for, for what can be a greater folly, than to lose what is truly beautiful in getting what we are without? It is hardly to be believed, that there does not exist a nation, which can paint a clear shadow, but the British. The power does not exist in France, Spain, Italy, or Germany: test their works, by Rembrandt, Rubens, Titian, Tintoretto, Velasquez, Ostade, Teniers, or Sir Joshua.

Let any man look into the shadows of La Roche's, Stafford and Charles, at the Duke of Sutherlands, and then go to the Murillo, and tell me I am in error if he dare. With these perfections of practice, what are we now struggling for, not to transfer the beauties of oil into fresco, of which it is perfectly capable, in its purity and light, but to transfer the horrors of fresco into oil.

With a militia officer for a keeper at the Academy, a president who believes in his infallibility, a secretary at the Royal Commission, frightened at offending the Academy, frightened at offending the Court, frightened for himself, and frightened for the Art, and a Royal Commission, more enchanted at anticipating the eminence of immature youth, than perfecting the excellence of established maturity, what will be the result?

I see the critic on the frescos in your last number, attacks the Academicians for not competing—surely those among them of eminent talent are decidedly right. How can any man expect that men of established repute, with fame, and profit, and honour to lose, will enter the lists with boys they are qualified to teach, who have neither fame, profit, or honour. Three years have now passed and no positive commissions are yet given, no extensive plan evident, no certainty after all who will be employed, or who will not, or whether, as Lord Brougham said, "the wisdom of Parliament may not stop the whole, after ruining three parts of the artists.

In my apprehensions for the future taste of the nation, even in this hour of hope, I candidly confess I have my apprehensions, from the tendencies, sympathies and timidities of our talented secretary Eastlake. It is delicate to allude to an artist of such refinement of mind, tenderness of heart and inoffensive temper, with any thing like caution; we are indebted to his reports, and the searching patience which has inspired them, but I shall ever regret he left England, and did not stay in it, as Etty, Hilton and Haydon did; he arrived in Rome at the very moment of the German delusion, and being of a nature of mind that has a strong gusto to refine on what is obscure, prove what is impossible, and from modesty of character so equally balance probabilities as to leave his readers as tortured to decide which is truth, as himself; it will be seen at once he was prepared to receive the Theories in vogue, which were so angelic that Raphael was excluded from the code as too corrupt, the extreme infantine simplicity of which were sure to attract his nature, and though he publicly wishes it to be understood he is not mingled up with Cornelius and Overbeck, he has made no hesitation whatever to burke all which has been done in Britain for 40 years, to push them forward as the sole objects of imitation for the 40 to come.

If instead of petting Cornelius so offensively, he had remembered those who had rescued the country from the stigma of incapacity, whilst he was in Rome, it would not have been unjust. The Christ rejected by Hilton, the Judith and Holofornes of Etty, and the Solomon, Xenophon, Jerusalem, and Lazarus, of Haydon, are works which he need not have feared to have placed by the side of any of the lime illuminations of Cornelius. Surely common justice demanded such a feeling for his country, and for those men who kept alive the art, when there was no encouragement—*they* did not fly abroad in despair, and return with enthusiasm only when the treasury appeared in sight.

Throughout the reports British genius is sacrificed to a morbid flattery of Cornelius. Why is this? Is it to please the court? If the court desire it, the court should be told what is justice. Cornelius is the *ne plus ultra* of art according to the Royal Commission, but what was the opinion of his friend Rumohr?—viz., that he has no power of imitation or colour—that he is not deep in the naked figure—that he is unnatural in expression, but has a monumental power, fit for a wall. The worthy secretary, where justice might have been done to Hilton, Etty and Haydon, has been totally silent; not so, I regret to say, where injury might accrue. When the cartoons were dispersed, in the circular sent to the papers, he seemed to have recovered his recollection of one of them at least. What did he mean by stating publicly, as from the Royal Commission, "Haydon at the head of a section, goes to the Pantheon." This was utterly *untrue*. Haydon went to the Pantheon by himself, connected with no section—heading no section—and therefore I hope it was not put in in this malicious way, to lower Haydon in public estimation, by informing them his cartoons had not been rewarded,* and that whatever were his theories of art, *he was but the head of a section!* If it were it was worthy of the heart and understanding which never remembered the battle he had fought, the sufferings he had undergone, or the pictures he had painted, till a favourable moment occurred of inflicting another pang.

To conclude, the attempt to change the whole system of British Art, now making for the Royal Commission, ought to be opposed, if not guided by a steady hand. If it be not, it will ruin all for which the school has been celebrated, and leave the youth in the country, and the Art in such a state of inextricable confusion as a century will never replace or regain.

It is sophistry to talk about the Art undergoing a *change*, it is undergoing a *curse*, and without gaining the drawing they want, they will lose the colour, and light, and shadow, and surface they have, and end in being the ridicule of Europe. The existence of the present Keeper of the Academy in his present position, which but for his corrupt election never could have taken place, is a living, existing refutation of Sir Robert Peel's protection of the Institute, and an argument for ever of the necessity of Reform. Sir Robert says now, or infers, the House has no right to interfere; and yet, in 1839, he said, "Holding rooms as the Academy did of the public, it had unquestionably that right."† Lord John too, (*et tu quoque Brute,*) stands up for the Academy, yet in the same debate, 1839, he disdained to argue for the right of the House—saying with defiance,† "I waive all question about right." How can Lord John glory in the cause for which Russell bled on the scaffold and Sidney in the field, and oppose the independence of British artists. Are they to be the only serfs left? Is this doctrine worthy of his descent? Oh, Lord John. And will Lord Palmerston sacrifice the liberty of British Art for a miniature by Ross? Oh, Lord Palmerston.

Such is the influence in a civilized country of property, authority, and rank; and such are the blessings resulting from their security, that it is always considered in a period of refinement or corruption better to put up with any abuse of their exercise, than endanger their dignity by admitting the possibility of wrong, though the sanction of injustice has always in time sapped the greatest powers in the world.

One would have thought Sir Robert Peel had had some experience of the consequences of resisting common sense in 1832. So far from the British people having seen their best days, they have not yet reached one-tenth part of that glory or power to which their capital and their energy will ultimately bring them. But they are weighed down by prejudices, the excess of judicious submission to order, till they are brought to the very verge of abject servility.

The abstract principle of independance of mind exists only in the theory of their constitution, as a fiction, for it has long since ceased to be practised or acted on, or approved of as a reality by any who have their fortune to make, or any who have made their fortune.

I admire the caution with which all reforms take place in Britain so necessary to regulate and bridle excess, imprudent zeal, or injudicious enthusiasm. But let us take care in our reverence for the outworks of authority, a mine is not sprung in the centre of the citadel, because from pompous desire to keep up appearances, we fear a little wholesome chloride to cleanse the walls. The principle in Britain, that authority must be upheld, let what may be the injustice it has practised, will ultimately in the long run of human suffering, destroy all authority whatever.

I therefore heartily wish success to any movement which will force the Academy to reform, though I fear Sir Robert's talent and affection, the cowardice of the artists, and the coiled-snakism of the Academy itself.

Timon.

* The uke of Sutherland has since purchased Edward and John.

† See Debate, July 11, 1839.

SUGGESTIONS FOR A NATIONAL COLLECTION OF STUDIES OF OUR NATIONAL ARCHITECTURE.

(A LETTER TO THE EDITOR.)

Sir—Some little stir has recently been made in the House of Commons relative to British Antiquities and the British Museum, and as I have always felt that Gothic architecture has not had its due share of accommodation in the National Museum, I inclose you a copy of a letter which I some time back ventured to address to the Trustees of that institution, relative to a classification of Gothic Architecture, although perhaps I ought to have known that any suggestions from so humble an individual as myself could have no weight in that quarter, not because any communication of the kind would be at once rejected as informal, but that emanating from so obscure a source the subject was not made of sufficient importance. I had previously waited upon Sir Henry Ellis in company with my friend Mr. Inman, to whom I entered into a full explanation of my views, and who seemed to think with me that a scheme of the kind would be highly beneficial in itself, and if taken up as it ought to be, might be carried into effect with comparative ease after a commencement had once been made. Encouraged by this, and being of opinion that unless a separate gallery were established for the purpose, no more appropriate place could be found for such a collection as the one contemplated than the British Museum, I presumed to address the Trustees.

The result of that address confirms what I have above stated; yet as a classification of Gothic Architecture would be of the greatest value to the profession as well as the public, even in any form, I am unwilling that the subject should be entirely dropped, therefore send you my unsuccessful appeal to the Trustees, with some further remarks, conceiving that if the suggestions are of any real importance, there is a chance of their being taken into consideration and properly urged by some one possessing—I will not say greater zeal, but infinitely greater influence than myself.

7th November, 1842.

My Lords and Gentlemen,—On examining the plan for the completion of the buildings at the British Museum, I observed that a portion was appropriated to British Antiquities, and as this term might apply only to a very limited selection, I have presumed to address your Lordships, humbly submitting that an extension of accommodation for British Antiquities would be a desideratum, in order that works of British art from the earliest to the latest periods might be arranged in the National Museum.

It has, I think, been clearly ascertained that in order to promote art and civilization, the means of studying should be placed in as simple and clear a manner as possible within the reach of the public, who would by continued observation imbibe a degree of taste and knowledge not otherwise to be obtained. The great improvements in our cities have arisen by these means, and step by step, architecture has been raised to an importance in public opinion which it did not hold in the two preceding centuries, but, although the profession have acquired this high standing, hitherto little has been done for the general advancement of the taste and knowledge of the public, who from want of precedent are unable to form any opinion of the subject.

By devoting some portion of the new buildings of the National Museum to a classification of Gothic architecture, from the earliest to the latest ages, this object might be effected. It would not at present be necessary to have a costly building, a mere out-building would at first answer for the reception of fragments. Judiciously selected specimens could be obtained from almost every part of the country, and arranged in chronological order. In many instances this collection would be of immense importance to the professional student, by placing immediately before his view the forms of ornaments, mouldings and sculpture, in positions were it would be next to impossible to study them when existing in their original situation. In addition to the forms being placed so as to be clearly examined, the progressive styles of the art, might be shown in this collection; and this very important object could not be so simply defined in existing buildings without considerable attention and labour. The distinctive characteristics of Gothic architecture being divided into numerous classes, and each style imperceptibly growing out of the other; the gradations are so delicate, and the peculiarities so minute, that without a place for the reception of well selected examples, the student is put to considerable labour and expense before he can acquire any knowledge of that branch of the art; and then only by unwearied exertions, and the examination of many edifices. Even if he does not turn from the pursuit unsatisfied and disgusted, he finds after years of toil, he has but acquired an imperfect knowledge, because his time, his opportunities, or his means, were insufficient to carry out his object.

Many there are who soon stop short in the pursuit and when called upon to practice this part of their art, show their miserable deficiency. I regret to say examples are not wanting to confirm this opinion. At the present time the revival of a taste for Gothic architecture, is spreading to a great extent, but hithertoo no opportunity has been afforded for the proper study of the art, and very little is yet known of its principles; its origin is still a matter for contention, its decorations a mystery, and its construction is so little understood that it has become a thing to wonder at: few, very few, are acquainted with its effects, or its influence upon our feelings.

History is intimately associated with this art, each edifice is strewed over with decorations connected with the early history of the church, or sculptured legends of munificent donors, or in other buildings with the records of noble acts of chivalry, all important in the study of the art.

The art is not to be studied merely by fragments of stone, but much attention would be given to polychromy, an interesting and important branch of the ancient art, and at this time but little known; this would also comprise heraldry, as necessarily connected with Gothic architecture, a subject of great historical usefulness; stained or painted glass would also form a valuable and exceedingly interesting subject, not as a mere subject of curiosity, but as a branch of the art inseparable from it.

To the professor, the student, and the antiquary, a collection of Gothic antiquities would be of inestimable value for the investigation of the principles of the art. To the general observer it would be important in founding judgment and true taste. The arrangements might be such that by a very little application a degree of knowledge might be acquired, sufficient to prevent the recurrence of those disgraceful applications of this style of architecture, which have of late years been executed, owing to ignorance of its genius and principles.

Very little difficulty would be found in forming this museum. In many parts of the country buildings are necessarily taken down, and the desirable portion of the remains might be easily obtained; many buildings have been destroyed entirely, but there are yet numerous fragments which would form a most valuable and instructive series of artistical studies and historical documents. Such collection might very properly be made to include similar specimens of continental Gothic, so arranged as to facilitate immediate comparison of the respective styles of the same period in our own and other countries, and thus make evident, almost at a glance, their characteristic differences and resemblances, whereby attention to such circumstances would be forced, and they would be more firmly impressed upon the memory.

Let but a beginning be made, let the nucleus of such a collection be formed, and there is no doubt that it would be materially augmented in a short time by donations and contributions both of original specimens or authenticated models, and these not confined to architecture exclusively, but extending to other branches of art and ornamental design of the middle ages. As little doubt can there be that such addition to the present collections in the British Museum would be welcomed not by professional men alone, but equally so by the general public, and for both it would possess a more immediate interest, and would exercise upon them a more direct influence, than other works of antiquity, which, however valuable as archæological studies, are too remote from our feelings and associations to be looked upon otherwise than as matters of wonder and curiosity. Whatever objections there may be to what I have thus ventured to suggest, it certainly cannot be alleged as one of them, that a gallery of British Antiquities would be out of place in, and foreign to the purposes of a British Museum; and, however the suggestion itself may be received, I trust that the motives which have led to it—the warm interest I take in the subject, and an earnest desire that both the public and the architectural profession should become more familiar with, and better able to appreciate the architecture and arts of the middle ages—will sufficiently excuse my laying it before you, and clear me from the imputation of impertinence in so doing.

I have the honour to be, my Lords and Gentlemen,
Your most obedient humble servant,
E. B. Lamb.

To the Trustees of the British Museum.

British Museum, November 18, 1842

Sir.—Your letter of the 7th of November having been laid before the Trustees in which you suggest that in the new buildings of the Museum a greater extent of accommodation than that apparently contemplated should be provided for British antiquities, and that it would be expedient to devote some portion of the buildings to a classification of Gothic architecture, especially British, from the earliest to the latest ages, I am directed to acknowledge your communication and to acquaint you that the trustees are not prepared to recommend her Majesty's government to provide in the museum for any general collection of remains of the Gothic architecture of Great Britain.

I have the honor to be, Sir
Your most obedient Servant,
E. B. Lamb Esq. I. Forshall, *Secretary.*

The limited resources, as well as the deficiency of space, of the Institute of British Architects, entirely prevents the possibility of their carrying out the objects contained in the foregoing letter, yet there are still means by which the principle may be fully realized so as to be of the greatest benefit to the profession at large; and although my main object is, for the present at least, frustrated, a perfect classification of Gothic Architecture might be well arranged by drawings communicated from the various members of the Institute and other persons who feel an interest in the subject.

During both his early studies and his later practice, every architect has had occasion to sketch and measure portions of buildings in the particular locality where he has been engaged; and these subjects, after his particular object has been obtained, remain in his sketch book or portfolio, of little further use to himself and of none to his brethren: what an immense store of knowledge thus remains hidden, for want of a suitable place to deposit such documents! accordingly, I feel assured that if a suitable place could be found, the hidden treasures would be brought to light by all who had a real love for the art, and would thus form the nucleus of a perfect classification of Gothic Architecture. But although the facts are certain as regards the present state of the most valuable sketches, much would be required to be done to induce the authors to deliver them, or copies of them, to the Institute.

The main object would be to collect together accurate drawings of buildings, or portions of buildings, with details drawn and measured, and arrange them in guard books, under certain heads, so as to be easily referred to, but as the whole of this would require a fixed system, I would suggest that a committe should be formed of members of the Institute to arrange the business, who would communicate with the different members, requesting them to co-operate in the formation of a classification of Gothic Architecture, by contributing such sketches of buildings, or parts of buildings as they may have had opportunities of collecting together, with any remarks upon them which they might wish to communicate. It would be the duty of the committee to correspond with any person, although not in the profession, who they thought might forward their views, and although in many instances their labour would be in vain, they would be amply repaid by communications from others in short replies to questions relative to buildings at a distance, and by carefully measured details of mouldings, arches, doors, windows, &c., stained glass, heraldry, and other equally interesting subjects. It would be also the means of drawing out much valuable information from members who are well qualified, but who do not feel sufficient confidence to communicate a paper of their own suggestion. A letter from the committee requesting information from a member would be sure to produce some reply, and in most instances the information received would be a certain gain to the profession.

Year after year the Report of the Council has contained a request that communications should be made by the members, but the request being general the result has been very unsatisfactory, whereas a direct request from an authorized committee, for any information upon a building in a particular locality, would be sure to receive attention, and however brief the reply something is likely to be obtained, at least from those persons who felt an interest in this branch of the art.

The mere correspondence in a pursuit of this nature would be considerable, and the labours of the committee would necessarily be arduous, but as the result of such labour would be of the greatest value to the profession and all lovers of the art, they would be amply repaid by the gratification afforded to them in being the means of contributing something for the general benefit of the public. A collection of authentic drawings of existing buildings, or parts of buildings with dimensions carefully taken, together with such information as may be intelligibly conveyed in a few words, pointing out such records, facts, or even legends, as may tend to fix a date, would form the most valuable precedents, independent of actual examples or casts, which could be placed before the professional student. Means, too, might be afforded for the public to obtain access to these documents, of course under certain restrictions, in order that something might be done to inform the public upon a subject of which, at present, they know so little.—The knowledge of the general forms and dimensions of existing buildings, acquired in various countries by the architectural student, has hitherto been applied in reproducing ancient forms, as the countries he has visited and the buildings he has seen have been necessarily limited. In consequence of this, the investigation of principles has seldom been his object; content that at Athens or Rome, Cologne or York, remains of fine buildings in their several styles still exist, they are adopted as precedents on all occasions, and London as well as most other large cities, teems with Compo Temples with three tiers of narrow holes in the wall called windows, or else miniature York Cathedrals, divested of all ornamental tracery and paneling. Precedent if properly used and not abused would form the foundation of a sound system, and it is in this way a collection of Gothic fragments or authentic drawings would be the means of familiarizing the mind with noble inventions; this should be the study of the architect, and precedent be left for the public to form their taste and judgment, in order that they may hold in check the ignorant pretender, who decks out his productions with ornament both flimsy and spurious, ill understood and grossly misapplied.

I am fully aware that there may be many objections and difficulties to surmount before much progress could be made in this desirable object: a committee competent, and at the same time willing, to act must necessarily be formed of men of sufficient standing in the profession to insure the carrying out of such a scheme; and this would press upon valuable time, but those who regarded the art as an enlightened study, and not as a mere means of yielding pounds, shillings and pence, wouldnot deem a little time bestowed in its advancement a sacrifice.

It is singular that the National Art should be considered so little of in the National Museum: several packing cases of marble fragments have recently been imported at a great expense, and some part of the new building is to be prepared to receive them; and these subjects no doubt are curious and interesting, and may serve to add another link to the chain of Ancient Art, but assuredly are of little practical use, for in our practice of Grecian Architecture we have not got a single step beyond the examples provided by Stuart and his contemporaries, notwithstanding so much—or rather so *many* things have since been discovered—have first been hailed as valuable acquisitions, then treasured up and forgotten, certainly not turned to any account whatever as studies. Surely if so much cost is incurred and so much space is allowed for subjects which are merely curious, something should be done for the useful; and at the present time when information on Gothic architecture is eagerly sought for by all, some space might be allowed in the British Museum for fragments of this branch of art.

A knowledge of Gothic Architecture is to be obtained only by close attention to existing examples, and those examples are frequently nearly inaccessible; whereas were a collection formed in the Museum, or even in a shed adjoining, it would be hailed by the profession and the public as another step for the general benefit of all—of the public no less than the profession, of the profession no less than the public. At all events, as an individual in the profession, I can have no particular interest in thus earnestly recommending what might prove even more serviceable to many others in it than to myself. Were I actuated by selfish considerations, I should hardly urge any scheme that would tend to advance others in the same career; or did I take—as has been done before now—a narrow and jealous view of the interests of the profession to which I belong, hardly should I insist upon the expediency of rendering the public better informed in the study of our art. Yet unless the public do become so, they will either be indifferent to the art, or injudicious, therefore mischievous patrons of it. Mere building there will always be,—that will take of itself, but architecture can flourish only in proportion as it is seconded by a popular feeling for it, based upon sound principles of taste generally diffused among us.

I am, Sir, yours most obediently,

26, Charlotte Street, Portland Place, E. B. Lamb.
August 8, 1844.

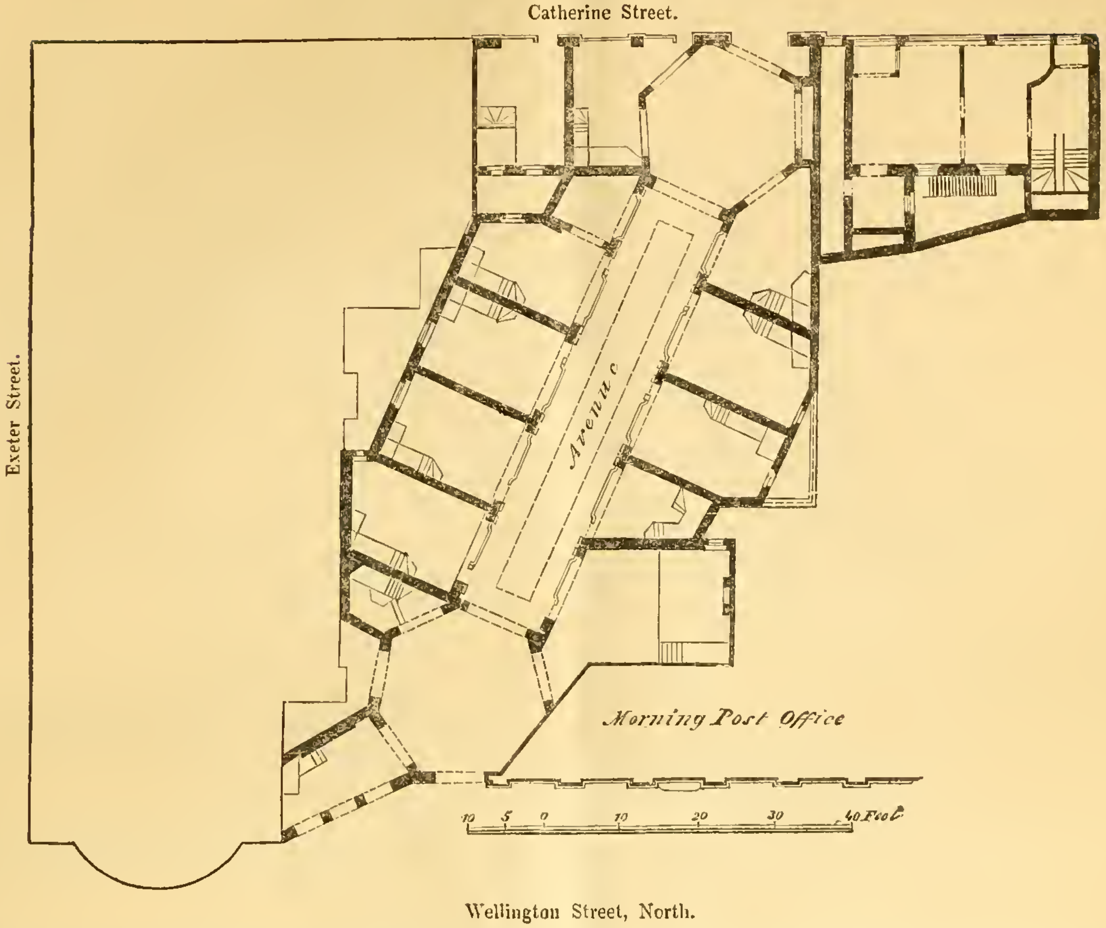
GOLDSMITHS' HALL.

Instead of putting them into an "*Errata*," where they would probably be overlooked, we adopt this mode of correcting one or two mistakes and inaccuracies in the article and its illustrations in our last number, because by so doing we can at the same time give some additional explanation.—In the plan of the building there is an oversight on the part of the engraver which will probably have puzzled many of our readers, for owing to those parts being filled up with shadow, it now looks as if there was a square pillar put between the four columns on each side of the staircase, in such a manner as to be the centre of a group: whereas those squares are intended to represent only the pedestals of two statues—viz., an Apollo and Diana—which so placed add considerably to the general effect. There are besides, on the pedestals or angles of the first flight of stairs, four other statues of smaller dimensions, representing the "Seasons," personified as children. Creditable, however, as are these last to the artist, (Mr. S. Nixon), they do not seem to carry much meaning with them: perhaps even symbolism would be puzzled to find one for them; nevertheless we risk one—which is that a banquet at Goldsmiths' Hall is always *seasonable*, let it take place when it may, in summer or winter—autumn or spring.

In the letter-press,—one error—of no very great importance indeed—occurs in the note at the foot of the first column, where it should have been printed "hardly need we recommend the 'London Interiors' for the manner in which the literary part *is executed*," but the two last words being omitted, the sense is rather muddled. An error of a more serious kind disfigures the last paragraph, where after it is said that the oak screen mars the general effect of the Banquetting Hall, we should read thus: "far better would it have been had the order been continued quite round the room, and the screen formed by filling up the lower part of the intercolumns to the height of the present screen." In addition to this correction, we may now further remark that besides being objectionable as breaking up the uniformity, and we may say the *integrity* of the design, this screen very ill accords with the rest of the architecture in regard to colour and material. Oak columns cut but a poor figure alongside others in scagliola with veined sienna shafts and white capitals and bases. One way or the other uniformity of character ought to have been kept up: either all the columns ought to have been oak, or those of the screen ought to have been scagliola. At present the south end of the room is quite out of keeping with the rest; nay, does not seem to belong to it. Fortunately, offensive as the error is, it is not irreparable: what ought to have been done at first, may very easily be done now; the question is only one of expense, and the expense would not exceed that of one of the Company's banquets. Let that end of the room, then, be made to correspond with the opposite one, by giving it like that scagliola pilasters, which would differ from the others only by becoming insulated square pillars above the screen,—which latter would of course require to be refronted also, and made to harmonize in colour with the walls.

Preparation of a beautiful Green Colour without Arsenic.—48 lb. of sulphate of copper and 2 lb. of bichromate of potash are dissolved in the requisite quantity of water, and 2 lb. of carbonate of potash (pearlash) and 1 lb. of chalk added to the clear solution. The precipitate is pressed, dried, and rubbed to a powder. This colour is not so beautiful as the Schweinfurth green, but is peculiarly well adapted for painting dwelling rooms and work shops, there being no fear of any poisoning from arsenic. By varying the proportions a number of different tints of this colour may be obtained. Bittheilungen des Bohm. Gewerbevereins, 1842.'

NEW EXETER CHANGE. *(With Plan.)*



Of late years more than one new class of buildings has sprung up among us, all more or less indicative of, and in accordance with the habits and necessities of the present age. Among them we may reckon Club-houses—those splendid establishments which are almost the only *palazzi* our metropolis can boast of;—Railway Termini and Stations; and Bazaars and Arcades, which last seem to have been introduced here in imitation of what the French with more propriety designate '*Passages*' and 'Galeries'; since the applicability of the other term depends upon the particular architectural design—whether the building be really *Arcaded* or not.

The convenience of such covered-in or *in-door* streets, and their peculiar suitableness in a climate like ours, are almost self-evident; and equally so is the readiness with which they adapt themselves to architectural character. Financially considered they have besides this advantage that although in proportion to the space afforded, the rentals of the shops may be higher than elsewhere, the occupiers have not to pay for any more room than they themselves require, consequently have not to speculate also upon sub-letting the upper part of their houses. Notwithstanding, however, that there is apparently so much in favour of such enclosed avenues of shops, they have not taken much in this country. The Burlington and Lowther Arcades have, till now, been the only instances of the kind in town, unless we choose to reckon with them that on the West side of the Opera House. On the East side of Temple Bar there is not one: in regard to 'Arcades,' the City people have not aped the West-enders, although they might have done so very advantageously, since it assuredly would be a most decided and very great improvement, were some of those numerous alleys and narrow thoroughfares of great traffic, which run across from Lombard Street to Cornhill and Threadneedle Street, to be converted into covered avenues, so as to be at least dry, clean, and comfortable at all times, even if not particularly ornamental as to architecture.

In point of architecture, the Burlington itself is but a very dowdy affair, although spoken of when first erected as something quite "magnificent." Therefore, to say that the Lowther is far superior as to design would be no particular compliment to the latter, which is really very elegant and tasteful,—Infinitely more satisfactory than many things which are of greater pretension, and for which greater importance is claimed. As regards its roof, with its series of arches, pendentives, and dome skylights, the "Lowther" has been imitated almost verbatim in the Royal Arcade, Newcastle, which is of somewhat greater extent, its length being 250 feet—exactly that of the Opera House Arcade, but it is considerably wider than the last mentioned, that being only 14 feet, whereas the one at Newcastle is 20 feet broad.

If not to be compared with any of the above as to mere size, whether length or height, New Exeter Change—a very *great change* indeed, and for the better, as compared with its stable-like predecessor, —shows what may be accomplished upon a small scale, and how great diversity of character and design may be bestowed upon such places. One decided and highly pleasing novelty is that of its plan, which, instead of forming one uniform space from end to end, is divided into three compartments, viz. a polygonal one at each end (the West one a heptagon, the other a hexagon,) connected by a centre avenue, measuring 60 feet by 12 feet, and 20 in height. This peculiarity of plan was no doubt suggested by that of the site, and this building may therefore serve as as instance to show how, by clever treatment, a *primâ facie* defect, or an awkward and untoward circumstance, may be turned to account. While the obliquity of the line of the avenue to the adjoining streets is effectually concealed, two advantages result from it: first, the length is somewhat increased; secondly, a thorough view of the building is not seen on merely passing by it in the street, when the eye only catches a glimpse as it were of the interior, which accordingly reveals itself more picturesquely and invitingly.

In addition to the variety and play of the ground plan, we have here another species of variety and contrast, namely that arising from the different modes of lighting. While the two polygonal compartments are ceiled over, the central avenue may be technically described as *pseudo-hypæthral*, that is, covered in only by a continuous arched skylight springing from the cove, but not divided architecturally into compartments or forming any ceiling, since the design would remain just the same were that space overhead unglazed. Here, then, the light comes in immediately from above, while the two vestibules or ends have only what they receive from this centre avenue and from their open entrances. Having pointed out—and with hearty approbation—what we consider unusual merits, we shall hardly be thought very unfair and invidious, or disposed to find fault for the nonce, if we also advert to what is, if not a positive blemish in the design itself, some drawback upon it: we allude to the disagreeable and marring effect—to our eyes at least—occasioned by the backs and naked brick walls of the adjoining houses being seen through the skylight over the centre avenue. If they were not to be kept out of sight by employing either ground or "waved" glass for the skylight, the backs of those houses as belonging *architecturally* to the Change itself, should have been treated accordingly; had which been done, their being seen from below through the skylight would have very greatly enhanced the total effect, and would have been also a novelty in itself. But, unluckily, extraneous circumstances and accidents of the kind are very rarely taken into account in making designs, in doing which it is too readily taken for granted that nothing will be seen but what is actually meant to be seen—as in this instance.

We have as yet said nothing of what will assuredly strike the ordinary spectator—in other words, the public—first and foremost, namely the polychromic decoration, here for the very first time introduced into any place of the kind, except we look upon the Pantheon Bazaar a previous example of it. In this respect, therefore, New Exeter Change is of quite novel character, and a decided advance upon every other "Arcade." All the more desirable it is that advantage should be taken of such places for applying it, because any decoration of the kind in the open air is almost utterly out of the question in this climate, even were it to be executed in fresco. This specimen of it is, we presume, entirely in distemper (by Mr. Collman), and is sufficiently satisfactory in its general appearance and effect, although, perhaps, some of the ornaments—those on the cove and ceilings—somewhat too minute, or else too scantily supplied. The giving the windows above the shops painted arabesque borderings in the Pompeian style, instead of architectural dressings, is by no means an unhappy idea; but we are not exactly pleased with the intermediate small arched panels. Square headed ones, either not so much sunk or not sunk at all, would, in our opinion, have better suited the design. It could be wished, too, that some colour or ornament had been bestowed on the entablatures of the shops. Since that has not been done (at least not yet), we hope that if intended to be plain they will be kept so, and not now be allowed to be painted according to the fancy of their respective occupiers; for should that be done, the whole place might just as well have been merely white-washed.

For the New Exeter we wish as much prosperity and fame as was enjoyed by its predecessor; yet, though we would not have the remark taken as one of evil augury, we cannot help entertaining some apprehension for it as a speculation, on account of its being in a situation where no thoroughfare whatever is required, because merely as such it is no public convenience—except as affording shelter during a shower of rain—for it opens no nearer communication, were any wanted, between Catherine and Wellington Streets, than what is already provided by Exeter Street, almost immediately adjoining. It will of course now quite supersede the last-mentioned street, but then the traffic there is so inconsiderable as not to be worth speculating upon. The Change must therefore depend upon its own attractions, and as far as architectural attractions will serve it, Mr. Sydney Smirke has bestowed on it not a few, and those of no ordinary kind.

ON THE SUPPLY OF WATER TO TOWNS.

(Continued from page 282.)

Extracts from the First Report of the Commissioners for Inquiring into the State of Large Towns and Populous Districts.

Mr. Thomas Wicksteed, C.E., Engineer to the East London Water Works, and also to the Kent and Vauxhall Water Works, was examined in answer to the following question: "Have you calculated what would be the abstract cost of lifting a certain quantity of water, say 1000 gallons, 100 feet high, supposing the engine set up and all the establishment fixed?" Mr. Wicksteed stated, "I have gone into those calculations, but each case must have a different calculation. No general rule can be laid down for it. I will take two towns. The town of Hull, where the corporation are going to enlarge their works, having just obtained an Act of Parliament for that purpose. Hull is a very flat town; the works will be about half a mile from the outskirts, and the whole supply of water will be raised by steam engines. At present they raise the water about 40 feet: it is proposed to raise it about 120 feet above the town. The extent of the proposed pipeage will be about 40 miles; the supply will be for about 110,000 or 120,000 inhabitants; in this case the whole of the water must be raised by steam machinery, and having no elevated ground, and having to raise water by mechanical power in a stand-pipe, the head of water is limited to a certain extent, and the head of water being limited, the sizes of the mains must be proportioned to the limited head. Now, in Cork there is a very large river, and ample water-power there, and steam-power will not be required for above six weeks out of the twelve months; the cost, therefore, of carrying on these works, as far as the machinery is concerned, will be less. There is also elevated ground close to the city, where it is proposed to erect the water-works 280 feet high. The water can be raised immediately by the natural power of the river to a very great elevation; and thus the sizes of the pipes will require to be much less than if the elevation were less, so that the estimate for the same work at Hull would be very different from the estimate for the work at Cork; and in almost every town the circumstances vary. In some cases a supply may be obtained by going a little distance from the town; the source may be so elevated that no machinery will be required to lift the water. At Kingston, in Jamaica, they have within four or five miles a fall of about 600 feet, so that the expense of supplying Kingston will be comparatively very small, as no machinery will be required to raise the water. In fact, in almost every case there must be a variation according to its circumstances.—In my first report to the corporation of Hull I stated, "The annual consumption of coals will be in the following proportion: for 6000 houses, 180 tons; for 13,000 houses, 390 tons; for 20,000 houses, 600 tons."

—At the request of the commissioners Mr. Wicksteed prepared the following statements.

Cost of Raising Water.

1st. A single pumping engine, made by Boulton and Watt in 1809, working 10½ hours per diem, 6 days per week, mean power 29½ horses; quantity of water raised per diem equal to 612,360 gallons, 100 feet high; the cost of coals 12s. per ton. In the estimate for the cost all charges for coals, labour, and stores, are included, but no charge for interest upon outlay, or repairs of machinery and buildings; all other charges for working the engine are included.

	s.	d.
Cost of raising 1000 gallons 100 feet high . .	0	0·543
Or, cost of raising 22,099 gallons 100 feet high . .	1	0·

This estimate is made upon an average of two years' working.

2nd. Two single pumping engines, made by Boulton and Watt in 1809, working 24 hours per diem, 7 days per week, mean power of each engine 30½ horses; quantity of water raised per diem 2,922,480 gallons, 90 feet high; the cost of coals 12s. per ton. Labour, stores, &c. taken as in the first case. The estimate made upon an average of 10 years' working.

	s.	d.
Cost of raising 1000 galloos 100 feet high . .	0	0·358
Or, cost of raising 33,519 gallons 100 feet high . .	1	0·

3rd. Two single pumping engines, made by Boulton and Watt, one in 1816 and one in 1828, working 12 hours per diem, 7 days per week, mean power of each engine 76 horses; quantity of water raised per diem 3,601,116 gallons, 100 feet high; cost of coals 12s. per ton. Labour, stores, &c. as before. The estimate made upon an average of 10 years' working.

	s.	d.
Cost of raising 1000 gallons 100 feet high . .	0	0·333
Or, cost of raising 36,036 gallons 100 feet high . .	1	0·

4th. One single pumping engine, made by Harvey and Co., upon the expansive principle, in 1837, working 24 hours per diem, 7 days per week, mean power 95½ horses; quantity of water raised per diem 4,107,816 gallons, 110 feet high; cost of coals 12s. per ton. Labour and stores as before. The estimate made upon an average of 4 years' working.

	s.	d.
Cost of raising 1000 gallons 100 feet high . .	0	0·150
Or, cost of raising 80,000 gallons 100 feet high . .	1	0·

The foregoing statements of the cost of raising water with different engines will show that there is a great variation. The comparison, however, is favourable to the engines upon the old plan, as those quoted are good ones. The following table will show the variation more clearly:—

To raise 100,000,000 of gallons of water 100 feet high, it would cost—

According to the 1st statement	.	£362
Ditto 2nd ditto	.	238
Ditto 3rd ditto	.	222
Ditto 4th ditto	.	100

Mr. Wicksteed stated that "a very great economy may be introduced by the use of the expansive-engine and plunger-pump, the advantages of which have been felt in the mines of Cornwall for 30 years or more, although he believes it was not introduced into water-works establishments until the latter end of 1837, when an engine upon that principle was set to work at the East London Waterworks, and is now working most satisfactorily, having from the time of its first starting continued to raise 225 barrels of water with the same quantity of coals that the best engine on the works, made upon the old construction, required (and requires) to raise 100 barrels. Since that time another large engine of the same description has been erected at the Southwark Waterworks, whose performance is equally good, if not superior. The comparison above given is too much in favour of the old engines and against the new, taken as a class, as there are instances in London, and in the country, where the quantity of water raised by the consumption of a given quantity of coals is not more than one-fourth or one-fifth of that raised by the new engine. There is another way of shewing the advantage to be derived from the introduction of this new engine; namely, that the same quantity of water may be raised from 2¼ to five times the height by the consumption of a given quantity of coals; and as the size of the pipes depends upon the velocity of the water passing through, and as the velocity increases as the square root of the head of water, so by increasing the head of water four times, the sizes of the pipes may be reduced to one-half, and the chief item in the expenditure in new works may consequently be reduced one-half, and thus less capital will be required; and, as it often happens that it is more convenient to spend a small sum annually than a large sum at once, this is a matter of great importance. And again, in many, if not most towns where the works have been established for a long period, and the length of pipeage has gradually been much increased, the pipes originally laid down become inadequate to afford the increased demand, the consequence of which is, that the extremities of the district are generally supplied most miserably. Instead of having to lay down new and large mains, the erection of the new engine, by which the head of water may be increased at the same cost of coals, increases the utility of the old mains, and prevents the necessity of a large outlay in new ones."

How are the settling reservoirs constructed and arranged?—We take the water in by a canal about two miles in length; that comes into a wide canal or small reservoir, at the end of which there are two sets of gates; one communicating with one reservoir, the other communicating with another reservoir. We admit the water into both reservoirs. We then draw it out of one reservoir while the second one is kept closed; the next day we draw it out of the second one and fill up the first one. During the time of floods we have the means of shutting off the water altogether for four or five days from those reservoirs.

How do you get quit of the matter that settles below?—The deposit accumulates very slowly. About 12 or 13 years ago we cleaned out two small basins; I think they had not been cleaned out before for 15 or 16 years; with regard to our large reservoirs, which have been made since 1836, I have no idea that in my time we shall have to clean them out. The area of the large reservoirs is one 6½ and the other 5½ acres.

Are you aware of any difference in the quality of the water passed through iron pipes, as compared with the quality of that passed through lead?—Both in iron pipes and lead pipes a coating very rapidly takes place in our district; that coating is, I believe, a carbonate of iron and sulphate of lime in one case, and, I believe, carbonate and sulphate of lead in the other, which forms a thin crust round the inside of the pipes, about the thickness of a thick sheet of paper, and as soon as that is formed, being an insoluble salt, and no further corrosion takes place; but the corrosion is upon the *outside* of the pipe when it is of iron, and that depends upon the qualify of the ground.

Advantages of a Constant Supply of Water instead of Alternate.

Thomas Hawksley, Esq., Civil Engineer, stated that he designed and constructed the Trent Water-works at Nottingham in the year 1830-31, and is resident engineer at this time, and has also been employed by several other Companies.—The number of houses to which water is supplied from the works which he superintends at Nottingham is about 8000, containing a population of about 35,000 persons.

The greatest pressure at which water is kept upon the pipes supplied is about 120 feet, and that on a considerable portion of the town. The average pressure may be stated to be about 80 feet, there being in Nottingham great variations in altitude.—The high pressure is kept upon all classes of pipes and at all times. The extra cost of pumping to raise the water to the highest points for which it is ordinarily required is very slight. There is but one pressure at Nottingham, and that is the same at all times, and is found to be economical. If the water were lifted only half the height the saving would not amount to more than about 1-20th of the total charge.

With the tenants' service pipes full at all times, and in constant communication with the mains and chief reservoir, it dispenses with the necessity of the tenants having water-tanks. All the houses that have been supplied since the Trent Water Company has been established, which are very numerous (indeed, probably amounting to 5000 or more out of 8000) are without water-butts. In the houses taken by the Trent Company from the former Company, the tenants of which became tenants of the Trent Water Company, there were brick cisterns under the floors already existing; of course we only attached the old communication pipes to the service pipes of the new Company, and so far as the majority of those tenants are concerned we do supply the tanks, for they existed before; but even in many of those cases the tanks have been abandoned, and the tenants take their water in the same way as others.

In answer to the question—"It is stated that under the common arrangement of having water "on" for such a time on alternate days as may fill butts and tanks, that of the total capital invested in the complete machinery, the portion of the tenant's outlay consisting of the house butts or tank, ball-cocks and pipes, involves the expenditure of a capital equal to that invested by the Company; for example, if the Company's capital amount to £50,000 for engines, mains, &c., the tenants' capital invested for tanks, ball-cocks, and pipes will involve an equal expenditure, and that half perhaps of the tenant's portion will consist of the expense of the tank, butt, and ball-cock?" Mr. Hawksley said—"The expense of the tank or butt will in general be more than half the tenant's expense considered exclusively of the cost of the communication pipe used in the Street, which is at Nottingham provided and maintained by the Company, but probably not otherwise."

In the capital of a Company the pipe to each of the individual houses is not included. In general that would be the tenant's charge; but in the case of Nottingham it constitutes only a small portion of the expense of works, it costs the Company about a shilling a foot on the average, including taking up the street, putting down the pipe, and enclosing it, and may amount to between £2000 and £3000. The cost of each of the Company's branches may possibly average 15*s*., but as one branch will in the majority of instances supply a whole court, the cost per tenement supplied will not exceed 6*s*. or 7*s*. The expenditure at Nottingham for the supply of 8000 houses amounts to about £30,000. The cost of butts or cisterns fitted with a ball-cock, pump or draw-off cock, and other appurtenances would (if required) amount to £30,000 at the least, if, as the questions imply, each of the 8000 tenants were to be provided with a separate cistern or tank capable of containing water for two days supply after the present rate of consumption, and that of more than half this cost the public is disburthened by the introduction of the system of constant delivery. By this arrangement of keeping the pipes constantly full, dispensing with the necessity of tanks, more than half the tenants' expense is got rid of, or more than one-third of the then total expense of introducing water into houses.

Where butts or receptacles for water are used they become sources of impurity; they are not properly covered; soot and dust get in; in summer time they are frequently exposed to the action of the sun, and the wooden butts are apt to decay. All labour of cleansing these causes of impurity is prevented by the arrangement of keeping the pipes constantly full. The effect of the arrangement is to substitute one large reservoir or tank well situated and under effectual care, for the many thousand ill placed butts and tanks requisite to afford a copious supply on the common arrangement.

There is also the saving of the room occupied by the tank, which is in some districts of much importance; there is the avoidance of the damp from the evaporation of a body of water in the house, the saving of accidents and of leakage, and of the inconvenience from having the tank sometimes empty. In many houses where there is no convenience for a tank in the upper part of the house it is placed in a lower apartment, and the water must be borne up stairs for use; the labour incurred necessarily restricts the free employment of the water for many purposes to which it might be beneficially and healthfully employed. In such places, too, the expense of a force-pump to charge tanks for water-closets, and of waste and warning-pipes, is sometimes necessary. This apparatus for the middle and higher class houses is not only very expensive but liable to be often out of repair, constantly bringing the plumber into the house. Another and a very serious inconvenience affecting the habits and sanatory condition of the population attendant on the system of partial or occasional supply is that it creates an inconvenience and an obstacle to the use of baths. With a constant supply of water at a sufficient pressure baths might be supplied in private houses with little difficulty or expense, so little, indeed, that he believes it to be practicable, and hopes yet to see baths introduced into the houses of labouring men for the use of themselves and families. There may be a *saving* in the tenants' outlay for pipes. In the metropolis and other places, where the Companies' supply is only occasional, the pipes are larger than necessary that the water may be delivered within a short time. In towns the usual size of the tenants' pipes is ¾ inch, and in the larger houses 1 inch; whereas with the constant supply ½ inch pipes will serve the same purpose. If necessary we can have stronger pipes of the same weight. Pipes of ½ inch diameter and 2¾ lb. weight per foot are found to be secure at the strongest pressure employed in Nottingham.

In answer to a question respecting the actual waste of water at the Nottingham works Mr. Hawksley said—"A judgment may perhaps be best formed as to the small extent of waste from a statement of the actual amount of supply. The actual amount of supply at Nottingham is not more than from 80 to 90 gallons per house per diem; this is taken by about 8000 tenements and works of every description, amongst which are breweries, dye-works, steam-engines, and inns, and other places of large consumption."

The system of constant supply diminishes the rate of delivery in the service-pipes and sub-mains very materially, distributing over a greater number of hours the quantity of water which otherwise must be delivered in a very short period.—It is spreading the water over the 12 hours of the day; and with the advantage that as the water travels more slowly through the pipes, smaller pipes will be equivalent to larger.

The constant supply is also the means of a large economy of men. The Nottingham Company has maintained its supply by night and by day ever since its establishment, except during a period of one month, when for the purpose of experiment the water was shut off at 10 in the evening, and turned on again at 5 in the morning. It was then found that it would be more expensive to keep extra turncocks, do extra repairs to valves, draw plugs to cleanse the pipes, and attend to complaints. The original plan was therefore resumed. We find that one experienced man, and one boy of about 18 years of age are, on the system of constant supply, quite sufficient to manage the distribution of the supply to about 8000 tenements, and keep all the works of distribution in perfect repair, including cocks, main pipes, service pipes, and tenants' communication pipes, to the extent they are laid under the public highways. The Old Company has adopted the system of the Trent Water Company, and now maintains a constant supply. Any company that possesses an ample quantity of water at its works, and a sufficient reservoir in an elevated situation, may adopt this mode of supply without difficulty or disadvantage, and indeed the difficulty and disadvantage is far from insuperable when an elevated reservoir cannot be obtained.

"The term waste would imply an excessive expense for the pumping of water. Now it appears, from one instance, cited by Mr. Wicksteed, of the duty of a steam engine of good construction, that this one single pumping engine, upon the expansive principle, and with coals costing 12*s.* per ton, with labour and stores, and all except the interest on fixed capital, the cost of raising 80,000 gallons of water 100 feet high was 1*s.*; that by another, Taylor's Cornish engine, 1 lb. of coal converted into steam raises 10,000 gallons of water 10 feet high: in other words, if a room 20 feet square were filled 4 feet deep with water, 1 lb. of coal converted into steam would overcome the friction of the engine, and raise that water into a room 10 feet above it. Does your own experience justify the conclusion from such instances, that when the machinery and distributing pipes are fixed, and there is an unlimited supply of water, as from a river, the expense of pumping additional quantities is inconsiderable as an element of calculation?—Assuming the possibility of varying our works without cost, the experience at Nottingham is to this effect, that we could give 8 or 10 times the present unlimited supply for about a double charge; that we could raise all the water now taken 50 feet higher by increasing the charge 5 or 6 per cent., and that were we to lower the head to half its present height, the saving of expense would not exceed 6 or 7 per cent. on the gross charge to the tenant. The answer may be otherwise given thus. The Trent Water Company supply houses at an annual average charge of about 7*s.* 6*d.*, at any level required, even into the attics of four or five story buildings; if the supply were afforded to the level of the pavement only, the charge could not be reduced more than 6*d.* per house, or for the labourers' tenement not more than 4*d.*

"It is stated that the daily supply of the metropolis is equal to a lake 50 acres of a mean depth of three feet,—what, on Mr. Wicksteed's estimate, would be the additional expense incurred if the supply were doubled and the additional quantity was raised by pumping 150 feet high?—On Mr. Wicksteed's experience the expense would be £20 10*s.* per diem, or £9,300 per annum, which as about 200,000 houses are supplied by the Companies, when divided gives 11*d.* per house per annum for the expense of the pumping to a height of 100 feet, or 16½*d.* of pumping to a height of 150 feet. I wish it, however, to be understood that I do not concur in Mr. Wicksteed's mode of estimating the cost. It is quite true that the expense of pumping forms, in nearly all cases, but a small portion of the total charge to the tenant; but Mr. Wicksteed's statement would afford a result fallaciously low. Mr. Wicksteed's engine uses less coal, but employs more capital, so that the saving is rather apparent than real. And again, the London and many other Companies would be unable to obtain a supply of fuel at the price assigned by Mr. Wicksteed.

"In respect to the apprehension expressed, that if the system of constant supply at high pressure were adopted much larger mains would be required, what is the evidence of fact and experience?—Directly the reverse of the hypothesis. If the supply of water for ordinary purposes be the only consideration, then, for the same reason that smaller pipes do suffice for the tenants' communication-pipes, smaller mains will suffice for the system of constant supply at high pressure. Where 20-inch mains are used on the system of periodical supply, 12-inch mains would amply suffice for the system of constant supply; instead of the 7 and 6-inch mains, 5 or 4-inch would suffice; instead of 3-inch service-pipes for the occasional supply, 2-inch would suffice for the constant supply; indeed, for constant conveyance, sizes much smaller than these would answer the purpose; but as there are irregularities of draught, it is needful to provide accordingly. The objection of Mr. Wicksteed is founded upon a supposed state of things which never does occur, namely, of all the pipes discharging water at the same time.

"An objection to the introduction of water into the houses of the poorest classes is thus stated by Mr. Wicksteed:—'Where a landlord has got 20 or 30, 40 or 50 houses, and requires a supply of water, if they are poor houses it is frequently given by one common stand-cock to all the houses. If he was to put a separate supply to those houses by a lead-pipe, the lead-pipe would be there in the evening but would be gone in the morning.' Now, do you find that tenants are apt, for the sake of the lead, to cut off their own supplies of water; and what, under all circumstances, is your experience on the point?—We have some of the poorest and worst-conditioned people in Nottingham, and we scarcely ever experience anything of the kind. In fact, the water at high pressure serves as a police on the pipe. The cutting off a cock with the water at high pressure is rather a difficult matter to do quietly: 'knocking up' is too noisy; and when a knife is put into such a pipe and a slit is made, a sharp, flat, wide stream issues, very inconvenient to the operator; and when the pipe is divided there is the full rush of the jet to denounce the thief. We have lead-pipes all over the town, in the most exposed places, and I can affirm that such an event rarely occurs *out* of the houses, and *never* within."

"Does your own experience furnish any datum from which the expence of supplies of water, including the wear and tear of engines, interest on fixed capital for machinery and all distributary pipes, the necessary expenses of management, in other words, the total expenses, may be judged of?—Yes; the total expense is on the experience of the last five years 2·88*d.* per 1000 gallons. This is equal to 12*l.* per million gallons.

"We are desirous of being informed of the several establishment charges of a Water Company, or in other words, what charges are independent of the quantity of water pumped, and what not, and their amount. Can you give us from your practical experience, say at Nottingham, where you lift your water 135 feet high?—On an average of five years' experience of the Trent Company, at Nottingham, they are as follows for each million and for each thousand gallons."

Tabular Statement of the Expenses incurred in supplying the Town of Nottingham with Water, according to the experience of the Trent Water Works Company.

Description of Charges.	Cost per 1000 Gallons.	Cost per Million Gallons.	Total of each Class of Items per Millon Gallons.	Proportion per Cent. of Total Charge.	
	d.	£. *s.* *d.*	£. *s.* *d.*		
1. *Charges nearly proportionate to the Quantity supplied.*					
Coals	0·3035	1 5 3½		10·5	
Oil and tallow	0·0480	0 4 0		1·7	
Sundries	0·0137	0 1 1¾	1 12 4¼	·5	13·5
Hemp. leather, &c.	0·0119	0 1 0		·4	
Repairs of pumping machinery	0·0111	0 0 11		·4	
(nearly = 0½*d.*)	0·3882				
2. *Charges which diminish nearly as the Quantity pumped or supplied increases.*					
Salaries of law clerk, engineer, office clerks, collector, &c.	0·3720	1 11 0		12·9	
Parochial and other taxes	0·1328	0 11 0¾		4·6	
Wages of turncocks, plumbers, &c.	0·1295	0 10 9½		4·5	
Incidentals attending the management	0·0461	0 3 10		1·6	
Law charges and expenses of policemen	0·0366	0 3 0½		1·3	
Rents of various premises, acknowledgments under Act of Parliament, &c.	0·0300	0 2 6	3 6 1¾	1·	27·6
Repair and maintenance of mains, cocks, communication-pipes, and other works of distribution	0·0196	0 1 7½		·7	
Stationery, advertising, &c.	0·0136	0 1 1½		·5	
Compensations for damage, &c.	0·0089	0 0 9		·3	
Gratuities, medical assistance, &c.	0·0049	0 0 5		·2	
(nearly = 0¾*d.*)	0·7940				
3. *Charges which diminish less rapidly than the Quantity of Water pumped or supplied increases.*					
Wages of engine-man	0·1063	0 8 10¼		3·7	
Wages of stoker and reservoir keeper	0·0650	0 5 5		2·3	
Cleaning and other ordinary charges of the lower or filtering reservoir	0·0367	0 3 0¾	1 0 0¼	1·3	8 3
Repairs of buildings	0·0215	0 1 9½		·7	
Cleaning and other ordinary charges of the upper or storing reservoir	0·0107	0 0 10¾		·4	
(nearly = 0¼*d.*)	0·2402				
Interest on invested capital, varying directly with extent of works and inversely with amount of supply (nearly = 1½*d.*)	1·4570	6 1 5	6 1 5	50·6	
Totals (nearly = 2⅞*d.*)	2·8794	..	14 19 11¼	100·	
The income amounts to 3·17*d.* per 1000 gallons; the difference (0·29*d.*) is applied to extension of works.					

The price of fuel will vary greatly in different places. And the description of engine will also vary, and influence the consumption of fuel.

The different descriptions of engines, and prices of fuel, taken in relation to each other, will afford the result shown in the above table, and they will stand nearly as follows:—

Description of Engine.	Steam Pressure.	Cost of Fuel,
		s.
1. H.P.—Double powered, non-condensing	30 + 0	32
2. B. and W.—Double powered, condensing ..	$3\frac{1}{2}$ + atmos.	25
3. B. and W.—Single powered, condensing	$3\frac{1}{2}$ + atmos.	20
4. Cornish.—Double powered, condensing†	30 + atmos.	16
5. Cornish.—Single powered, condensing†	30 + atmos.	12
6. Cornish.—Single powered, condensing†	45 + atmos.	9
7. Taylor's Cornish.—Single powered condensing†	..	6

"Then is the relative economy of these engines such that, for instance, the engine No. 6 would perform the same amount of work with 9s. worth of fuel, to do which the engine No. 2 would require 25s. worth?—Yes; but against this advantage must be placed the vastly greater first cost the engine No. 6, and its much greater liability to accident. By the use of the Cornish engine No. 6 in place of the Boulton and Watt engine No. 2, a saving of nearly 0·2d. per thousand gallons would be effected in the fuel account, but the capital account would be increased fully 0·1*d.*; the resulting economy to set against increased risk would, therefore, not exceed a twenty-ninth part of the whole charge. I should, therefore, be in general disinclined to recommend the adoption of the Cornish engine, except, perhaps, in the case of works of such great extent and so arranged that the public would not be inconvenienced by the stoppage of a single engine."

"The cost of construction of the works at Nottingham, is something less than 1*l.* per individual, supplied by the Trent Water Company, but if that Company had the sole supply of the district over which its pipes are laid, the cost would not exceed 15*s.* per individual. The expense attendant on the supply of water and management of the works amounts to about 44 per cent. on the income, which is slightly less than the proportion of the like expense in London."

"You have stated that, on the system of constant supply at high pressure, smaller instead of larger mains would suffice. It has been stated that at one town, where a high pressure was put on old mains and distributary pipes constructed for a low pressure, the pipes which burst were very few, and the inconvenience (which it was anticipated would be very great) was inconsiderable. Does your practical experience enable you to express a confident opinion that the mains and ordinary distributary pipes for the system of periodical supply would not be required to be extensively superseded, and others of greater thickness substituted for the application of a system of constant supply, under a system of moderate high pressure, such as that contemplated?—Yes; the amount of pressure does not practically enter into the determination of the thickness of the metal of main pipes. Any thickness at which mains can in the regular course of foundry business be cast will afford many times the strength requisite to retain water under a pressure of 150 feet. In fact, pipes are proportioned according to the difficulty of running the metal and adjusting the core; and, in practice, it is customary to prescribe a thickness of, at most, one-fifth the square root of the diameter ($\cdot 18 \sqrt{d}$), a proportion which has no reference whatever to the strain arising from the pressure. Pipes are now cast lighter than formerly, although the pressure under which water was usually transmitted has been increased.

"Be so good as to explain the method by which you ascertain the dimensions of pipes for a constant supply to the attic stories?—Assuming the case of a street of houses 600 yards long, I proceed thus:—I first ascertain, perhaps, by the parish books, the numbers and rentals of the houses; I then estimate the consumption of water in each house in gallons at $12\frac{2}{3}\sqrt{\text{rent in pounds}}$, which I find by experience to afford a result as accurate as the nature of the inquiry will permit.

"This gives for houses of 6*l.* rent 40 gallons per diem; 10*l.* rent 56 gallons per diem; 20*l.* rent 88 gallons per diem; 50*l.* rent 163 gallons per diem; 100*l.* rent 260 gallons per diem, 200*l.* rent 410 gallons per diem; 500*l.* rent 756 gallons per diem. To obtain a proper practical taper, I divide the length of the pipe into portions of about 200 yards, and assign to each the quantity of water to be conveyed; thus

Final 200 yards	. . 13,000	gallons per diem.
Middle 200 yards	11,000 + 13,000 = 24,000	,,
First 200 yards	8,000 + 24,000 = 32,000	,,

I next consider that nearly the whole of the water will be consumed in the four or five hours elapsing between breakfast and dinner: to err on the safe side, I assume the delivery to take place in four hours, and that the whole of the water taken off from each length has to be passed to the end of that length. It will sometimes happen that the reservoir from which the supply is obtained is nearly on the level of the attic stories, and that in consequence perhaps not more than four feet of head can be allowed on each length of 200 yards to produce the velocity and overcome the friction: allowing this quantity in the case assumed, I shall be enabled to apply the formula,

$$\frac{1}{15}\sqrt[5]{\frac{q^2 l}{h}} = d,$$

which I have found to apply with great exactness: in this formula (q) represents the number of gallons to be delivered per hour, (l) the length of the pipe in yards, (h) the head in feet, and (d) the diameter of the pipe in inches. We now obtain the following diameters, first 200 yards $5\frac{2}{10}$ inches; second ditto $4\frac{5}{10}$ inches; third ditto $3\frac{6}{10}$ inches; to which, adding half an inch for possible contraction by corrosion, the practical diameters become six inches, five inches, and four inches for a street producing in London a water rental of at least 300*l.*

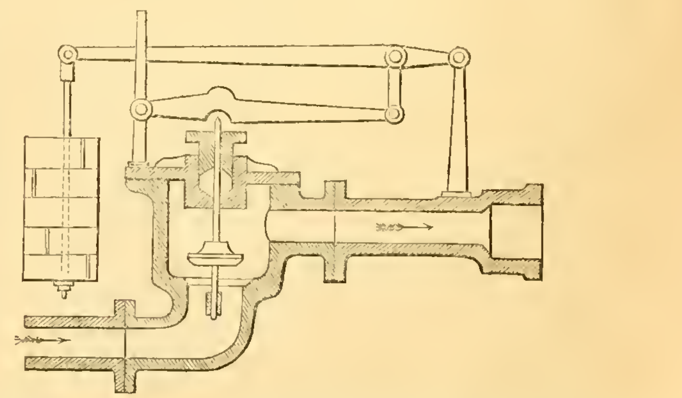
"What would be the saving in the size of the pipes consequent on the system of constant supply as compared with the intermittent system?—The diameters of the service-pipes and sub-mains are diminished about one-third, and the weights of the pipes about one-half.

"The saving in the size of the service-pipes, the mains, and so forth, would compensate for the cost of throwing up by engines an additional quantity of water to meet the apprehended waste and additional consumption, and keeping it constantly on?—Yes; and the management is much more easy, and the number of men necessary to superintend the distribution of the water becomes much fewer,—in fact, it demands very little attention indeed, where the water is constantly running through the pipes; but where the water is given at intervals, many persons are put to great inconvenience; then they are complaining, and must be attended to; and the ball-cocks when they go down will stick very frequently, and there is, consequently, a great waste of water, so that a great quantity of water is not well applied. The waste is very great on the intermittent supply, much more, I am satisfied, than most engineers are aware of. We have found, in many instances, where our supply has been turned off a particular street for a short time, the ball-cock of a cistern has gone down, and the water run to waste after being again turned on. That happens in all towns where the supply is intermittent; and I believe the waste from this and some other causes is much greater than that which occurs in a constant supply.

"In stating generally your view that the supply of a town by the medium of a constant supply and high pressure is quite as cheap or cheaper than under the other system of an intermittent supply, do you take into consideration that, in the one case of constant supply and high pressure, there would be greater advantage to the people and a greater supply of water?—I did not take that into consideration in the first instance; but I think the saving in the number of officers and in other respects would more than compensate for the cost of pumping that quantity of water; for the mere cost of raising the water is but a trifling portion of the expenses of a Water Company: a great many expenses are permanent standing expenses; the greater proportion are in a great degree independent of the quantity of water lifted.—For 4*s.* 4*d.* a house, we give the constant supply of water which is required for the use of a cottager's family.

"Under the existing circumstances at the prices charged and the benefit conferred, do the Company divide actually five per cent. upon the outlay?—Yes, and the 50*l.* shares of the Company sell at from 70*l.* to 73*l.* each, and have done so for some years. The dividends of the Company are 3*l.* on each 50*l.* share, and that is considered in the transfer of shares to represent a value of 70*l.*

"If a city were situate near a very high elevation, on which it would be convenient to place the reservoir, say 300 feet, giving a greater pressure for the



tenants' communication pipes in the lower districts than is requisite for the various purposes of constant supply, at high pressure, have you any plan of

† Expansive action.

meeting such cases, or modifying such pressure?—In such case I should endeavour to bring the leading main from the higher part of the city to the lower, lay off the sub-mains and services by lines of equal altitude, and reduce the pressure at proper decrements of height by a loaded valve, as shown by the sketch."

Filtration.

Mr. Hawksley stated that with regard to filtration, that it is always advantageous to filter water which is not naturally bright, to clear it from matters held in suspension. If the extent and thickness of the filtering-bed be very considerable, prior subsidence may be altogether dispensed with; but if the surface be limited, and the thickness small in respect to the quantity of water to be treated, as is usually the case when artificial filters are employed, then it becomes necessary to resort to previous subsidence. There are particles so fine and minute, as to be incapable of being deposited by the force of gravity, though they may be detained by filters, if the operation be slowly and cautiously conducted. At Nottingham, the construction of the filter is this: the reservoir which lies on the banks of the Trent, about a mile from the town, is excavated in a natural stratum of clean sand and gravel, through which the water slowly percolates to a distance of 150 feet from the river. The adventitious solid matter is gently deposited on the bed of the river, from which it is washed away by the action of the stream. Sometimes the water comes down the river exceedingly thick, and discoloured by peat and other vegetable matters; it is sometimes of the colour of tea: nevertheless filtration through the bed of 150 feet renders the water perfectly pellucid. When the bottom of the reservoir has been bright from a recent sweeping, a pin may be seen at the depth of eight or nine feet. The reservoir being exposed to the action of the sun produces vegetation of the *conferva* genus, which is removed at short intervals of about three weeks each in summer and of about six weeks in winter, by pumping out the water and the use of the broom. To prevent the small communication-pipes from being choked by the accidental introduction of leaves and other extraneous substances, the water is drawn through large sieves of fine strainer cloth. In addition to the reservoir there is a filter tunnel passing through a similar stratum for a considerable distance up the adjoining lands. This tunnel is four feet in diameter, and half-brick thick, and being laid without mortar or cement, cost only 10*s.* a foot, including excavation to a depth of 12 feet. The office of the reservoir, in addition to the filtration through the bank, is to receive and accumulate the water during the time the engine is not at work. The tunnel is formed simply for the purpose of filtration, and it has the advantage of not exposing the water to the action of the sun.—The water is transmitted to the upper reservoir by an engine along a main-pipe, which passes through the middle of the town and supplies all the inferior pipes in its course. The upper reservoir, placed at the extremity of this pipe, receives the excess of water pumped by the engine, and returns it down the same pipe so soon as the engine ceases to act, and hence a constant supply is maintained without difficulty, trouble, or expense. The distance of the site of the filtering and subsiding reservoirs would not occasion such expense or inconvenience as to prescribe close limits. The engineering difficulties would be very insignificant, and the expense really trifling in comparison with the resulting advantages. Not the least of which would be the securement of an unfailing supply of pure water for several ages to come.

If for the supply of the metropolis it were found desirable to take up the water of the Thames in its full purity above Windsor, and erect filters or subsiding beds thereabout, the probable expense of its transmission above a supply taken up near the metropolis would be for the transmission of 500 gallons of water per second two mains, each of 60 inches diameter, would be requisite. The resistance from friction may be calculated from the formula for long pipes

$$P = \frac{Q^3 l}{140\, d^5},$$

in which (P) represents the horse-power necessary to overcome the friction, (*l*) the length of the pipe in inches, (Q) the quantity of water to be delivered in one second, and (*d*) the diameter of the pipe. From this we ascertain that the resistance arising from friction in pipes of the given size, and 25 miles long, would require less than 450 h. p. beyond the force employed to raise the water into an elevated reservoir. If this reservoir were situated at a height of 220 feet, the steam power required to *raise* the water would be about 2000 nominal horses, and the total power to be employed in transmitting and raising 500 gallons of water per second would amount to less than 2500 horses. The cost of the main pipes would be about 1,000,000*l.*; of the engines and machinery, with some reserve of power, about 150,000*l.*; and of the tanks and reservoirs probably 200,000*l.* A first investment of 15*s.* per head, or 9*d.* of addition to the annual water charge of each of the population would therefore enable a constant supply of the purest soft water to be delivered at all hours, and into every story throughout London, and that without injury to the interest of the existing companies who might derive their supplies from this common source. A *very* considerable economy of management and working expenses would indeed result from this consolidation of engineering operations which would go far in reduction of the increased charge of 9*d.* per annum.

Supply of Water for Baths.

Mr. Thomas Hawksley stated that he had been consulted in respect to public baths, and had been engaged in making some private baths.—On the assumption that one hogshead, or 54 gallons of water, would suffice for the ablution of each person, the cost of pumping and engine expenses for 100 persons per diem would be threepence, and the extra expense of filtration by artificial means something less than 2*d.* more.—The expense of fuel for heating 100 hogsheads of water from a mean temperature of, say 52°, for baths, to blood heat, or say 98°, would require 270 lb. of Newcastle coal, which would cost in London about 3*s.* In addition to this, a further quantity of fuel would be required to replace the heat lost by radiation, evaporation, and conduction, which would be subject to great variation according to circumstances. An equal quantity of coal would in general, however, be sufficient for this purpose. On a larger scale there would be some saving.—The whole expense of hot baths in numbers of not less than 100 per diem would stand nearly thus for each person for the single bath:—

	s.	d.
Water	0	$0\frac{1}{4}$
Fuel	0	$0\frac{1}{2}$
Attendance	0	1
Interest on building and incidentals	0	1
	0	$2\frac{3}{4}$

The probable cost of maintaining a tepid swimming bath, suppose 80 feet long and 30 feet wide, and of the average depth of 5 feet, and supposing 10,000 gallons of fresh water daily admited into it, would be for warming that quantity of water, about 2 cwt. of coal, and it would probably in practice require 4 or 5 cwt. in addition to sustain the temperature of the bath. A remunerative charge for the use of the tepid bath would probably be about 2*d.* per head, if taken by 200 or 300 persons per diem.

Fountains.

With respect to the use of water for fountains, Mr. H. stated that a jet delivered under a pressure of 36 feet through a plate pierced with a half-inch aperture, would deliver 900 gallons per hour to a height of 30 feet or upwards, at an expense of $2\frac{1}{2}$*d.* per hour. An inch orifice would deliver four times this quantity to a height somewhat greater, and would be charged about 8*d.* per hour.

Supposing the water works maintained by the town, and that it was determined to supply the public fountains at the expense of pumping only, a half-inch jet would cost per hour, including coals, wages, and the working expenses of the engine, very nearly $\frac{1}{2}$*d.*, or for a day of 14 hours, 7*d.* per diem, and an inch jet 2*d.* per hour, or 2*s.* 4*d.* per diem. This is the cost at Nottingham, where the water is raised 135 feet; but under other circumstances it might be less; and for the cost of pumping only for small wayside fountains delivering say one or two hogsheads of water per hour, would be $\frac{1}{2}$*d.* to 1*d.* per diem.

Watering and Cleansing Streets.

Mr. H. stated that for watering, the rule of assessment is $\frac{1}{2}$*d.* per square yard of surface watered, if for small surfaces, and $\frac{1}{3}$*d.* if for extensive surfaces, for the season.

In the metropolis, the charge for water for watering the streets is sometimes $2\frac{1}{2}$*d.* per ton, and one ton it is ascertained will water so as to lay the dust of 600 square yards of gravel or Macadamized roads, or 400 square yards of granite paved roads. It appears that the number of days for which the water is required to lay the dust is, on the average of 20 years' experience, about 120 per annum. A common charge is $\frac{3}{4}$*d.* per square yard for the water for a season. When the parishes perform the service, it is usually at from $1\frac{1}{2}$*d.* to 2*d.* per pound on the rental. Now what would be your charge of the expense of water per house of 20 feet frontage for the season?—Our charge for the supply of water to a street one mile long and 15 yards between the kirbstones, would, by our charge per ton, be 16*l.*; for twice over, 32*l.*; which with houses of seven yards frontage would be a charge of 1*s.* 6*d.* per house, or allowing for occasional vacant spaces in the row of houses, say 2*s.* per house for the supply of water during the like season.—For watering streets twice per diem, I think one man might, with proper and properly-placed apparatus for jets, effect the watering of about one mile. Supposing the wages to be 20*s.* and expense of hose 10*s.*, or altogether 30*s.*, per week, the additional expense for labour would be about 1*s.* 6*d.* per annum (omitting the Sundays), or allowing for vacancies, say 2*s.*

It is stated that an ordinary sweeper usually sweeps 1000 square yards of pavement per diem, and a good labourer of the class about one half more, and that the expense of sweeping by hand labour is between 2*l.* and 3*l.* per mile of street 15 yards wide. Have you had any observations of the labour and expense of the more effectual mode of cleansing granite or wood pavement by scouring with a jet?—No precise observations. I have seen an open space of about 1500 square yards of level pavement cleansed in less than 20 minutes by water acting under a pressure of 80 feet.

Watering Gardens.

In respect to the watering of gardens, it would appear that one man with a jet of the force to rise 50 feet perpendicular height would with that one jet, at an angle of 45 degrees, command an area of about 2000 square yards. From your information, that about 40 jets would command a length of a mile of road, and that one man might water that mile twice a day, may it not be inferred that by a proper distribution of pipes and arrangement of cocks one man might water 20 acres of garden ground in a day? Yes; for although 2 miles of such a road contains only 10 acres, the range commanded by an equal number of jets would in a garden command twice that area, and the interruptions would be much fewer than in a public road.—It is stated to be a heavy wetting shower when the excess fills gutters, and, running away, covers the ground to the depth of a quarter of an inch. How many tons of water would fall in such a shower on an acre? A fall of rain sufficient to cover the earth to a depth of $\frac{1}{10}$th of an inch will, under ordinary circumstances, fully saturate the dust of a public thoroughfare: this quantity is equal to 750 gallons, or about $3\frac{1}{2}$ tons, or 2 loads of water per acre.—In what time would such a quantity be delivered from a hose by a jet under the moderate pressure of 50 feet? The velocity, and consequently the time, will in some degree depend upon the arrangement of the apparatus: a *contracted* jet, issuing under a pressure of 50 feet, at a $\frac{7}{8}$ths aperture, will deliver 750 gallons in 14 or 15 minutes: a judiciously formed nozzle will deliver the same quantity in 10 minutes.—The rate of expense of laying down a set of water pipes per acre would be from 15*l.* to 30*l.* according to circumstances, and at the cost of supply at Nottingham of 3*d.* per 1000 gallons a fall of water equivalent to a shower would be given at $2\frac{1}{4}$*d.* per shower per acre.

It is stated by Mr. Braidwood that, in London, 26 men working an engine of two 7-inch barrels will throw a $\frac{13}{16}$th of an inch jet 50 feet high; and the following is an account of some experiments made at the works of the Southwark Water Company, to ascertain the capacity of the existing works to afford several jets for street cleansing or for extinguishing fires.

Experiments on Jets of Water.

"*Result of Experiments made on the* 31*st January*, 1844, *to ascertain the Height that a Jet of Water will rise from the Mains and Services belonging to the Southwark Water Company, under a Fixed Pressure of* 120 *Feet.*

The first trial was made in Union-street, between High-street and Gravel-lane, Borough, over an extent of 800 yards of 7-inch main, and through the fire-brigade stand-pipes, hose, and jets.

This 7-inch main is connected to the 9-inch main in the High-street, Borough, which, after a run of 500 yards, is joined to 200 yards of 12-inch main, and then continued by 550 yards of 15-inch main to the great main leading from the Company's works at Battersea, making a total distance of 5500 yards from the place where the experiment is made.

One	$2\frac{1}{2}$-inch stand pipe,	with	40 feet of hose,	and	$\frac{7}{8}$-inch jet,	rose	50 feet.
Two	$2\frac{1}{2}$	„	40	„	$\frac{7}{8}$	„	45 „
Three	$2\frac{1}{2}$	„	40	„	$\frac{7}{8}$	„	40 „
Four	$2\frac{1}{2}$	„	40	„	$\frac{7}{8}$	„	35 „
Five	$2\frac{1}{2}$	„	40	„	$\frac{7}{8}$	„	30 „
Six	$2\frac{1}{2}$	„	40	„	$\frac{7}{8}$	„	27 „

Then all the fire-plugs on the main were closed except the first and one $2\frac{1}{2}$-inch stand-pipe, with 160 feet of hose, and a $\frac{7}{8}$-inch jet rose 40 feet.

The quantity of water delivered from the same main through one stand-pipe and different lengths of hose was as follows, viz.:—

One $2\frac{1}{2}$-in. stand pipe,	40 feet of hose,	$\frac{7}{8}$-in. jet,	delivered	96 gals.	in	59 sec.
One $2\frac{1}{2}$ „	80 „	$\frac{7}{8}$	„	112	„	65 „
One $2\frac{1}{2}$ „	160 „	$\frac{7}{8}$	„	116	„	70 „
One $2\frac{1}{2}$ „	40 „	$2\frac{1}{2}$	„	118	„	27 „

The second trial in Tooley-street off a 9-inch main, 1400 yards in length, connected to 1000 yards of 15-inch, and 6650 yards from the works.

One $2\frac{1}{2}$-inch stand pipe,	40 feet of hose,	$\frac{7}{8}$-inch jet, rose 60 feet.	
Two $2\frac{1}{2}$ „	40 „	$\frac{7}{8}$-inch, difference not perceptible.	
Four $2\frac{1}{2}$ „	40 „	$\frac{7}{8}$-inch jet, rose 45 feet.	
Six $2\frac{1}{2}$ „	40 „	$\frac{7}{8}$ „	40 „

Quantity delivered from the same main through—

One $2\frac{1}{2}$-inch stand pipe,	40 feet of hose,	$\frac{7}{8}$-inch jet,	114 gals.	in	64 sec.
Four $2\frac{1}{2}$ „	40 „	$\frac{7}{8}$ „	115	„	75 „
Six $2\frac{1}{2}$ „	40 „	$\frac{7}{8}$ „	112	„	78 „

Four-inch service in Tooley-street, 200 yards long, supplied through 200 yards of 5-inch pipe, from 9-inch main one $2\frac{1}{2}$-inch stand pipe, fixed on the 4-inch service near the 5-inch pipe, with 40 feet of hose $\frac{7}{8}$-inch jet, rose 40 feet; two $2\frac{1}{2}$-inch stand pipe $\frac{7}{8}$-inch jet, rose 31 feet.

One $2\frac{1}{2}$-inch stand pipe fixed at end of service.

200 yards from 5-inch pipe, 40 feet of hose, $\frac{7}{8}$-inch jet, rose 34 feet.
Two $2\frac{1}{2}$-inch stand pipe, 40 „ $\frac{7}{8}$ „ 23 „

Quantity delivered from the plug near the 5-inch main through—

One $2\frac{1}{2}$-inch stand pipe,	40 feet of hose,	$\frac{7}{8}$-inch jet,	112 gals.	in	82 sec.
Two $2\frac{1}{2}$ „	40 „	$\frac{7}{8}$ „	117	„	103 „

Quantity from end plug of service 200 yards from the 5-inch main—

One $2\frac{1}{2}$-inch stand pipe,	40 feet of hose,	$\frac{7}{8}$-inch jet,	112 gals.	in	90 sec.
Two $2\frac{1}{2}$ „	40 „	$\frac{7}{8}$ „	114	„	118 „ "

In confirmation of these results it is stated in answer to some inquiries made at Philadelphia, that "the water will rise from a hose attached to a fire-plug in the street at the extreme point of delivery, during the night to the height of about 45 or 50 feet. During the day when the consumption of water is very great, it will not rise more than 20 to 30 feet. Do these results correspond with your experience and observations?—Yes, they do. But it may be well to state that the great diminution of velocity, and consequently of elevation, observable in the least favourable experiment of each set, is to be chiefly attributed to the great aggregate area of the jets in proportion to the area of the stand-pipe and hose.

Although the height to which water will rise from jets is in general, in consequence of the resistance of the atmosphere, half the height due to the pressure, will it not, in a hose or in a pipe, rise to the full level, so that it may be poured out to extinguish fires, or used for any purpose from the full height?—When the water is not in motion, it will rise to the level of the reservoir. When it is in motion, there will be friction in the main pipes, by which the height will be in some degree diminished. When the main pipes are of considerable size, compared with the area of the jet, this friction will be insignificant. The higher water is carried in a pipe, or the higher the nozzle of a hose pipe is carried, the more the resistance of the atmosphere is avoided. If a jet acting under a pressure of 100 feet, attained an elevation of 50 feet when discharged from the level of the pavement, then if the hose pipe were elevated to the height of 50 feet, a jet would still be given of probably 20 or 25 feet high. By this means the water would attain an elevation of 70 or 75 feet high, in place of 50; hence the advantage of carrying a hose-pipe up-stairs, or up a ladder, or as nearly as possible to the height of the story where the fire occurs. Another advantage gained by carrying up the hose pipe is a better direction of the jet, and more certain application of the water than can be had from the ground.

Expense of Raising Water by Steam Power, by Mr. Farey.

To give a correct idea of the performance of the most economical steam-engines yet constructed, Mr. Farey has made the following computations:—

Taylor's engine, at United Mines, which has made the highest performance of any yet constructed, has on an average of all the variations of its performance, during the 12 months of the year 1841 raised $92\frac{1}{2}$ millions pounds weight of water, one foot high, by each bushel of coal which has been consumed by it; and in 1842 the average was $99\frac{1}{8}$ millions.

An average of the two years would be $95\frac{3}{4}$ millions. A bushel of the coal actually used is considered on an average to weigh 94 pounds, and if Taylor's engine be reckoned to raise only 94 millions pounds one foot high, by the consumption of each bushel of 94 pounds, then one pound of coal will raise one million pounds of water one foot high.

As a million pounds is not a very conceivable quantity, it may be considered as 16,000 cubic feet of water (which reckoning each cubic foot to weigh $62\frac{1}{2}$ pounds, would be a million pounds weight) raised one foot high. Or if the height be reckoned at 10 feet, instead of one foot, then it would be 1600 cubic feet of water raised 10 feet high, by the combustion of one pound of coal.

To render this more clear, suppose an apartment 20 feet square on the floor, between the walls, to be filled 4 feet deep with water, like a large bath, it would contain the 1600 cubic feet of water. And supposing another upper apartment of the same size over the former, the height from the lower floor to the upper floor being 10 feet, then with the consumption of one pound of coal Taylor's engine would exert a sufficient power to raise all the water from the lower apartment into the upper one, in addition to overcoming the friction of all the moving parts of the engine and of its pump work.

A robust labouring man, possessing such strength and capability of enduring exertion, as is an average of that class of men in Britain, would be incessantly employed during 4 hours $26\frac{2}{3}$ minutes in performing the above work, such a man could work at that rate during 10 hours in a day, and six days in a week. Taylor's engine would perform the day's work of the man with a consumption of only $2\frac{1}{4}$ pounds of coal.

A good draught horse would be $45\frac{3}{4}$ minutes in performing the above work and could continue to work at that rate during eight hours in a day, for six days in a week. Taylor's engine would perform the day's work of the horse with the consumption of $10\frac{1}{2}$ pounds of coal.

What is called a horse power in steam engines, as fixed by Mr. Watt, viz. 33,000 pounds force acting through a space of one foot per minute, is half as much more as the average of what a good draught horse can do, so as to continue working during eight hours per day, and for six days per week.

Taylor's engine, (or any other,) when raising 94 millions per bushel, consumes only 1·98 pounds of coal per hour for each horse power which is exerted by it in raising the water, independently of overcoming its own friction, and that of the pumps. Or when it exerts 100 horse it consumes only 198 pounds of coal per hour.

Taylor's engine exerted $102\frac{2}{3}$ horse power on an average of all the variations of the power which it exerted in the year 1841, and $127\frac{3}{4}$ horse power in 1842. On an average of both years it would be 115 horse power, and which, according to the above statement of 1·98 pounds of coal, would be attended by a consumption of $227\frac{3}{4}$ pounds of coal per hour, that being on an assumption that the average performance during the two years was 94 millions, when in fact it was $95\frac{3}{4}$ millions.

ON THE FORM OF SEWERS.

A considerable portion of the report of the Commission on "Health of Towns" is devoted to the discussion of the forms of sewers, in consequence of the pertinacity of the Westminster Commission in retaining a bad form.

Forms of Sewers.

Wm. Hosking, C. E. thinks the best form is that of the longitudinal section of an egg placed with its small end down. It confines the water when there is a small quantity, so that it may act upon the substances that pass into the drain with most effect, and it gives an increased space to the water as the water increases in depth. It is quite certain that the same quantity of water will carry over a quickly-curved bottom substances which would remain upon a bottom less curved, and consequently upon a flat bottom.

W. D. Guthrie, C. E., holds the same opinion. Mr. Beck, Tower Hamlets' Surveyor, builds all new sewers with semicircular bottoms, as does Mr. Newman, Surrey and Kent Surveyor.

Mr. Cresy, C. E., says that he has often considered the form used in the Borough district, and also the Westminster district, and in other districts; and his impression is, that the form which would nearest approach an egg-shape, would be the preferable one. There is more economy in it, and greater strength. If the bottom was narrower, it would give greater facility for the drainage, and anything deposited in the sewer would be more readily washed away, and there would be no deposit so great as is the case at Westminster, where they are obliged to cleanse them by men. The operation is a very disagreeable one, and it is sometimes necessary to do it frequently, and it is a cause of great expense and nuisance to the inhabitants. If you were to take the section of an egg, I do not think it would be possible to have a better form. You would obtain more strength by that than by any other form. There is less material required in that shape than is required in the Westminster sewer. If you have the same quantity of material to use with the egg-shape, that you have with the section of the Westminster sewer, you will get a much greater capacity. In the Westminster district of sewers you have footings which extend considerably on each side, and you are obliged to excavate the whole trench to the width of those footings; and when you are at the depth of 24 or 25 feet, that adds considerably to the expense.

Mr. Kelsey, City Surveyor, says of his sewers, that some of them are true ellipses. Inclined sides have been largely used. They were introduced by my predecessor prior to 1823. He also states the failures which have, apparently, taken place in consequence of the insufficient strength of sewers. The Fleet-street sewer, built in 1668, and varying in size from 4 ft. 3 in. by 2 ft. 6 in. to 4 ft. 9 in. by 3 ft., and (as I recollect is noted in the record of it) built with 9-in. walls and 14-in. contrefortes at intervals, fell in, at three separate places, in 1715, 1725, and 1739, and was rebuilt with 14-in. walls. The sewer of Ludgate-hill and street, built soon after 1666, and varying from 4 ft. 2 in. by 2 ft. 9 in. to 4 ft. 6 in. by 3 ft., was repaired, in 1729, from St. Paul's Churchyard down to the Fleet ditch, "great part of the walls having fallen in and the paved bottom washed away." In 1822 it again failed, and great part was rebuilt and enlarged. The sewer at Walbrook fell in (1821), and a body of earth 8 feet square and 16 feet high was washed away. In 1838 part of the sewer in King-street, Smithfield, fell in, leaving a space from the curb on one side home to the wall of the houses on the south-east side. The 19th Charles II., cap. 3, sec. 46 (1667), the Act for Rebuilding the City of London, now repealed as to sewers, directs that sewers 5 feet high and 3 feet wide shall have side walls $1\frac{1}{2}$ brick thick, the top arch 1 brick on end; the bottom to be paved plain, and then 1 brick on edge circular. The ancient brick arch of the Walbrook sewer, in Lothbury, was $1\frac{1}{2}$ brick thick, having stood about four hundred years, until destroyed in 1834.

Mr. Hawksley, C.E., considers that the sewage of towns may be improved in general construction, and rendered more economical, by the use of egg-shaped sewers, built with radiating bricks. He finds an egg-shaped sewer, 2 ft. 9 in. high, and 2 ft. wide, may be laid at a depth of at least 8 feet for about 3*s*. per foot, the bricks radiating, and the rim $4\frac{1}{2}$ inches thick. Such a sewer will be large enough for two-thirds of the streets of a provincial town, if the inclination be not less than 1 inch in 10 feet. Such a sewer would frequently drain 500 or 600 houses, and would relatively answer the purpose of second sized (4 ft. 6 in. by 2 ft. 6 in.) sewers in London.

Professor Butler Williams enters into the scientific investigation at great length, and proves incontestably the superiority of the egg-shaped sewer over the Westminster flat-sided sewer.

The condemnation of the Westminster system is indeed unequivocal, and its inefficiency attested on all hands. Professor Williams proves that 66,669*l*. 15*s*. has been in the last ten years positively lost in the Westminster Commission of Sewers, through the ignorance and perversity of its conductors.

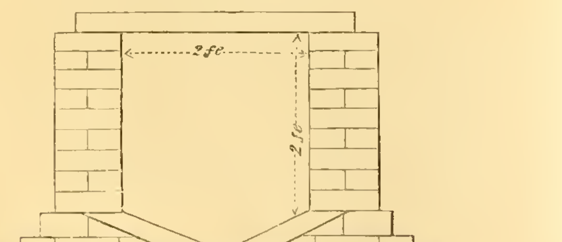
Mr. Stevens, an architect and surveyor, details the notorious Notting-hill case. The sewer has an arched top, arched bottom, and upright sides. There are two classes of sewers built under the Westminster regulations, the one being 3 feet 6 in height, and the other about 5 feet. They are both built with a semicircular arch at the top, and a segment of a circle at the bottom, with upright and parallel sides. The upright walls are $1\frac{1}{2}$ brick, or $13\frac{1}{2}$ in.: the thickness of the arch at the top 2 half bricks, or 9 inches.—"On what account is the extra thickness of the side walls? Is it to protect them from the lateral pressure? I think so.—Is that the effect? In my experience I have found that has not been the effect.—You speak from the experience you have had in the construction of sewers at Notting-hill and elsewhere? Yes.—Is the bottom the segment of a large circle? Yes.—Not semicircular? No; there does not appear to be any principle involved in the construction of this sewer to provide against the crushing in of the sides. Its stability depends upon the firmness of the mortar, on its being hard, and adhering to the sides of the bricks. The circumstance of the wetness of the ground, in the instance I refer to, prevented the mortar setting; the sewer becoming affected by the lateral pressure of the ground, the walls slid off the footings. The form of the exterior of the sewer is flat at the bottom, with footings under the side walls, spreading out a considerable way on each side of the sewer: the perpendicular walls are built upon these footings. I have seen several of the arched sewers, and I know of none in which a failure has taken place in the 9-inch arch, although but two-thirds the thickness of the side walls of the Westminster sewers. The soil there (at Notting-hill) is a stiff clay very liable to sudden slips. It is filled with fissures, and in wet weather, the water finding its way into these fissures, causes large masses to slide; and without a moment's notice it will sink suddenly, so that the sewer might be subject to great and sudden pressure. In the first instance we did not strut it, because the ground appeared to be firm, and we thought it would stand. Afterwards we strutted it, as we thought very securely, but the pressure of the ground was not only such as to crush the ground but the struts as well, The sewer is on the side of a hill, with the strata in the direction of the hill; so that the pressure was greater on one side of the sewer than on the other. It may be well, perhaps, to give some account of the progress of that failure. The sewer was commenced so long since as November, 1842; application was then made to the commissioners for permission to make a sewer across the ground at Notting-hill, which permission was granted. The work was contracted for, and in my opinion done in a very superior manner: the bricks were good, and the lime and sand of a very excellent quality. About December it failed by the crushing in of the sides. The proprietor of the ground called my attention to the failure in the first instance, from having observed the falling of the ground on the top of the sewer, which had some time previously been filled in level, but was then lying hollow. I went into the sewer, and through it as far as practicable, and found that the sides had collapsed. On further examination I found that the ground had slipped to an extent of from forty to fifty feet from the sewer, and upon excavating and opening the sewer the width between the side walls was found to be only 1 ft. 7 in., instead of 2 ft. 6 in., the size it was originally built. The persons in attendance from the commissioners reported that a failure had taken place. I was summoned to attend the commissioners, and laid before them a copy of the report I had made to my employer, stating that I believed the failure to have originated in the form of the sewer, and not in any deficiency in the workmanship. The commissioners however thought otherwise, and said they could allow no difference to be made in the form, and it must be rebuilt in the same form: that they would send a person down from their office to be constantly on the spot, and to give directions from time to time to the workmen, in order that it should be done in accordance with their regulations. The sewer was most carefully rebuilt; the whole height of the sewer was strutted, parallel planks of three inches in thickness being placed on each side of the sewer, and sustained in their position by short transverse struts cut from the end of scaffold-poles, and about five or six inches in diameter. There were three sets of these struttings in the height, so as to leave a very small portion of the whole unprotected. When about a hundred feet of the sewer had been constructed in this way, and the ground filled in upon it, we perceived indications of a fresh failure, and in three or four days after, the pressure of the ground became so great, that the ends of the struts were in many cases forced through the 3-inch planks, and the planks themselves bent hollow. Hence we were obliged to take it up a second time; my employer then applied to the commissioners for permission to put in a sewer of a different form in order to ascertain, whether the failure arose from a deficiency of workmanship or any inadequacy in the form. I attended the commissioners on the day when that letter was read, and had a very long conference with them upon the subject; they wished to know the alteration we proposed to make, and I submitted to them a section of a differently formed sewer, the sides being arched as well as the top and bottom—a similar form to that adopted by the Finsbury division, but rather more round; I thought this necessary, in consequence of the extreme wetness and want of solidity in the ground. Some discussion arose with the commissioners on that question; and it was repeatedly urged that the expense of such experimental sewer would be borne entirely by my employer, but that in the event of its being found inadequate it should be taken up and replaced by any other they might require, at our cost. It ended, however, in their refusing to allow any alteration to be made. Immediately afterwards, feeling that the ground was our own, and that we had a right to make experiments upon it without reference to the commissioners, we commenced a sewer of a new form, intending, if our experiment succeeded, to call the attention of the commissioners to the subject, and to request their inspection. One day, however, during the progress of this experimental sewer, we received a notice from the commissioners, stating that they understood we were making a sewer of different form from that prescribed by their regulations, and cautioning us from making such a sewer, because if made in that form they should not adopt it, if required so to do. We paid no attention to that notice at the time, not intending it to form a part of the permanent sewer, unless they might be induced to adopt it in the event of success. We shortly afterwards received another notice from them, enclosing an extract from their Act of Parliament, 47 Geo. 3, cap. 7, giving them power to "prostrate, demolish, or put down," a sewer built contrary to their rules, charge us with the expenses, and otherwise punish us. As we were not disposed to get into a collision with them, we abandoned that sewer, and have since built the sewers in the form prescribed by them, and they stand perfectly well. I apprehend that arises from the altered condition of the ground, for in the course of these alterations the ground has been very much improved; it is now dry: whereas at the time we commenced, it was very full of water. The sewer is built in mortar, and the section of the present one is the same as the section of the original one. In the course of the examination of the sewer after its failure, a singular circumstance presented itself: the footings in several places were forced upwards, the position of the bricks at the sides of the sewer being canted upwards.

"Do you conceive the footings add to the stability of the drain? Decidedly not; I think they weaken it very materially. They prevent the pressure of the earth being distributed equally over the sewer; I conceive that a most important condition to be considered in the building of a sewer is that the resistance afforded by the sewer should be equal, and in the opposite direction to the pressure to which it is submitted; there is no great difficulty in ascertaining the forces operating upon sewers; they vary in direction and extent as the degree of mobility of the ground: you might imagine the ground to be so fluid that the pressure should assimilate itself to that of water: in proportion as the ground gets more solid there is less of lateral and upward pressure, and the sewer becomes subjected to the simple pressure arising from the gravity of the superincumbent material.

"It appears from the drawing you have produced that one side was more depressed than the other; will you state the cause of that? I imagine that arose from the sewer being on the side of a hill, and in consequence of the pressure from the hill. The present condition of the sewer is dependent on the circumstance of the earth having becoming stationary. It is not owing to any alteration in the mode of building the sewer? None whatever.—Would you still conclude from your experience that the original form was essentially bad? Yes; I consider that the sewer stands now merely from the accident of the ground having become hard and mortar having become consolidated.

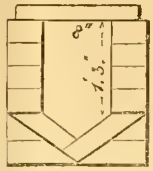
Mr. Hugh Biers, an extensive builder, prefers the Finsbury sewers. For a small cheap sewer he proposes the following plan of a sewer quite sufficient for an upper drainage to 20 or 30 houses. Do you use any particular

Section of a Sewer for Surface or Upper Drainage.



At 6 feet depth of digging this sewer will cost 7s. per foot lineal. For every additional course in depth add 10d. per foot lineal.

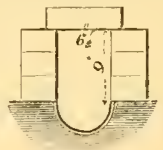
kind of mortar or cement? Stone lime and river sand are always used.—Are you satisfied that the nature of the mortar is sufficiently adhesive for those purposes? Yes; quite so.



What are the advantages you propose by this new form of drain shown in the drawing? Strength and durability with the same inside area as a 12-in. barrel-drain, and without additional cost.—What would be the effect of the discharge of water through that drain as respects the shape of the bottom? All the sullage must fall to the centre, and the water passing through the drain would by its concentration have greater power in expelling such sullage.

You consider an acute angle at the bottom better than the segment of a circle? I do so; and the more especially as the segment of a circle in stone would make it very expensive. I speak from experience; and where I am not bound by a covenant to construct a barrel-drain, I invariably build one similar to this. In a barrel-drain, a very great portion of the outside is mortar; in this you have nothing but the hard material.—Have you built this drain to any extent? Only to my own private buildings.—What is the actual cost per foot run of a 12-inch barrel-drain? A 12-inch barrel-drain will cost about 2s. per foot run.—Suppose you had well burnt earthen-pipes sufficiently strong for those communicating drains from the house to the larger sewer, which would be less expensive and give a sufficient area? If as durable, I think it would.—Have you seen such? I have seen and used them, especially where there has been a deficiency in the current.—Have you seen them in trial? Yes, I have; but I do not think they are so durable as a brick drain, and there is also a difficulty in taking them up to cleanse.—Do you think for the humbler class of houses some such as those might be adopted? I think they might, especially if improved upon, and which might be easily done.—Have you any knowledge of those kind of pipes which have been proposed, strong burnt pipes glazed on the inside? I have not seen any of a very new construction.—If they were glazed in the inside, would that give a freer waterway than those made of bricks, which are of course rough on the inside? They would of course be much better; and if every third or fourth was made to open, or be made in halves, or with a cover even less than that, it would be a great improvement in getting at the drain to cleanse it. I have very often constructed drains to the smaller houses, according to this drawing, with a tile bottom, bricks on the sides, and covered with a stone or brick, and I find that much better than the 9-inch barrel-drain, which requires so much mortar to fill up the outside of the joints, and besides being so much cheaper.—On what do you lay the tile? On the earth itself, and

Section of a Drain equal in Area to a 9-inch Barrel Drain, but much cheaper in construction, adapted to the smaller description of houses.



Cost price, 10d. per foot; the bottom, a strong garden-drain tile.

the brick side, just clear of the tile.—Is not there a bad joint? No; if it is flushed in with a little cement it makes a much stronger description of drain than the 9-inch barrel-drain.—If they were made of tiles well burnt, and glazed inside, would they not give a freer waterway than those made of bricks? Yes.—They would in consequence require less declivity than if made of bricks? Generally speaking, pipes are used where we cannot get so much current.—That would give you an opportunity of having them shallower? Yes; there would not be so much digging.—That would be of advantage, in giving you a clear waterway? Yes; where I can get a current I never hesitate about the expense of a little digging."

Mr. Roe details the effect of his improvements in the Finsbury commission of sewers. The sewers, at the time he became surveyor, were constructed with upright side walls. The sewer called the first-sized sewer had 14-inch side walls, was five feet in height, and three feet in width; the second-sized sewer was four feet six in height, and two feet six in width. Soon after he became surveyor a sewer of the first size, with 14-inch side walls, was built in a clay ground at the side of a hill, by a very good bricklayer, and a very respectable contractor; but, though that had every advantage of execution and material, the side walls, being upright, were not sufficiently strong; the ground forced in the upper side wall of the sewer for a length of 300 feet. After that, he proposed to the commissioners that they should adopt a curved side wall, instead of an upright side wall. The bottoms of the old drains were semicircular. He used the common stock brick for the sides. At the same time he suggested to the commissioners, that by adopting curved side walls it would do away with four inches of the 14-inch side walls, which would yet be stronger than before. The commissioners considering that an advantage, have adopted the oval sewer, and decreased the quantity of material. When the walls were upright, it was necessary to give an increased thickness to them to obtain the requisite strength; but by making that curve on the sides, the shape being an arch to a certain extent, renders that thickness unnecessary; it resists the pressure from without. The difference of cost of those two sewers is 3*s.* a foot in the larger size; in the other, or second size, the cost remains about the same, as it had only a 9-inch wall before. There are many cross streets in the district where there are but few houses to drain, where, if a long length of sewer was built, it would become very expensive to those few houses. Curved-formed sewers, he considered, would enable the commissioners to afford a sewer for those cross streets of a much cheaper description, and he suggested that they should adopt a sewer half brick in thickness, built of blocks of brickwork and cement all round, and that that would be sufficiently strong, if made with radiated bricks, with blocks in cement. That suggestion the commissioners have adopted, and that enables them to afford the public a saving of 5*s.* a foot run upon the second-sized sewers. They have the same capacity as the second-sized sewers.

"What was the difference of the expense between using the radiated bricks and the common stock bricks in the construction of sewers? The brickmaker charged 8*s.* a thousand more for the radiated stock than the common stock; the common stock is 32*s.*; he charges 2*l.* for the radiated bricks; but if there was a competition for radiated bricks, they would cost very little more than the common brick.—What is the difference in the expense in building a sewer with the radiated brick as compared with the common brick? The difference consists in the radiated brick being used with less materials, as they fill up the space which would otherwise be occupied by cement; therefore in reality there is no extra cost, for it saves so much cement. There is also less work in putting them in, while if a man has to use mortar, he has not to take up so much mortar or cement as with the common brick.—Would it not be desirable, if you could, to have a block burnt, so as to have ready to your hands such blocks as you wanted, of two or three different sizes? I believe it would. A brickmaker who called at the office, and saw this form of sewer, considered he could burn bricks which would suit us better, and enable us to do the work at less expense. The inverts of the first and second sized sewers are put in with blocks, formed in wooden moulds with cement. Class (C) in the diagram, which is the smallest sewer, is formed with less material in moulds with cement.—Put in with joints? Yes, the whole round of the sewer takes those moulds.—You used very little cement with the old sewers? None at all; we now use it in the bottom, and we have found it to answer a very good purpose, for in bad bottoms in running sand they could no work in without blocks. We have sewers of all classes in it now.—To what height do you carry this cement; is it to the average height that the water runs in those sewers? To the common run of the water, generally, in the main sewers. The cemented invert is composed of three blocks, one in the centre and one on each side."

"The river Fleet is now arched over for some miles (with the exception of the portion in Clerkenwell, the execution of which is waiting for the opening of the new street); this arching has been done by the commissioners appropriating 1,000*l.* a-year for it; last year and this year it was carried up to Kentish Town beyond the Seven Sisters road; within the last three years 14,000*l.* has been expended upon the river Fleet; since 1826, altogether 38,000*l.*—"Is it necessary, in the construction of sewers in your district, to strut or prop the sewers in the progress of building them? The earth is all strutted' not the sewer.—Have you any quicksands to go through which require extraordinary precaution? Cases might arise where the sewer would require to be strutted inside during its execution; we have gone through very bad ground, and have built a new sewer on the side of a hill; but in those cases we have not found it necessary.—How do you describe the curves of the sides? We have a template for the men to work to.—What description of ground do you contemplate ever to be necessary to require the strutting of the inside of the sewer? I should say in a very rainy season, through slippery clayey ground: I do not consider that we should require to strut the curved form of sewer in any ground, as we have used it in tunnelling in very bad ground; in River-lane we tunnelled a second sized sewer at the depth of 38 feet. We passed under the New River and met a ground in which the men sank up to their knees for 100 feet in length, where we had to put in a foundation; still we made the sewer with safety, and it stands.—Do you use any special precautions, where you tunnel through a quicksand such as you have described? Yes; instead of open timbering, we secure it with close timbering."

"At what distance from the point where you have been working have you known houses affected? I have known houses affected for 1500 feet from the side of the sewer at Pentonville. A sewer was built before I came to the commission towards North-street, and it had the effect of loosening the ground, or causing the ground to slip the whole way up the hill; it may be seen to this day in the garden walls, which have not been repaired.—Are you troubled with the rising of the sand? Yes.—Do you use means to prevent that? We have no occasion to do that, since we used blocks; they answer for every purpose.—What is the greatest height to which you have known sand rise in a night? Not more than five or six inches in a night. The slip of 1500 feet was on the side of a hill, not on flat ground. The first sized sewer is evidently formed for the purpose of meeting the case of an increased quantity of water passing down. The commissioners of the Holborn and Finsbury division have been very careful in that respect. In the course of the river Fleet, it was thought necessary to build a sewer 12 feet high and 12 feet in width on the Calthorpe estate. Afterwards the commissioners, having another portion to build, referred it to their officers to suggest what size would suit: the portion of the sewer next built was below that. The reports of the officers certified that a sewer of 10 feet in width and 9 feet high would be sufficient, from an advantage in the difference in the fall, there being more fall in this situation, which rendered the proportion of the current through the smaller sewer equal to the larger one.—What was the area of the larger sewer? The area was 12 feet by 12, with a circular arch of six feet radius; the upright side walls four feet; and the rest was occupied by the invert. The river Fleet takes the water from Highgate and Hampstead, and I have known it rise six, eight, and ten feet in a night; there have been instances of persons being carried away by it. It is in my recollection that at Battle Bridge the water has been six or eight feet deep, and persons were carried about in boats."

Mr. Dowley, Surveyor of the Westminster Commission—"Do you use cement in the construction of your sewers? We do in some parts.—Where do you use that? The three centre courses of every invert are built in cement.—What lime do you use for the rest? Dorking lime."

Mr. Kelsey, Surveyor of the City Commission—"Our main sewers are very large. The London Bridge sewer is 10 feet by 8 feet, and that is oval at its commencement, and it terminates at Moorgate-street 8 feet 3 inches by 6 feet 9 inches. The reasons which induced me to adopt that size are contained in the following statement:—

"The Bishopsgate-street sewer, which receives the waters of Shoreditch and adjacent places, being 5 feet by 3 feet, and opening into the Irongate sewer, which averages 8 feet by 3 feet 8 inches, is at times overcharged, and pours back the upland waters.

"The sewer in Walbrook and Dowgate Hill, which received waters from the Finsbury division, was built 5 feet by 3 feet. It was destroyed in 1821, and the houses endangered by continual overcharges from the upland districts.

The ancient Walbrook, which, at the most, drained the land south of Islington and Ball's Pond, &c., must have been much more capacious than the present Fleet sewer.

The Fleet sewer, which drains the hollow land south-westward of Highgate, is 18 feet 6 inches by 12 feet at the mouth, and 12 feet 3 inches by 11 feet 7½ inches at the city boundary. This has often been surcharged; and only within the last year, the culvert, so ably constructed at its mouth by Mr. James Walker, was severely injured by the flood consequent upon a thunder-storm.

The sewer from Moorfields to Holloway appears to measure upon the map about three lineal miles. In process of time, and as buildings increase, it may throw out branches in all directions, and the three miles may become thirty. Not only all the atmospheric waters which may, upon an average, fall within the valley south-eastward of Highgate (or at least a large portion of them), but all the artificial supplies which the wants of its yet future inhabitants, as well as of those intermediate between Islington and Moorfields, may require will have to be carried off by the city sewers.

In anticipation of this, and knowing the disadvantages attendant upon sewers of too small capacity, not only has this large sewer been provided, but it has been kept 18 inches deeper than the Wilson-street sewer, so that that may be hereafter deepened should circumstances require it; and preparation has also been made for the reception of an auxiliary sewer, of equal depth, at the city boundary by Finsbury-place.

Undertanding by the term 'data' ascertained facts upon which to raise a calculation, there are none; but I think there are sufficient results of experience to justify the precaution taken by me.

As some proof that I am not altogether without justification, I beg to observe that, since the work was begun, Mr. Roe has informed me that the water has risen in one of the shafts in Wilson-street 7 feet above the crown of the sewer, although the Eldon-street sewer is 5 feet by 3 feet 2 inches, the London Wall sewer 6 feet by 4 feet, and the main trunk increases from 8 feet 3 inches by 6 feet 9 inches to 10 feet by 8 feet at its mouth.

Fall of Sewers.

Professor Hosking—"Have you turned your mind to the practicability of improving the healthiness of inconveniently low situations in or near London; such, for instance, as that part of Westminster between Tothill-street and the Horseferry-road? I have; and I believe that the soil drainage of that district may be made perfectly efficient, and a very proper and satisfactory backwater obtained from the river to scour its sewage into the river. The tide rises and falls in the Thames at London, at ordinary spring tides, about 18 feet, and at neap tides about 14 feet. Now if the outfall of a common sewer be about three feet above low water of neap tides, it will be high enough to allow the escape of everything that can have to pass through the sewer. I have found from experience that sewers, moderately well supplied with backwater, may be made with much less fall than is generally considered necessary, and less than this Bill requires. I myself directed the diversion of one of the large sewers at the western extremity of London, the Counters Creek Sewer, for a mile and a half of its length; and for the purpose of obtaining deeper drainage at the upper end, I prevailed upon the Commissioners to allow the fall to be at the slight rate of 1·63 inch—less than 1¾ inch—in 100 feet throughout the diverted length, the sewer being the course of a small stream, the drainage of the uplands. With this small stream the sewer, with its slight fall, is kept perfectly clean; no accumulations of any kind take place in it; and I think I may assume, therefore, that a fall of two inches in 100 feet, with a good backwater at frequent intervals, would be sufficient. With a fall of two inches in 100 feet, in a length of 4,000 feet, the fall would be six feet eight inches. Now 4000 feet is rather more than three-quarters of a mile; throughout which length from the river the sewers of the district alluded to might be deepened to three feet above low water of neap tides at their outfalls, rise at the rate of two inches in the hundred feet, and leave six feet ten inches of depth from the bottom of the sewer at the upper end to the top of high water of spring tides. A reservoir, formed in any convenient place inland, near the heads of the sewers, and connected with the river by cast-iron pipes or with a brick culvert, may be filled to high water level at every flow of the tide. The water being penned back, there will be in the reservoir from five feet to six feet six inches in depth above the bottoms of the sewers at their highest, available to scour them when the tide shall have ebbed in the river below the outfalls of the sewers, and a scour may be thus effected once in every 12 hours, often enough to render them perfectly inoffensive. There would be no expense after the original formation but the drawing of the sluices at low tide to effect the scour.

"Mr. Beek, Tower Hamlets Commission—Where I could get the fall, I like it about a quarter of an inch to 10 feet; I think that is desirable; but there are sewers where we have only the eighth of an inch fall. They act exceedingly well.—Is that the least fall you have known? No; I have put a drain on a dead level; that will not act quite so well, but the others do very well. I put in a sewer for Mr. De Beauvoir, 3000 feet long, on a dead level, which I was obliged to do from being unable to obtain a fall. That sewer has been built ten years, and it has never been cleaned.—Is it subjected to any particular flow of water from any manufactory? No; it is from Hoxton New Town, or De Beauvoir Town.—Does it receive any flow of water from the tide? No.—Is there much discharge from the mouth of it? It discharges into another sewer, in Kingsland-road, belonging to the Holborn and Finsbury division.—Are you aware whether that is the principal feeder into that sewer? I should think not.—Is there a considerable fall in the sewer into which that empties? No; that is nearly on a dead level also.

Mr. Roe—What is the general fall in your sewers; what do you consider a fair fall? I find in the regulation of the Commissioners a fall of a quarter of an inch in 10 feet is required as the least fall; but we give them as much fall as we can; there are places where we cannot get a quarter of an inch in 10 feet. The outlets of our sewers are not under our own control.—In that case do you find the flushing effectual in a horizontal line? Yes.—You are obliged to put your flushing-gates nearer? Yes; we have a sewer building on a dead level, in consequence of the difficulty of outlet; in that case we have placed a gate for 1600 feet; and we are in hopes we shall do with a greater distance than that hereafter; but that is the greatest length we have had an opportunity of working on a horizontal direction.

Connection of Sewers and Drains.

With regard to the impropriety of connecting sewers at right angles much evidence was given, as also with regard to the impropriety of allowing drains to enter the sewers too high. Mr. Roe says, there has been an improvement in the mode of connecting one sewer with another. The general mode was, to connect them at right angles, or nearly so. The objections to that I found to be, that there were great accumulations in the sewers; the water flowing from the collateral sewer retarded the column of water in the main sewer, and thus caused an obstruction by which the filth and deposit which would otherwise have passed off into the main drain, was retarded and accumulated at that point and above it. The theoretic explanation of this is given by Professor Butler Williams. Mr. Kelsey, of the City Commission expresses a decided concurrence in the same views. Professor Donaldson states that his sewers are brought into contact with the main sewers either by cants or by circles.

Drains.

This subject was much discussed, and it was the decided feeling of the Commission of Enquiry that the system of drains enforced by the Commissioners of Sewers was unnecessary and oppressive.

Mr. Biers—Being a sewer builder to a very large extent, I have often persons to deal with who contrive to obtain a surreptitious drainage. To avoid the present charges, which I admit to be exceedingly heavy, and often much too large, especially for the poorer class of houses, the will sometimes give a neighbour, who has paid, a trifle to permit a communication through his drain; and they will often do without a drain at all. All rated houses pay to the sewer rate, whether drained or not, but the building the sewer is a distinct and separate charge upon the building. I have at least 1000*l.* laid out in sewers, of which I dare say I shall never see a quarter, in consequence of this surreptitious mode of getting a drainage. I can mention one case that lately occurred where a person had for thirteen years drained three houses through one drain, having only paid for one house; he was found out, and then paid me for the other two. In another instance the cost of a sewer built abutting upon the front and flank of a house amounted to nearly the value of the house itself (it being one of the smaller description of buildings). For this sewer I have never been paid, nor do I suppose I ever shall be. The sewers are in a number of places much larger than necessary. There should be a smaller sized sewer for the poorer description of houses, which would be sufficient for the upper drainage, where the sewer would not be further extended. I built in the Edgeware-road five houses, the sewage of which cost me very nearly 500*l.* This extravagant sized sewer is entered by an 18 inch barrel-drain, through which upwards of forty houses have been drained for the last twenty years, and there has never been any stoppage of the least importance. I had reason to expect that if this large sewer was built I should be repaid a moiety of the expense; but after the sewer was built the Commissioners found that they could not compel the owners on the opposite side to break up their old drainage and adopt the new; so there the sewer now remains, either as a charge upon the houses, or a loss to myself. If the smaller description of drain was to drain the roadway, and the houses on each side of the roadway, half the area of the present Westminster small sewer would be sufficient.

You would say that an 18-inch barrel-drain would be sufficient for 40 or 50 houses? Yes, it would be quite sufficient for 200 or 300 yards in the upper part of a line of sewer. That 18-inch barrel-drain has a very good fall, perhaps an inch and a half to 10 feet, and in places perhaps more than that.—What is the least fall which you would consider necessary for an efficient drainage? I have put sewage in at as slight a current as half an inch to 10 feet, were the depth of digging was such that it could not be more.

What is the average expense of constructing sewers of the largest description mentioned by you? About a guinea a lineal foot; a little more or less, according to the depth of digging, &c. The second class is two or three shillings per foot less. The third class somewhere about 10*s.*; or less even than that.

Mr. Roe—Can you state the length of any court which has been drained by an 18-inch barrel drain? The longest length I know is about 160 feet.—Do you think it would require to be of a larger size, if it was carried farther? That would entirely depend upon the fall which might be given, and also the supply of water.—Suppose you had a good fall, and a sufficient supply of water, what length of court do you think could be drained by an 18-inch drain? I know one instance where an 18-inch drain is carried 400 feet at the back of about 40 houses, where there is a good supply of water, and it is kept clean.

Mr. Stevens—There is a lower class of buildings—cottages—where these expenses are proportionately more heavy. Take, for instance, labourers' houses, built to let at rents averaging 4*s.* a-week each; the expense of a sewer of the second class would amount to about 6*l.* a house. The builders of such houses have not generally the means themselves; they get credit for the materials, and pay interest for them; and as soon as the houses are built and let, raise money upon them. This is the way in which large numbers of small houses are built, mostly by persons who look after their own property, and ultimately they fall into the hands of builders, or persons speculating in houses of this class. There are a great number of such persons, and to them the e[illegible]ase of sewage is of most serious consequence. The result is, they omit [illegible] together. The expense of the sewer to each of these houses would be abo[illegible]t 6*l.*: the cost of the house itself not more than 50*l.* To defray the cost of sewer, and pay the interest upon it by an annual charge, spread over a period of 30 years, 7*s.* a year would not be felt on a rental, and would be amply sufficient; but an additional sum of 240*l.*, added to the cost of building at the outset, prevents the builder adopting sewage at all, and he will make a cesspool in a cellar, or adopt some other substitute.

Mr. Dowley—The Westminster Commission of Sewers, as usual, got roughly handled. What is the reason you have not adopted practically a smaller scale of barrel drain, one of two feet, or 18 inches for some small streets of alleys? It has been considered that it would be a very dangerous precedent to go on; we should have applications from every other street in the neighbourhood to do the like, and it is a dangerous thing; we should never get regular good sewers built, and it is very difficult to tell when we begin a sewer how far it will ultimately extend.—You think it would be objectionable as introducing a bad precedent? Yes.—If it was found useful, it would not be introducing a bad precedent? No, probably not.—You think it might work well for the smaller kind of houses? Yes, I think possibly it might.—Then that smaller class of drain being made cheaper, would allow the landlord to charge less to the poor tenant? Yes.

Mr. Drew, Surrey and Kent Commission—Do you think that even an 18-inch barrel-drain carried up a small street may frequently be sufficient? Yes. —That would be a great deal cheaper than one of those large drains now used? Much cheaper.

The Tower Hamlets Commission also thought small drains might be advantageously used in minor streets and courts. In the City the plan has been adopted of making the Sewers at the expense of the Commission, without contributions from private parties, and only charging for the drains, which were also made by the Commission. This new plan seems to have answered well. It appears to be the strong impression of the Committee of Inquiry that the drains should be carried up to the houses by the Commissioners of Sewers, but on a less oppressive system. The objection of some surveyors to small drains arises from the fact that they occasionally get clogged by the mischievous propensities of the lower classes.

Mr. Bratt, a large holder of small houses, says, Some of the inconvenience I have experienced is that where I have been willing to lay a drain for a considerable length, I have met with refusal, and been told that it must be a second-sized sewer.—What size were you willing to have laid? In the case I especially allude to, I would have laid an 18-inch barrel drain.—For how many houses? For one.—Were you prevented from so doing by some regulation of the Commission? Yes, I was compelled to pay a sum of upwards of 60*l.* to the Commissioner of Sewers for laying down a sewer.—Does the fact of a great number of tenements in that district not being drained, arise from the nature of the regulations which have been laid down by the Commissioners? It arises from the want of sewers within reach. In many places, the water lies above ground for the length of half a mile.—There is no underground sewage, and yet those houses have to pay sewer rate? Yes.—How long have the owners of that property paid rates? I am now 60 years of age, and I recollect that district ever since I was 14. From that period they have paid sewer rate.—And no sewage has been carried up to the houses? None whatever.—Have you any evidence as to the previous payment of sewer rate on that same property before your own recollection? It is understood to have been paid for the last two centuries.

Communication or Entry of Sewers.

In consequence of the present ill-managed system, even where sewers exist, drains are not carried into them from private houses, a very serious evil. Mr. Beek, of the Tower Hamlets, says—Have the Commissioners the power to enforce a communication with the sewer where there is one? No. —You may have a sewer opposite to any of those poorer dwellings, and yet people may not avail themselves of it? Yes.—Is that the case in other parts of the district? Yes; in Rosemary-lane we have put in a sewer 1,500 feet in length, and there have been but ten communications. We have put in a sewer in Globe-lane, where many complaints were made, and I should say there have not been 30 communications made in the 6,000 feet of that sewer.

Mr. Roe—The drains communicate with the sewer two feet from the bottom.—When there is a new district to be built over, which of course will require drainage, what are the rules and regulations with regard to carrying up a sewer from the main sewer; have the Commissioners the power to compel the builder to carry a sewer? They have not; the old law of sewers only authorizes the maintaining of sewers.

On the Canonbury estate, which was lately let for building, provision was made for the sewage, without making sewers in the lines of the public streets, by receptacles for sewage, without any communication from them. The Foundling Hospital estate was leased for the builders to make sewers, the Commissioners having no control over them. When they were made, these persons applied to the Commissioners for leave to communicate with the existing sewers; the Commissioners then exercised their authority by saying, "No; these sewers are inadequately built; therefore we will not suffer them to communicate." That is the only power the Commissioners can exercise, namely, not suffering the communication. The inhabitants, of course, applied for relief, and ultimately the directors of the Foundling Hospital came to the Commissioners. The answer was, "Gentlemen, you have suffered these sewers to be made by builders in a very improper way; therefore we cannot suffer them to communicate, for we shall have them to rebuild in the course of two or three years." The question then was, what was to be done? It was at length agreed that the whole of the sewers on the Foundling estate should be surveyed; those that were good should be allowed to stand, and the Commissioners would take to them; those that were not, should be rebuilt. That was the condition of the communication taking place. The Foundling estate adopted that method, and the whole of that estate is now drained as well as any other part of the division.—When once you admit a range of collateral sewers to communicate with yours, you undertake the repairs? I am afraid that we are bound; we have no alternative.

Mr. Hertslet, of the Westminster Commission—Are there many houses which do not drain into your sewers? A great many. The greater part of Drury-lane, where we lately made a large sewer, does not drain into it, though we gave notice at the houses on each side of the formation of the sewer. Directly they find they have so much per foot frontage to pay, they will not apply; the tenant says it is not his business, we may go to his landlord; and the landlord says it is time enough to see about it when the lease is out.—That applies to the expense of making the sewer; but do not they object, when the sewer is made, to lock into it in some instances? Yes, in some instances they object to the trifling expense of carrying the drain from the sewers to the house.—Are there cases in which they object to the expense of making any sewer, and others in which they object to making a drain to the sewer, even when made? Yes; but there are comparatively but few cases of the latter kind, when the mere expense of the drain is in question. Are there parties who neglect locking into the sewers, though the sewers are near them? There are.

Mr. Drew, of the Surrey and Kent—What have been the number of applications for permission to drain private houses during each of the the last ten years? From March 1833 to

March 1834	63	March 1839	77
1835	82	1840	116
1836	62	1841	92
1837	87	1842	130
1838	55	1843	112

Many of these were for the drainage of more than a single house.

Houses Using the same Drain.

Connected with the last subject is that of the propriety of more than one house using the same drain. It has long been felt as an oppressive regulation, that under all circumstances by most of the commissions it has been enforced that each house shall have a distinct barrel-drain. Mr. Cresy, C. E. states—At Rutland Gate, at Knightsbridge, where I had to construct two sewers in the same piece of ground, one was a two-feet-six sewer, and the other a three-feet sewer. I had the laying out of a piece of ground at Rutland Gate, and I petitioned to have one sewer, thinking that would be sufficient to drain the houses on both sides of it. The Commissioners refused to give me leave to build one sewer, and obliged me to build two; and consequently I was at the additional expense of 1000*l.* to construct it. After it was done they refused to give me an outlet, and that occasioned considerable difficulty to us and involved us in litigation, and expenses to the amount of nearly 1000*l.* were incurred: afterwards the matter was referred to arbitration, and the arbitrator decided that we should have a communication with the sewer, and we had a communication with the sewer under the arbitrator's decision.—You state that those drains are two feet six, and three feet. Do you think that smaller drains than those may be often available, and equally useful for the purpose of going between rows of houses of the humbler class? Certainly, and in the Borough district that has been permitted. In draining Southwark-square, the drains are collected at the backs of the houses, into a drain of that kind, and afterwards carried into the main sewer: seven, eight, nine or ten of them draining by means of an 18-inch barrel-drain.

Mr. Drew confirms the practice of the Surrey and Kent Commission, who allow three houses to join together, and so let their water come in through one barrel-drain, from which no evil accrues.

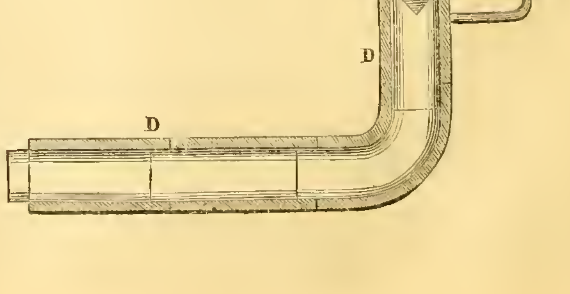
Fees for Entering.

These form another grievance. The charge will be found in a table appended to this article.

Tile and Pipe Drains.

As a means of remedying the serious evil of the cost of drains, the utility of tiles or pipes was seriously canvassed. Mr. W. D. Guthrie states, "To suppose any system of flushing would be efficient or perfect, where attention is paid to the common or main sewers alone, while the short connecting drains from houses are left entirely uninfluenced by the body of water, which may be passed along the main, would be as absurd as to suppose that perfect surface cleanliness of a large town had been effected because dirt and mud had been removed from the face of the principal streets and thoroughfares, whilst narrow streets, courts, and alleys, were entirely neglected.—The mode of flushing which he thinks superior to any system yet in operation may be thus shortly described: presuming that the existing defects in private drains have been remedied by the substitution of strong tubes of small calibre, and presuming that there is an arrangement in each tenement for carrying off the soil by water, then all that is necessary to secure perfect cleanliness is to erect a water tank or reservoir, of dimensions suited to each individual case, in such a situation that its contents, when suddenly evacuated, may sweep the whole length of the private sewer, filling completely its interior, and thereby effectually carrying every impurity before it on to the street or common sewer. Houses having water laid on need not be subjected to additional water-rates for a supply to its flushing tank, for if the rain water were conducted to it in the manner represented in this diagram, the purposes of flushing would be perfectly attained.

Let the water from the roof enter the cistern at A, as represented in the woodcut. Should the fall of rain be greater than the cistern is calculated to contain, the surplus may be carried off by the waste-pipe C, on which a valve of simple construction should be placed to prevent the effluvia rising from the drain tube D D. The flushing operation is effected by suddenly depressing the lever B, thereby elevating the plug P at the apex of the conical reservoir, the whole contents of which would immediately rush out with such force as to sweep everything through the house drains on to the main.



Cleansing Sewers and Flushing.

The great expense and excessive nuisance of the present mode of cleansing sewers was strongly proved, and competent and intelligent witnesses were unanimous in their approbation of the system of flushing, pursued by Mr. Roe, as efficient, and productive of great economy. Some of the witnesses seemed to be of opinion that the rats in the sewers are not injurious, but act as useful scavengers and stir up the mud in the water.

Ventilation of Sewers.

The ventilation of sewers was a good deal canvassed, it being considered in the highest degree expedient to get rid of the miasma and noxious gases which enter the houses. For this purpose, ventilating shafts were proposed by some parties. The serious evils of the gullies were strongly enforced by the engineering and medical evidence, by which it is ascertained that the presence of a gully opposite to a house is sufficient to produce disease.

Traps.

Trapping the sewers and gullies was necessarily a subject of engineering in connection with the preceding.

Mr. Biers—"The trap permitted by the Commissioners is but a very imperfect piece of mechanism, for the smell is often as offensive as if not trapped at all, and it is at the same time rather expensive. The Commissioners furnish the trap if the sewer is in progress of building, charging 20*s.* for it, but if a trap is put in after the sewer is built, then the charge is 3*l.*, and after all is not effective in keeping down the smell."

Mr. Kelsey, City—"You mentioned that you were trapping all the gullies at present as you get opportunity? Yes; and when there are complaints of a very grievous character they are done immediately.—Do you mean to trap all throughout the whole of the district? Yes; the Commissioners have put down between ten and eleven hundred already.—You spoke to another circumstance of having stench-traps; what is the precise arrangement of stench traps in your district? I have put a drawing in of the kind of thing which is used.—What is the object of it? To prevent the rush of air through the sewer grate being felt in the houses.—Is that rush exceedingly great? In some cases it is. They have very seldom failed when they have been introduced, and when they have failed it has been from a little tightness in the fitting. But there is one circumstance that annoys the Commissioners and the inspector very sorely; there is a class of men who make a living of getting into the sewers to pick up anything valuable that falls into them, and when they pass by one of those traps they feel a little want of ventilation, and they put a brick or stick to keep it up, and then we have a complaint that the air-flap does not answer. They go down into the river by stealth, we cannot prevent it; boys as a piece of fun go in. I have thought of putting a grating at the mouth of the sewer; but then I am afraid of stopping something that ought to go out."

River Valves of Sewers.

The construction of the outlets to the river was detailed by several witnesses. Professor Hosking speaking of the sewer at Fulham says—"I provide for stopping out the tide by flapping the mouths of the sewers, and as these flaps are self-acting, the sewers empty themselves without assistance, and when the tide flows the flaps are pressed close up by the tidal water, and the sewers are free to receive the water that may accrue upon the surface from rain or snow. Their capacity may, however, be insufficient, and the district may be flooded before the ebb takes place, a difficulty that cannot be wholly provided for without pumping."

Mr. Beek, Tower Hamlets—"What measures are usually adopted for preventing the ingress of water from the river? There are valves to all the outlets.—Do you find that those valves generally act well? Yes. They very seldom fail; when they do, it is owing to some matter issuing from the sewers which prevents their closing, and of course the tide will rush in; that used to be frequently the case, but since some new sewers have been made, and iron instead of wooden outlets and valves have been used, they have been found perfectly tight, and act well.—Have you had any experience of slate valves? No; I am satisfied with iron; I have been behind them when there was 16 feet tide above my head.—Are they subject to corrosion? No; they have been there for many years.—Are there any places in London where there are watchmen appointed to examine the state of the valves? We have an officer denominated a sluice-keeper, whose business is to open and shut them if necessary, and generally to superintend them."

Mr. Newman, Surrey and Kent—"Do the flaps ever fail in keeping out the tide? No; I do not remember an instance of the kind in my division.—Some of your district is below high-water mark?—Nearly the whole of it.—All your main arched sewers have flaps? Yes, they have not only flaps but pen-stocks.—Have you men who open and shut them? Yes, men who live near them; it is only in Surrey, where the levels are so very low, that is the case.—You would consider such an arrangement desirable in all cases where you have a drain below high-water mark to attend to? Decidedly; there is a flap next to the river, a few feet above the flap there is a pen-stock, which is worked up and down by machinery; that is closed or raised as may be required from time to time.—Is that attended to every tide? Yes. If that work were not attended to, there would be injury to the level.—If it did not open, it would shut in the land water; and if it did not shut, it would let in the tide? Yes.—Who attends to these? The sluice-keeper, who lives on or near the premises.—Is one man sufficient? Yes.—How many of those openings have you into the river? I have two main sewers, where there are pen-stocks, and men residing; there are minor sewers were there is one sluice-keeper to attend to several.—Where are those to be seen? The first is the Duffield sewer, in Bermondsey; the other, the Earl sewer, at Rotherhithe."

Want of Concentration.

Most of the other points alluded to in the report relate to administration. One of the most important is the want conceotration and the evils which accrue from it.

Scientific Skill.

A fact of great interest, showing the important and beneficial results which accrue from the proper application of science and skill, and the heavy losses sustained from the want of it, is exhibited by a comparison of Mr. Roe's operations in the Finsbury Commission, and Professor Donaldson in the Westminster Commission. In 1843 alone £7,900 was saved in Finsbury, while in the last ten years £66,669 15*s.* was lost in Westminster; "a sum," says Mr. Butler Williams, "sufficiently startling to cause the inquirer to scrutinize with care the reasons that are advanced in favour of the adoption of a form theoretically imperfect, and found practically not to answer so well in some cases as the more perfect theoretical shape which would produce such a great saving." We know no severer censure than is here conveyed.

From the facts detailed in this report we have drawn up the following synoptical table.

Commission of Sewers.	Total length of Sewers in yards.	Length constructed from 1831 to 1841 in yards.	Cost of Sewers since 1841.	Average Cost of cleansing per annum.	Size of 1st Class Sewer.	Cost of 1st Class Sewer, per yard.	Size of 2nd Class Sewer.	Cost of 2d Class Sewer per yard.	Size of 3rd Class Sewer.	Cost of 3d Class Sewer per yard.	Size of Draining in pipes.	Cost of Drains per yard.	Charge for entering.	Rate per annum per £.
Westminster (a)	—	70,093	—	2000*l.*	5ft6 × 3ft	—	5ft × 2ft6	57*s.*	—	—	9 in.	—	21*s.*	2*d.*&4*d*
Tower Hamlets	79,200	20,000	—	500to600*l*	4ft6 × 3ft	45*s.*to75*s.*	4ft × 2ft6	36*s*60*s.*	None.	—	12 in.	9*s.*	17*s.*	—
Holborn and Finsbury(b)	—	70,000	—	—	—	—	—	—	4f6 × 2f.6	—	3f.6to2f.6 2 ft. 1 ft. 8 in. 9 in.	6*s.* to 9*s.*	20*s.*	—
Surrey and Kent	—	19,751	—	—	5ft3 × 4ft9 5 ft × 3ft6 4ft9 × 3ft4	141*s.* 72*s.* 54*s.*	4ft6 × 2ft0	48*s.*	2f6 × 2f.8	14*s.*3*d.*	18 in. 15 in.	15*s.*to16*s.*1*d* 12*s.*to13*s.*6*d*	24*s.*	—
City of London	45,000	23,483	121,509*l.*	469*l.*	—	—	—	—	—	—	24in. × 18 24 in. 18 in. 15 in.	22*s.* 6*d.* 24*s.* 19*s.* 6*d.* 16*s.* 6*d.*	None.	4*d.*
Poplar	—	—	5,000*l.*	—	—	—	—	—	3f6 × 2f.6	—	—	—	—	2*d.*

(a) Length built by Commission, 27,056 yards; by individuals, 43,037; 30,000 yards 1st Class, 30,000 yards 2nd Class. (b) Length built in 4 years, 37,000 yards.

The want of adequate plans of districts, and the necessity for a general survey with the levels properly laid down, and level marks placed in property localities seems to be well established. In most cases, the memory or memoranda of the surveyors constitute the most available record.

The want of power on the part of commissions to construct new sewers under the present acts was commented on as a serious evil, to which no doubt a remedy will be applied.

PROFESSOR FARADAY ON HEAT.

A course of eight Lectures delivered at the Royal Institute.

Lecture V., *May* 18, 1844.

(Specially reported for this Journal.)

Amongst the phenomena accompanying the change of matter from the solid or fluid to the vaporous state, the vast increase in bulk is perhaps the most striking. If a small piece of camphor is placed in a flask and heat applied, it will be found that in a short time the whole of the flask will be filled with its vapour, which may be lighted at the mouth of the flask. When cooled it returns to its former solid state, and thus illustrates the difference between vapours and gases, the latter being permanent at ordinary temperatures, whilst the former require a higher heat to maintain them in the gaseous state. It is therefore seen that heat does not produce any permanent change in these cases, that, in fact, the change is only mechanical and temporary. The phenomena of ebullition may be accurately watched by using a transparent boiler, such as a glass tube, or still. Volumes of steam are formed which in the still condense into a few drops of water, which drops may be taken as a measure of the quantity of steam formed, for it is known that water is increased in bulk 1700 times by being converted into steam.

When water is heated, it increases in heat until it arrives at the boiling point or 212°, and though the heat may be continued for any length of time, the water becomes no hotter, but continues to give off steam of the same temperature as itself. There is here, then, the same phenomenon as when heat is applied to ice, and it is owing to the same cause, viz.. the absorption of latent heat by the steam, though to a much greater extent than in the case of water. Indeed, almost all the heat which is added to boiling water is rendered latent. This heat, however, may be all rendered sensible by condensing the steam, and in this manner cold water may be boiled by passing steam into it at a distance from the source of heat. One pound of steam will heat 6 or 7 pounds of water to the boiling point. In experiments carried on to ascertain the quantity of heat rendered latent by steam, it was found that 1lb. of steam passed into 10lb. of water at 60°, left 11lb. of water at 160°. The matter therefore stood thus :—

10 lb. of water had gained 100° each =	1100°
1 lb. of steam at 212° had lost . . .	52°
Therefore the latent heat of steam is	948°

The same amount of heat is found to be abstracted when steam is formed. There are many processes in the arts where it is not convenient to apply heat directly to a vessel, and in these cases steam is frequently used. Brewers, for instance, heat their liquors in this manner.

Water in being converted into vapour increases in bulk more than any other liquid, thus—

1 volume of Water becomes 1696 volumes of vapour.
1 „ Alcohol „ 659 „
1 „ Ether „ 443 „

It thus becomes specifically lighter than the air, and is therefore enabled to rise through it; for it is found that,

The specific gravity of steam is 0·625
„ „ air 1·000
„ vapour of alcohol 1·613
„ „ ether 2.580

By this means the vapour of water is carried into the upper and colder regions of the air, and there being condensed, falls on the high lands, and flow agains to the valleys as rivers. The vapour of camphor is too heavy to rise in the air, and may be poured from one vessel into another like water.

The boiling point of water, though at the surface of the earth, it is always about 212°, depends entirely on the pressure of the atmosphere. Thus water can be made to boil at exceedingly low temperatures, by removing the pressure of the air. Water which feels but slightly warm to the hand, boils under the receiver of an air pump. Alcohol will boil when cold, under the same circumstances. If a retort be filled with boiling water, and the neck corked up and put into cold water, the water will continue to boil for an hour or more. Water can also be made hotter than 212°, by increasing the pressure; for instance, by heating it in a closed vessel, when the pressure of its own vapour prevents it from boiling, and the temperature rises in proportion. The rate at which the heat increases with the pressure is shown in the following table.

Atmospheres.	Degrees.	Atmospheres.	Degrees.
At a pressure = 1 the heat is	212	At a pressure = 8 the heat is	342
2 „	250	9 „	351
3 „	275	10 „	359
4 „	294	15 „	393
5 „	309	20 „	418
6 „	320	25 „	440
7 „	332	50 „	511

A curious fact has been remarked with respect to the boiling point, that is, that it is slightly affected by the nature of the vessel containing the water. In two vessels, one of copper, the other of perfectly clean glass, the water in the copper will boil at 3° lower temperature than that in the glass. The bubbles which are given off in boiling, though in general rising form the bottom of the liquid, may, owing to this property, be made to rise form any part by inserting a bunch of metal wire in it. A piece of wood will in the same manner, regulate the bubbling spot in alcohol. Copper filings dropped into water, lowers the temperature of boiling, changes the place of boiling and breaks up the large bubbles into small ones. This difference of boiling point according to the containing vessel, must be taken into consideration in graduating thermometers, or great errors will be introduced into the graduations.

A list is here given of some fluids which readily pass from the liquid to the vaporous state, with the pressures and temperatures requisite to effect the change; the first column of figures expresses their boiling points at common pressure, the second, the pressure requisite at 60° to convert their vapours into liquids :—

	Degrees of Heat.	Pressure in Atmospheres.
Nitric oxide	—	53
Carbonic acid	—	47
Hydrochloric acid	—	42
Hydrosulphuric acid	—	18
Ammonia	—	7·5
Cyanogen	—	4·2
Chlorine	40	4·
Sulphurous acid	14	2·25
Sulphuric ether	98	0·48
Sulphuret of carbon	110	0·245
Alcohol	176	0·041
Water	212	0·0172
Spirits of turpentine	316	
Sulphur	570	
Oil of vitriol	620	
Mercury	662	

The effects which take place when bodies pass from the solid or liquid to vapour, are somewhat similar in all cases. Nearly all bodies evaporate below their boiling point. A little ether poured into a spouted vessel, fills the whole of it with its vapour, which may be poured out or lighted at the spout. In like manner water is continually evaporating at all temperatures, and during evaporation producing the sensation of cold, owing to the heat which it renders latent. It is on this principle that wine coolers act. Dr. Wollaston's cryophorus, freezes water by its own evaporation. It consists of a glass tube with a bulb at each end, sealed hermetically and containing a little water without air. The water being at one end, the other end is immersed in some ice, which, condensing the vapour as quickly as it is formed, so reduces the temperature that the water at the other end becomes frozen. Amusing instances of this ready evaporation of water occurs occasionally in domestic economy, when buns and biscuits are shut up in one case together. The water evaporates from buns and is readily absorbed by the dry biscuit, and becomes hard and sandy, whilst the biscuit which should be crisp becomes moist.

The physical history of vapour and the uses to which they are applied, has recently acquired great importance. The mechanical action of the vapour of water in the steam-engine is known to be almost without limits. This power arises from the vapour of water requiring 1700 times its original space, and the pressure which it exerts to fill that space. If an orifice be left in the vessel in which the steam is generated, sufficiently large, no effect will be there produced; but if not, and heat is continued, the vessel will yield to the great pressure, and explosion will result. This may be illustrated by a little toy known as the candle cracker, which is a drop of glass with water in the interior; this placed in the tallow of a candle becomes heated, steam is generated, and at last explodes with noise, and extinguishes the candle. This exhibits the force of expanding steam as well as on a larger scale. If a glass tube be blown into a bulb in the middle, and turned upwards with a very fine opening at one end, on heating the bulb enclosing the larger end, the vapour of ether will drive the liquid with great force into the air, which if lighted, will form a splendid stream of fire. The tendency of the pressure of the air to crush steam boilers which have been filled with steam, and which has subsequently been condensed, is shown strikingly by boiling a little water in a tin canister, closing it tightly when full of steam, then allowing it to cool, or more quickly by pouring water on it; the whole vessel will be collapsed and doubled up.

Lecture VI.—May 25, 1844.

When water and oil, of the same temperature, are brought into a warm room, they will be found, in time, to acquire the temperature of the room, but the oil will arrive at its full heat in half the time required by the water. From this it is inferred that bodies absorb various quantities of heat to arrive at the same temperature; and this is fully borne out by further investigation. This, which is called their *capacities* for heat, is found to vary with every substance, each substance rising in temperature by the application of the same amount of heat, according to its own rate; that body which requires the most heat to raise its temperature a certain degree, being said to have the greatest capacity for heat. From this it is inferrred that bodies, though of the same *temperature*, do not contain the same *quantity* of heat. The quantity of heat requisite to raise bodies to the same temperature is called their *specific* heat. A table of the specific heat of a few gaseous bodies is here given :—

Water	1·0000	Nitrogen gas	0.2754
Air	0·2669	Nitrous oxide gas	0·2369
Hydrogen gas	3·2936	Olefiant gas	0·4207
Carbonic acid gas	0·2210	Carbonic oxide gas	0·2884
Oxygen gas	0·2361	Aqueous water	0·8470

Table of specific heat of equal weights of—

Water	1000	Zinc	93
Sulphur	188	Silver	56
Glass	117	Mercury	33
Iron	110	Platinum	31
Copper	95	Lead	29

The compression of air diminishes its capacity for heat, and consequently its temperature rises. A little piece of apparatus, called the tinder syringe, has been constructed, by suddenly pressing the piston of which, a piece of tinder is ignited by the heat evolved from the compression of the air. The French girls in Paris are very dexterous with this little instrument. The expansion of air, on the contrary, by increasing its capacity, produces cold. A bottle of soda water, when opened is seen to smoke ; this is owing to the sudden expansion producing cold enough to condense the aqueous vapour previously invisible in the gas. A curious property with respect to heat has been observed with India rubber: when forcibly drawn out considerable heat is evolved, which is best observed by placing it against the lip both before and after extension. This may be repeated any number of times, but this property can hardly be connected with its capacity for heat.

The expansion and contraction of the atmosphere, and its consequent change of temperature, is no doubt a very influencial element in the changes which take place in the weather, and is an important consideration in the science of meteorology.

Heat bears a singular relation to electricity, which was first pointed out by Seebeck. He found that when two metals were attached together, and heated at their junction, a current of electricity was developed, which deflected the magnetic needle. The metals found most advantageous for this purpose are bismuth and antimony. In the first lecture electricity was employed as a source of heat, now the converse, heat as a source of electricity. A parallelogram of bars of antimony and bismuth, with the points of contact alternately heated and cooled, will deflect a magnetic needle placed over or under any part of it ; or by connecting the extremes with a galvanometer, its action is more evident. The term *thermo-electricity* is applied to this new collection of facts. Pelltier has added some curious observations on this point. He has proved that when a weak electric current from a single circuit is transmitted through a bar of equal lengths of bismuth and antimony soldered together, from the antimony to the bismuth, heat is evolved at the point of junction ; but if the current is sent in the other direction, cold is produced. A delicate thermometer inserted in a hole at the point of junction rises 80° in the first case, and sinks to 6° in the second. If the bar be placed on thawing ice, a little water may thus be frozen in the cavity made for the thermometer. Melloni and Nobili, by using groups of wires, and connecting them with a delicate galvanometer, have constructed apparatus so sensitive to heat, that the warmth of the hand held at a considerable distance affects it, and it will even indicate the warmth of a silkworm crawling over it.

But to return to vaporisation and its effects, which can be beautifully illustrated by means of carbonic acid. It has been shown that bodies evaporate at different temperatures : thus a little ether poured into a bladder will fill it with its vapour, whilst water would require a much higher temperature. Carbonic acid, which is usually known only in the gaseous state, can be liquified and even solidified by great pressure and cold. Cyanogen gas, discovered by Gay Lussac, can be very readily liquified, and this can be effected in the following manner. Place some cyanide of mercury in the body of a strong retort, to the mouth of which is fastened a stop-cock; apply heat and the gas will be liberated, close the stop-cock and the gas will accumulate in the retort like high pressure steam, and when the pressure is about equal to four atmospheres, the cyanogen becomes condensed into a liquid. Under similar circumstances carbonic acid and many other gases may be liquified, though most of them require very great pressures, as may be seen by reference to a table previously given. The most striking properties of carbonic acid gas are, that it is very dense, and extinguishes flame. Owing to its great density, it may be poured through the air from one vessel to the other ; a little bucket let down into an open-mouthed jar full of the gas may be drawn up full, as is proved by a lighted taper being extinguished when inserted into it. Generated from carbonate of ammonia and sulphuric acid in a closed tube, it is liquified when the pressure equals 47 atmospheres. [Mr. Faraday here exhibited the original tube in which he first liquified carbonic acid, in the laboratory of that institution, which was still charged with the liquid.] This has been ably carried out by Thilorier, who constructed apparatus for collecting it in large quantities; but Mr. Addams has constructed far more perfect apparatus for that purpose. It consists of two exceedingly strong iron vessels, in one the materials are placed for generating the gas, the other is used as a receiver for the liquid produced in the first. Thilorier discovered that when the liquid was allowed to rush into the air, part of it expanded nto gas, whilst the other part, from the loss of heat, which was absorbed by he gas, was frozen into a solid. This he collected in a tin box with perforated handles to allow the gas to escape. In this state carbonic acid is a snow-like substance, slowly vaporizing at ordinary temperatures. It can be handled without annoyance, feeling cold to the touch, but leaving a sensation like hot iron. Its temperature is about 130° or 140° below 0°. If placed in a retort with the neck immersed in water, the gas is slowly given off, and is seen rising through the water. Placed at the bottom of a glass vessel, it fills it with gas, which extinguishes a lighted taper. Laid on mercury it abstracts from it but little heat ; and it may, like water, be placed on a very hot metallic capsule and yet be but slowly evaporated, though the capsule be red hot. This apparently contradictory fact, that a body so intensely cold, and consisting of an immense quantity of gas, pent up, as it were, in small compass by that cold, should be scarcely affected by a red heat, arises from the circumstance that it is continually surrounded by the vapour of its own gas, which prevents it from touching the substances it is brought near, and this gas being a very bad conductor, protects it likewise from external influences. But should a liquid be added to it which would wet it and the substance experimented on, without at the same time being frozen by the cold, then the properties of the solid carbonic acid are developed. Ether, Thilorier found, was such a liquid, as may be seen by pouring a little ether on the solid acid resting on the mercury, which would have had little effect on otherwise, but which now freezes the mercury to a solid state. A saucepan may be frozen to a stool, as with the ice and salt. Glass vessels are instantly cracked, owing to their suddenly contracting. The degree of cold produced is intensely greater than mariners ever have experienced, and therefore any part of the body which was now touched with it would be perished. It is said that Messrs. Pepys and Allen, by dint of a tedious process of cooling, succeeded in freezing 40 lb. of mercury; but with the solid acid this is easily done. A piece of mercury frozen on the end of a stick, and held in some ice cold water, is immediately covered with icicles, which shoot through the water till it is frozen, at the same time the mercury is thawed and fall in drops to the bottom, thus proving that water in freezing gives out heat.

The next two lectures will contain the transmission of heat, and the nature of flame.

REGISTER OF NEW PATENTS.

(Under this head we propose giving abstracts of the specifications of all the most important patents as they are enrolled. If any additional information be required as to any patent, the same may be obtained by applying to Mr. LAXTON at the Office of this JOURNAL.)

MANUFACTURE OF GAS.

BAPTISTE BURET, merchant, and FRANCOIS MARIUS DAVID, manufacturer of gas apparatus, both of Leicester Square, in the county of Middlesex, for "*Improvements in the manufacture of gas.*"—Granted Jan. 30 ; Enrolled July 30, 1844.

This invention consists in the peculiar construction of retorts to be used in the manufacture of gas made from fatty matters, such as oil, tallow, pitch, tar and other substances. The retort employed by the patentees is of a cylindrical form, and made of iron or clay, and of the ordinary construction with the exception of having a division plate in the centre, which extends to within a short distance of the farther end ; this retort is fixed in the brickwork in a vertical position and is surrounded by a flue, the fire being below ; the cover or lid of the retort is provided with two pipes, an inlet and outlet, the former pipe is connected with a small tank or cistern containing the fatty matter, which is kept in a fluid state by means of hot air from the flue, the outlet pipe being connected with an arrangement of pipes which forms the condenser.

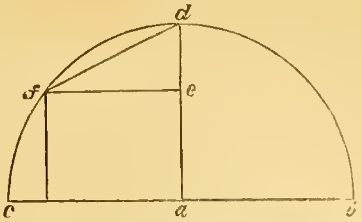
The pitch or other substance from which the gas is to be made, when in a fluid state passes through the inlet pipe and is allowed to drop on to red hot coke which is in the bottom of the retort, and the gas evolved passes through the outlet pipe, and through the condensers into the washing apparatus, which consists of a rectangular box having a compartment filled with heath and sticks through which the gas passes, and from thence into the gas holder, which completes the process of manufacturing gas according to these supposed improvements.

STEAM PROPELLERS.

ROBERT HODGSON, of Princes Street, Clapham, in the county of Surrey, for "*Improvements in propelling vessels, and in machinery for working the same.*"—Granted Feb. 2 ; Enrolled August 2, 1844.

This invention consists in a peculiar mode of applying vanes or floats to shafts for steam or other propellers. Fig. 1 is a geometrical figure intended to illustrate or show the proper position to be given to the vanes or propellers, presuming the propellers to be made, are intended for the stern of the vessel ; it will be necessary, in the first place, to ascertain the diameter of the largest circle which can be described within the space intended for the reception of the propellers: suppose, for instance, $a\ b$ to be the radius, then with such radius describe the semicircle *c d b*, and bisect it with a perpendicular line *a d*, and from *d* set off the chord of any angle between 45 and 60 degrees, as

Fig. 1.



d f, and from *f* draw a perpendicular to the base line *c b*, then *f e* is said to be the sine and *f d* the cosine, of the required angle. The width of the floats should not, it is said, in any part exceed the sine *f e*.

Figs. 2 and 3 in the annexed diagrams show two side views of a propeller having the floats fixed at an angle with the shaft in the form

Fig. 2.

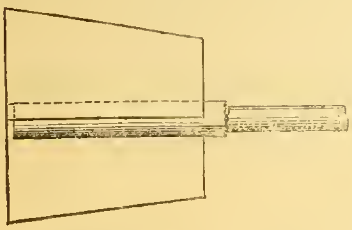
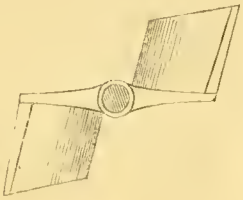


Fig. 4.



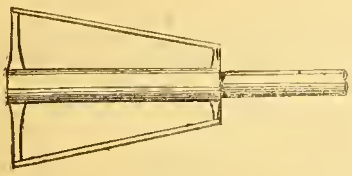


Fig. 3.

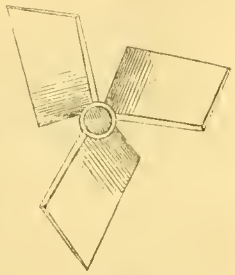
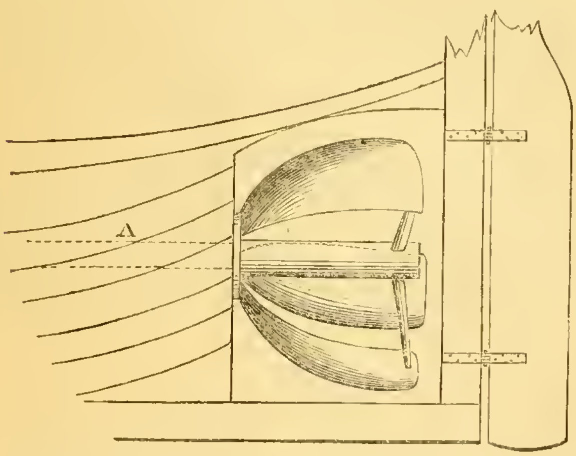


Fig. 5.

of a cone, the apex of which is foremost, or next to the stern of the boat. Fig. 4 shows an end view of the propeller, and shaft in section. Fig. 5 shows an end view of a similar propeller, but having three floats or vanes in place of two. Fig. 6 is a side view of a pro-

Fig. 6.



peller, the floats or vanes of which are of the form of a parabolic curve, A, being the stern of the boat with a portion of the dead wood removed for the reception of the propeller, which will be clearly understood.

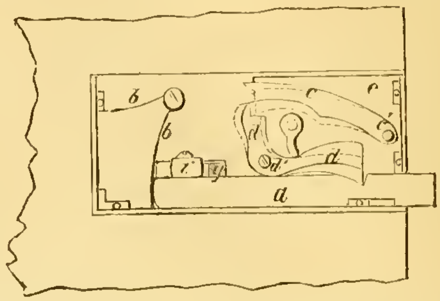
The inventor claims the attaching blades or propellers to ships at tangents coincident with the plane of a right cone placed longitudinally with the apex foremost; and also the employment of blades of the form of parabolic sections, whether attached to the shaft at tangents coincident with the plane of a right cone placed longitudinally with the apex foremost, or in a position parallel to the same.

LOCKS AND LATCHES.

WILLIAM FLETCHER, of Moreton House, Buckingham, Clerk, for "*Improvements in the construction of locks and latches applicable for doors and other purposes.*"—Granted January 30; Enrolled July 30, 1844.

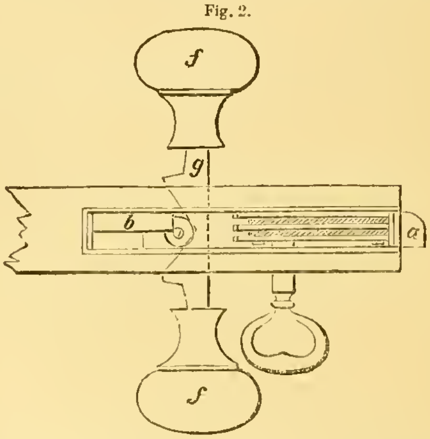
This invention for improvements in locks and latches applicable to doors and other purposes, will be understood by the following description and reference to the annexed drawings; fig. 1 being a front view

Fig. 1.



of a lock with one side removed, so as to show the interior; and fig. 2 a transverse section of the same; *a* is the bolt of the lock, which is

Fig. 2.



pressed outwards by a spring *b*, which presses against the end of the bolt; *c* is a lever or tumbler moving upon an axis *c'*, *d d* is another lever moving upon an axis *d'*, the lower end of this lever when the bolt is shot drops into a notch or recess formed in the bolt, the upper end supporting the end of the levers *c*; the lock contains three pair of these levers, which are divided or separated by plates, *e*, which plates are shown in section at fig. 2, and form wards to the said lock; *f f*, fig. 2, are the door handles fixed at each end of the spindle *g*, which spindle is made with two inclined planes shown in dotted lines, these inclined planes act against a small roller, *i*, fixed to the bolt, *a*, by means of a screw, which screw forms the axis of the roller; it will therefore be seen that on pressing either of the handles towards the door, or by pulling the same in an outward direction, that one of the inclined planes will press against the roller, *i*, and draw the bolt back inwards; that is to say when the levers or tumblers have been raised from the notch formed in the bolt *a*; the action of this lock, therefore is as follows:—

If the key be inserted and turned one-fourth of a revolution to the left hand, the upper end of the lever, *d*, will be forced back, and in so doing will raise the lower end out of the notch formed in the bolt *a*, the end of the lever *c* at the same time drops into a notch cut out of the end of the lever *d*, and prevents the lever *d* from falling into its original position; the whole of the levers being in like manner acted upon by the different projections of the key; the bolt may then be drawn back, or inwards, by forcing or pulling at one of the handles as above described; the levers will now be in the position shown by dotted lines, and in order to lock the door, it will only be necessary to shut the same, and having inserted the key, then by turning it round either to the right or left the various projections will raise the levers, *c*, and allow the levers, *d*, to drop into the notch formed in the bolt, *a*.

Figs. 3 and 4 show a modification of one of Mr. Fletcher's latches; fig. 2 being a side view showing the interior, and fig. 3 a transverse

Fig. 3.

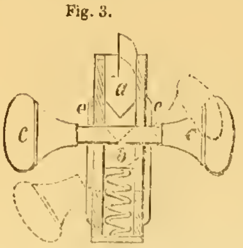
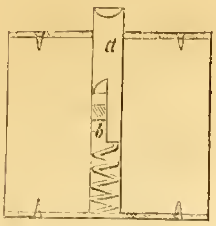


Fig. 4.



section; *a* is the bolt acted upon by a spiral spring so as to force it outwards, *b* is a stud fixed in the side of the bolt, *c c* are the handles, and *d* the spindle which it rests upon, or, in other words, is passed between the stud, *b*, and the brass plates, *e e*, which may be made to form the sides of the latch, and which have slots cut in them as will be understood. Thus by pressing the handle in the position shown by dotted lines, the edge of the plates, *e e*, form a fulcrum to the spindle, which bearing against the stud, *b*, forces the bolt, *a*, into the lock and allows the door to be opened. There are several other modifications of this latch described in the specification.

IMPROVEMENTS IN MAKING IRON AND STEEL.

Thomas Southall, of Kidderminster, in the county of Worcester, druggist, and Charles Crudgington, of the same place, banker, for "*Improvements in the manufacture of iron and steel.*"—Granted Feb. 8; Enrolled August 8, 1844.

This invention consists in a mode of improving the quality of the iron, or converting the same into steel, by the application of sulphur and a nitrate when the iron is in a melted state. For this purpose the inventor takes sulphur and nitre, together with borax, soda and potass, and also alum, the sulphur being in the state of brimstone of commerce, and the nitre in the state of saltpetre of commerce, the potass, borax, soda (subcarbonate of soda), and alum, being of the usual qualities; the above materials are to be thoroughly mixed together in a granulated state, in the following quantities, that is to say, equal quantities by weight of borax, nitre, sulphur and alum, with half the quantity by weight of potass and soda; the above ingredients when properly mixed together are to be made up in strong paper parcels (which will render the same more convenient for sinking below the surface of the metal,) of $1\frac{1}{2}$ lb. each, one of which parcels is to be used to about every 400 cwt. of pig iron when in a melted state, this proportion being used when it is only required to improve the quality of the iron, but when it is desired to convert the iron into steel the inventors use 4 lb. or rather more to every 400 cwt. of iron; the process of mixing is as follows: when the iron is in a melted state, for instance in the puddling furnace, the damper is to be lowered for about one minute, the above mixture is then to be put into the furnace and well incorporated with the iron by stirring, during the time of stirring, the damper is to be gradually raised, the iron during this time will be subjected to ebullition "when it will come to nature;" after which the iron may be balled, and put under the tilt hammer and then rolled in the ordinary manner.

The inventors observe that it will be necessary to use a greater or less proportion or quantity of the ingredients above described according to the quality of the iron, which proportion will be found in practice; moreover, when converting iron into steel, care should be taken not to use too much, which would have the effect of making the steel too brittle.

STEAM BOILERS.

James Johnstone, of Willow Park, Greenock, Esq., for "*improvements in steam boilers.*"—Granted Feb. 8; Enrolled July 26, 1844.

These improvements are said, in the specification, to have reference to that part of boilers called furnaces, and are constructed upon similar principles to the boilers for which Mr. Johnstone obtained a patent in April 1843. The annexed drawing shows two plans of a fire box constructed according to this invention. Fig. 1 being a side elevation, and fig. 2 an end view; *a*, *b*, *c*, *d*, fig. 1, is the fire box, and consists of an internal and external case firmly bound together by rivets *e*, *e*, *e*, and in such manner as to form a water space between the two cases; *f*, *g*, *f*, *g*, are two water conductors, which communicate with the water spaces; *h*, *i*, is a steam and water conductor attached to the top of the external case, and also communicates with the water spaces, each of these conductors has flanges at one end, which flanges are perforated with holes for the purpose of being rivetted or bolted to the end of the boiler, which should have holes previously made in its end, corresponding with the three conductors, the area of which, that is to say, the water conductors should be equal or greater than the

Fig. 2.

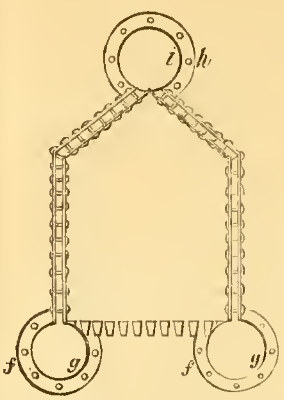
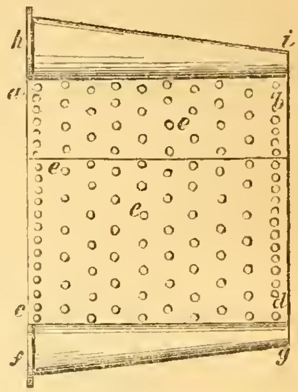


Fig. 1.



horizontal sectional area of the water space, the area of the conductor *h*, *i*, being equal to or greater than that of both water conductors; *l*, *l*, are the fire bars, below which, if it is desired, there may also be a water space communicating with the others. The water space at the front end of the fire box *m*, must be stopped up with a piece of iron made to fit such space, and firmly rivetted therein.

The patentee claims as his invention the construction and application of boiler furnaces and furnace boilers, of which the outer and inner fire boxes are bolted together at the roof as well as at the sides, so that a current of water is continuously kept flowing up the sides, and over and along the top of the inner fire box.

ORNAMENTAL GLASS.

Joseph Gibson, Jun., of Birmingham, in the county of Warwick, japanner, for "*Improvements in ornamenting glass.*"—Granted Feb. 10; Enrolled August 8, 1844.

This invention consists first in ornamenting glass with pearl, by cementing or otherwise affixing pieces of pearl to the back or inner surface of coloured or colourless glass, so that the pearl may be seen through the glass; and secondly in ornamenting glass with pearl and other substances. The mode of carrying out this invention is as follows: Mr. G. takes a piece of pearl of the shape and size required for the ornament, having one or both surfaces previously ground or filed perfectly flat, that portion of the glass to which the ornament or ornaments is to be fixed is to be covered with a thin stratum of copal or other transparent varnish, the ornament is then to be pressed closely against the surface of the glass so as to cause the ornament to adhere thereto; after which the piece of glass, together with the ornament, is to be put into an oven and subjected to a heat of about 120°, and allowed to remain there for 6 or 8 hours more or less, for the purpose of hardening the varnish, after which the whole surface of the glass upon which the ornament has been fixed may have a coat of varnish and be subjected to the process of drying as before, when the said surface may be painted with black or coloured paint, which when dried completes the process. Another process is by tracing the ornament upon the glass, and then carefully painting all the surface of the glass with the exception of that part where the ornament is to be placed, which is to be attached to the glass in the manner before described; the pieces of pearl forming the ornament may be previously ornamented with gold or silver as may be desired. Such ornamented glass is considered as being applicable for buttons, panels of doors, finger plates, work boxes, tables, and other cabinet furniture.

FIRE PROOF BUILDINGS.

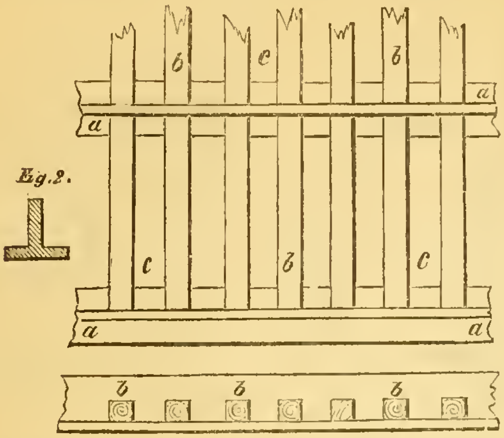
Henry Hawes Fox, of Northwoods, of Frampton Cotterel, Winterbourne, in the county of Gloucester, Doctor of Medic[ine], "*an Improved mode of constructing fire-proof floors, ceilings ar[...]*" —Granted Feb. 10; Enrolled August 9, 1844.

The mode of constructing fire-proof roofs according t[o ...] tion is as follows: *a a*, Fig. 1, are cast iron beams having [...] at the lower edge, as will be seen by Fig. 2, which shov[...] ection of one of the same; these beams extend acr[...]

e- with short s bore: cistern, inches.

and rest in the side walls; *b b b* show a number of joists which are supported by the flanges of the cast iron beams as will be clearly seen; upon these joists is laid about $\frac{3}{4}$ of an inch thick of plaster composed of one part lime and three parts coal ashes, which, says the in-

Fig. 1.



ventor, pressing through from between the "laths" or joists, serves as a key to hold the ceiling; upon this composition is then laid a mixture of eight-tenths of road grit, one-tenth of coal ashes, and the same quantity of lime mixed with water; this mixture, which the inventor calls pugging, should be laid on about the "thickness shown in the drawing," which is about $\frac{5}{16}$ of an inch, and the same well trodden; the specification does not show what is to support this mixture in the spaces between the joists, as at *c c*, but goes on to state that this latter surface is to be covered with a cement consisting of one part lime and two parts coarse sand, which surface is to be trowelled quite flat, and when the same is perfectly dry, it is to have about two coats of cold drawn linseed oil, made quite hot and laid on with a brush similar to those used by whitewashers, which when dry is said to make a very tough floor, and one not liable to be injured by cleaning or removing furniture.

The fire-proof ceiling is to be made with the above compositions and plastered in the ordinary manner.

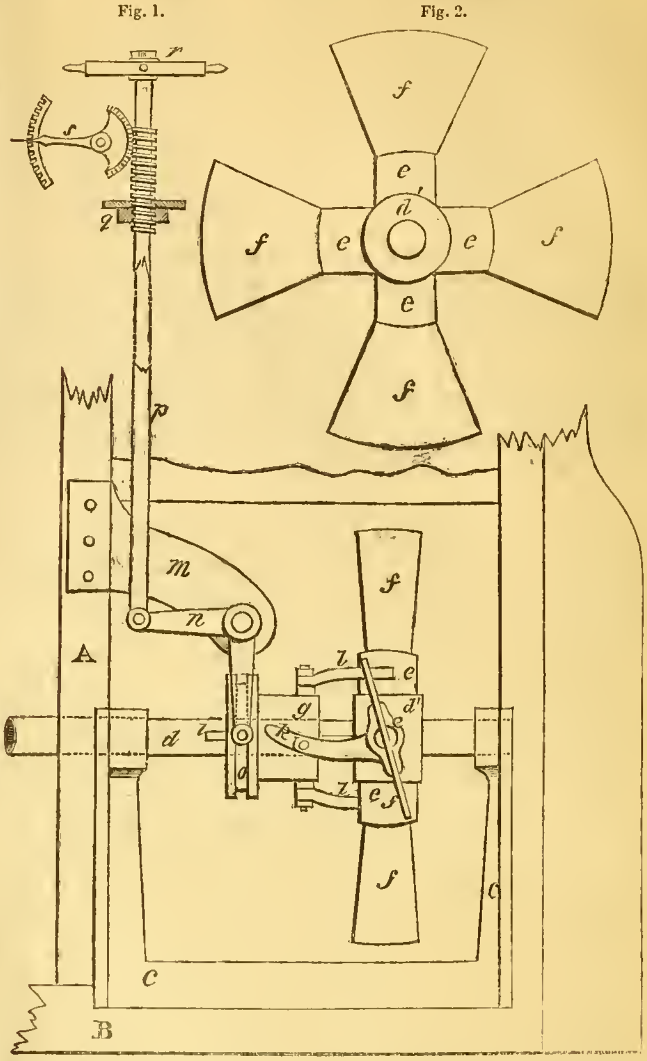
The only difference between the fire-proof roof and the floor is that it will be necessary to give a slight inclination to the roof in order that the water may get off, and also that the "floating" should be done with air mortar instead of the ingredients above described, and the coatings of linseed oil omitted, the roof being covered with pitch, paper, and sand in the following manner. Take 12 gals. of mineral tar and boil it down to 9 gals., the process of boiling should be done with care, and in such manner that the tar shall have acquired a proper consistency and adhesive quality, the roof is then to be covered with the tar in a hot state, and then covered with paper, one side of which is to be covered with raw tar, after the paper has been laid down with the tarred side downwards, this paper covering is then to be covered with hot tar and immediately covered with fine gravel freed from earthy matter, which completes the process of constructing fire-proof roofs according to the specification.

SCREW PROPELLER.

Bennet Woodcroft, of Manchester, consulting engineer, for "*improvements in propelling vessels.*"—Granted February 13; Enrolled August 13, 1844.

This invention consists in a mode of arranging the floats of screw propellers, whereby they may be placed at an angle forming a screw of any pitch, from $7\frac{1}{2}$ feet to $14\frac{1}{2}$ feet; and by which arrangement the speed of the vessel may be increased or diminished at pleasure, and also in an apparatus for indicating the angle or pitch at which the oats are set. Fig. 1, shows a side elevation of this apparatus, which fixed in the dead wood of the vessel, A being the stern post, and B eel; *c, c*, is a cast iron frame supporting the shaft *d*, upon which ly keyed, a boss *d'* having four projections *e, e, e*, of a peculiar d so constructed as to carry the vanes or floats *f, f, f*, and allow urning upon their axis so as to form any desired angle with shaft; *g*, is a boss or ferule which is made to slide endhe shaft, the same being prevented moving round upon v two fixed keys or feathers *i*, upon which the boss or s loosely. In the periphery of this boss there are four nly of which is seen in the drawing, these grooves receive four studs which are fixed to the arms or levers *l, l, l*, the opposite end of these arms pass through a slot formed in the projections *e, e, e*, and are attached to the axis of the vanes or floats. It will

Fig. 1. Fig. 2.



therefore be evident from the above that by sliding the boss backwards or forwards upon the shaft, that the angle of the floats may be varied, and the speed of the vessel increased or diminished as may be required. This sliding motion of the boss *g*, is effected as follows: *m*, is a bracket or support bolted to the stern post of the vessel, this bracket supports the axis *n*, of two bell cranked levers, one being at each side of the bracket; at the lower end of these levers there is a stud which fits loosely in the groove *o*, at the opposite end of these bell cranked levers there is attached a rod *p*, having a screw cut upon it, which passes through a nut *q*, fixed in the deck of the vessel; *r*, is a wheel fixed to the top of the rod *p*, and having a number of handles on its periphery, by turning which the rod will be raised or lowered, and consequently the bell cranked lever; *s*, is a lever moving upon an axis, one end of which forms a toothed sector, working in a rack attached to the screw rod *p*, the opposite end of the lever *s*, moves over a graduated plate, and indicates the angle or pitch at which the floats are set.

CHAINS FOR MINING.

Job Haines, of Tipton, in the county of Stafford, coal master, and Richard Haines, of the same place, coal merchant, for "*an improved method or methods of making or manufacturing links for the construction of flat chains used for mining and other purposes.*"—Granted February 13; Enrolled August 13, 1844.

This invention for improvements in the construction of flat chains for mining and other purposes, relates not only to the mode of manufacturing of flat chains for the purposes above described, but also to the peculiar form or configuration thereof. The links of these chains which are made from flat bar iron in the manner hereafter described are $4\frac{7}{8}$ inches extreme length, 1 inch wide, and $\frac{1}{2}$ inch thick in the middle, which part is of an oval form; the bosses at each end through which the pins pass being $\frac{5}{8}$ thick, and somewhat elongated, the object of which is to maintain the strength of the link as the holes through which the pins pass, wear by the continued action of the same in the direction of the length of each link, or the chain; we mention the sizes of the links in consequence of the inventor laying claim to the construction of flat chains, of the proportion shown in the drawings of the patent, which may either be increased or diminished according to the strength of chain required. The flat chain as shown consists of three of such links in breadth to form one length or compound link, the adjoining link consisting of two such links placed between the three, and at each side there are two links with flat sides, or half links, which together are equal to one of the links above described. The links thus arranged are fixed together by a pin or bolt $\frac{9}{16}$ diameter, which is passed through them and then rivetted so as to keep the whole firmly together.

That part of the invention which relates to improvements in the manufacture of flat chains, consists in making the links as above described, by rolling flat bar iron in a heated state between rollers having grooves in their peripheries, of the exact form of the links intended to be made, which grooves at intervals in the roller are enlarged so as to form the enlarged part of the links at each end thereof. The links after being rolled are placed between two dies or moulds, and subjected to pressure, which makes the links all of one size. The inventor claims the method or methods of manufacturing links for the construction of flat chains for mining and other purposes; the essential character of such improved method being that the links are all of the same size, and of the form and proportions shown in the drawings of the patent, the same being prepared by rolling bars of heated iron between rollers having grooves in their surface of the form of the links, and also the enlargement or cavities in the aforesaid grooves for forming the ends or enlarged part of the links, together with pressing the links after they have been cut from the bars, between dies or moulds whilst they are in a heated state.

WIRE CHAINS.

WILLIAM LOSH, of Newcastle-upon-Tyne, Esq., for "*improvements in the manufacture of chains for mining and other purposes.*"—Granted February 17; Enrolled August 17, 1844.

Fig. 1. Fig. 4.

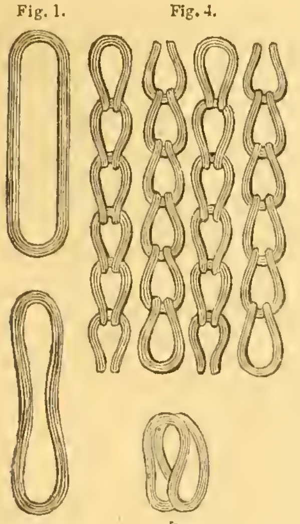


Fig. 2. Fig. 3.

This invention consists in a peculiar mode of constructing chains for mining and other purposes, from wire or elongated metal in the following manner. The inventor takes a piece of wire or elongated metal, and laps it a number of times round the mandril in the form shown at fig. 1, the two ends of the wire are then fastened together by forming them into a loop, or twisting them together. This wire link is then bent in the middle as shown at fig. 2, it is then bent or doubled up so as to bring the two ends together as at fig. 3, the links thus formed may then be passed through one another singly so as to form a continuous chain. It will also be evident (without the aid of a diagram) to those who understand the construction of chains, that each link may be made to pass through two or more links, according to the strength of chain required. In the construction of flat chains for mining purposes, the inventor places a number of chains together as at fig. 4, and binds the whole together transversely by threading wire through the links, or by means of plates, in the same manner as those of ordinary construction, for which he claims the mode of constructing chains of wire or elongated metal in the manner described, which chains are applicable for shipping, mining, and other purposes.

ENDLESS BELTS AND CHAINS.

JOHN KEBBLE, of Glasgow, gentleman, for "*improvements in transmitting power in working machinery where endless belts, chains, or straps are or may be used.*"—Granted February 17; Enrolled August 17, 1844.

It is well known that endless straps or belts of leather have been and are, and we may venture to say, will be employed for transmitting power from the main or driving shafts and from the minor or counter shafts to the various machines, from the willow to the loom, and which material has heretofore been found to be the best suited, and which is not likely to be superseded, at all events by the invention in question, which consists in the application of endless belts of metallic plates, joined together as hereinafter described, that is to say, an endless belt for transmitting rotary motion from one shaft or drum to another, consists of thin plates of steel or brass joined end to end by means of lap joints rivetted together. A second arrangement consists of joining the ends of metal plates so as to form endless bands for the purpose above described, by turning a portion of the plates at the ends round two cylindrical pieces of iron or steel, these pieces being connected at each end by means of flat springs bent in a semicircular form; the tension of these springs determines the strength of the endless belt, and renders the same elastic.

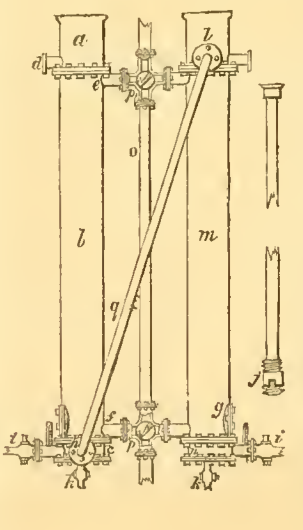
DYEING OF FURS.

ISABELLA LARBALESTIER, of Noble-street, Falcon-square, London, furrier, for "*improvements in making certain skins resemble the sable fur.*"—Granted February 26; Enrolled July 27, 1844.

This invention consists in applying to the surface of the skins called "Hampaster," a colouring composition to give them the appearance of sable fur. The process pursued is as follows, although the patentee has given the proportions of the different materials that she uses, she does not confine herself thereto, so long as the character of the composition be retained. The skins being previously dressed, are first to be covered over with a "killing" or slacked lime, made in the proportion of one pound of lime to a gallon of water; this "killing" is to be put on the hair surface of the skin lightly with a brush, and allowed to remain on for twelve hours, after that it is to be thoroughly beaten off; it is then to have a coat of the colouring composition put on, made of the following materials:—3 lb. of roasted gall nuts, 4 oz. of salammonia, 14 oz. of sumack, 12 oz. of black antimony, 2 oz. of verdigris, 10 oz. of lettirsedge, 4 oz. of copper-dust, 10 oz. of argile, all to be reduced to a fine powder, and gradually mixed smoothly with nine gallons of water. Apply with a brush a coat of this mixture over the surface of the skins, and then allow them to remain for twenty-four hours, laying each two skins together with their hair surfaces touching each other; care being taken that they do not become heated. After remaining twenty-four hours, the skins are to be well beaten, and the process repeated until the skins are made the colour required. They have then to be cleaned, by putting them into a closed cylinder with sand and mahogany sawdust, and giving a rotatory motion to it for about two hours, taking care that the temperature is not less than blood heat; after this process of cleaning, the skins will then be in a fit state for the market.

REFRIGERATOR.

THOMAS MASTERMAN, of the Dolphin Brewery, Broad-street, Ratcliff, in the county of Middlesex, common brewer, for "*a certain method or mechanism for the speedy cooling of liquids, being within certain degrees of temperature; and which method or mechanism he terms a refrigerator.*"—Granted February 24; Enrolled April 1844.—Reported in the 'London Journal.'



An elevation, partly in section of the improved refrigerator, is shown in the annexed figure, *a*, is a cast iron cylinder, termed the "cistern;" it is 18 inches deep, with a flange at its lower end, and a short lateral flanged pipe *d*, of $2\frac{1}{2}$ inches bore. *b*, is a cast iron cylinder, called the "case;" it is 12 feet deep, with a flange at each end, and two short lateral pieces *e*, *f*, of $2\frac{1}{2}$ inches bore; and just above the lower flange, there is a flanged arm-hole *g*, of 6 inches diameter, closed perfectly water-tight by a door, when repairs are not going on. *c*, is another cast iron cylinder, termed the "receiver;" it is 4 inches deep, with a flange at each end, and two short lateral pipes *h*, *i*, of $2\frac{1}{2}$ inches bore: the inner diameter of the cistern, case, and receiver, is $13\frac{1}{2}$ inches.

Between the flange of the cistern and the upper flange of the case, and between the lower flange of the case and the upper flange of the receiver, a circular plate of gun-metal, one inch thick, is interposed; and in each plate 169 holes are drilled. The tops of the holes in the upper plate are countersunk, to receive the conical heads of a series of brass tubes, which pass through the two plates. An enlarged view of one of the tubes is represented at fig. 2; they are 12 ft. 3 in. long, with a bore of ½ in., and as thin as a due regard to proper strength will admit. On the lower end of each tube, a brass collar, one inch long, is soldered, having a screw-thread on its exterior, for the reception of a circular brass nut *j*, over which a leather washer is placed, when the tubes are inserted through the holes in the plates, with their conical heads resting in the countersunk holes: and then, by screwing up the nuts, the tubes are held firmly in their places: the joints are made water-tight by the application of a composition of white and red lead. The receiver *c*, has a cast iron bottom, with a brass cock *k*, for drawing off that part of the cooled liquid which remains in the refrigerator after the operation is concluded, and also for drawing off the water afterwards run into the cistern to cleanse the tubes and receiver.

The parts *l*, *m*, *n*, correspond with the parts *a*, *b*, *c*, excepting that the cistern *l*, has two lateral pipes, instead of one, and the receiver *n*, only one lateral pipe *i*, instead of two. These parts are connected together by a pipe *o*, 2½ inches in bore, with suitable horizontal branches, at the intersections of which a cock *p*, is placed, as shown in section at fig. 1. One of the pipes of the cistern *l*, is connected by a pipe *q*, 2½ inches in bore, with the pipe *h*, of the receiver *c*; the remaining pipe of the cistern *l*, and the pipe *d*, of the cistern *a*, are attached to the feeding-pipes of the liquid to each cistern. The pipes *i*, of the receivers, are furnished with cocks, to regulate the flow of liquid through the tubes, so that it may be discharged from the receiver at the required temperature, which can be ascertained by inserting the bulb of a thermometer through a hole, drilled for that purpose, in each of the discharging pipes *i*, between the receiver and the cock.

When the liquid to be cooled is contained in a shallow cooler, commonly used in breweries and distilleries, the refrigerator is fixed so that the top of its two cisterns is level with, or a few inches higher than, the upper edge of the side of the cooler: thus preventing the cisterns (which are open at the top) from overflowing. Or, where the liquid is contained in a vessel placed higher than the top of the cisterns, then the cisterns may be prevented from overflowing by a float, acting, by a lever, on a cock or valve in each of their feeding-pipes: the discharging-pipes for the liquid remaining as before described. Or these discharging-pipes may be carried upwards until they reach just above the level of the bottom of the cisterns; and, in this case, the flow of liquid through the tubes can be regulated by a cock, placed in each of the feeding-pipes: the mode of operating will in other respects be the same as described below.

The following is the mode of operating, when the spigots of the cocks *p*, are turned into a suitable position for causing the water to flow through the cases successively:—The cocks *k*, in the bottom of the receivers, being closed, a current of cold water is made to flow through the pipe *o*, (entering at the bottom,) and the lower cock *p*, into the case *m*, until it is full; then, passing through the upper cock *p*, and descending through the pipe *o*, it enters the case *b*, and ascends therein until that is also filled; it then flows out through the lateral pipe at the top of the case *b*, into the pipe *o*, again, and is carried away. The current being thus established through both cases, and the feeding-pipe of the cistern *l*, being plugged up, the liquid to be cooled is caused to run in a small stream through the other feeding-pipe into the cistern *a*; it then descends through the tubes in the case *b*, into the receiver *c*, from which it ascends through the pipe *q*, into the cistern *l*, and thence descends through the tubes in the case *m*, into the receiver *n*: thus the two sets of tubes and the pipe *q*, will be full of the liquid. The cock of the feeding-pipe is then opened to its full extent, and the discharging cock of the receiver *n*, is opened more or less, throughout the operation, until the liquid is discharged through it at the required temperature.

When either of the cases *b*, *m*, with their appendages, are used separately, the spigot of the upper cock *p*, is turned into a suitable position for causing the water to be carried away, after it has passed through one of the cases, instead of running down the pipe *o*, to the other case; and the pipe *q*, as well as the feeding-pipe of the cistern which is not to be used, is plugged up.

If both cases are to be used at the same time, but for cooling different liquids, the spigots of the cocks *p*, are turned into such a position as to close that part of the pipe *o*, which is between them, and to divide the current of water, entering at the lower end of the pipe *o*, into two parts; one part flowing into and out of the case *b*, and the other part into and out of the case *m*. The pipe *q*, must be plugged up; the feeding-pipe to each cistern opened; and the discharging-cock attached to each receiver must be used to discharge the liquid therefrom.

The patentee states, that by means of this refrigerator the liquid may be cooled from any degree of temperature below its boiling point to nearly the temperature of the cold water employed in the process. Where a very large quantity of liquid is required to be cooled, it is preferable, instead of immoderately increasing the number and length of the tubes in each case, to connect two or more of the above-described refrigerators by proper feeding and discharging pipes. A cylindrical case, of an inner diameter of 12 inches, will contain 127 tubes, of half-an-inch bore; and where the diameter is 15 inches, the number may be increased to 217.

WATER PROOFING COTTONS.

Charles Townend, of Manchester, fustian manufacturer, for "*an improved process or manufacture, whereby cotton fabrics are aided and made repellent to water and mildew, and any unpleasant smell is prevented in such fabrics.*"—Granted March 6; Enrolled May 6, 1844.

This invention consists of making a solution for rendering "beaverteens" and other cotton fabrics repellent to water and mildew; for this purpose the patentee takes the following proportions for a piece of goods 60 yards long, 27 inches wide, and weight 40 lb.

20 lb. calcined British gum mixed with 8 gallons of cold water until fine and pasty.

10 lb. of palm or white soap dissolved in 8 gallons of boiling water.

Mix the two solutions together, and add one pint of logwood liquor. The whole is then to be boiled together, to which is to be added another solution consisting of 3 lb. rock alum dissolved in one gallon of water. The three mixtures when added together are allowed to boil for a few minutes, when it is ready for use.

In this mixture the fabric is steeped in the usual manner of stiffening cotton fabrics.

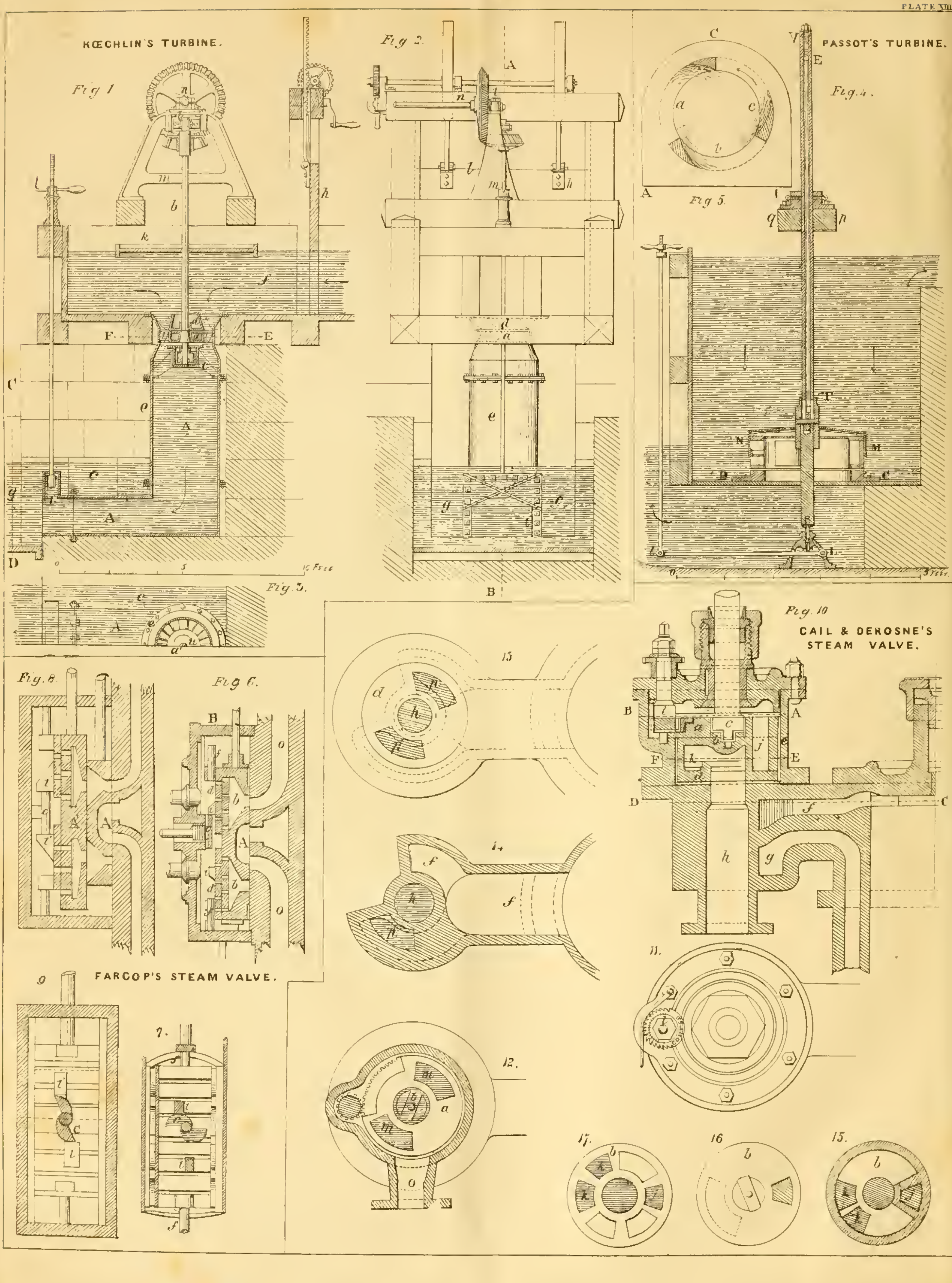
The patentee proposes another method, by first steeping the cloth in a solution of 6 lb. of sulphate of zinc dissolved in 9 gallons of water, and afterwards dipping the cloth in the above mixture of gum and soap, to which is added ¼ of an ounce of pearlash instead of the alum.

EXPOSITION DE L'INDUSTRIE FRANCAISE.

Knowing the earnest desire of the scientific public for information, and the interest which attaches to French ingenuity and mechanical skill, we have availed ourselves of the valuable reports of M. Burat, C.E., to give an account of some of the most remarkable and interesting objects exhibited at the recent Exposition de l'Industrie Française, at Paris. A feature quite novel to us is the number of turbines exhibited, a class of machine, of which, we believe, no specimen exists in England, and of which the only description is a slight sketch by Mr. George Rennie, C. E., who has not, however, introduced any mention of it in his edition of Buchanan's Millwork. In France, however, we suppose that at least a hundred must be now in operation, and they must undoubtedly be successful, or they would not so early have secured the patronage of a class so prejudiced as the French millers. Another subject selected by us for the present occasion, is an improvement on Edwards's Expansion Slide Valve, and we shall continue from time to time to give an account of such other machines as may prove most useful or interesting to our readers.

Hydraulic Machines.

Not the least interesting section of the Exposition was that devoted to hydraulic apparatus. The *rapporteur*, in introducing the subject, say, "Many people imagine that the first cost and fitting up an hydraulic motor are less than those of a steam engine. What has had a great influence in propagating this error has been that the establishment of hydraulic motors generally took place under such unfavourable conditions, and on such a defective system, that the first expense was diminished at the expense of the power of which only a third or fourth was utilized. When, however, we calculate, beyond the purchase of the right of water and the adjoining ground, the construction of dams, head of water, mill race, and wheel well made, we shall find that for an equal amount of power, the fitting up of a steam engine is less expensive. The advantage, however, of hydraulic motors is, that though the cost of establishment may be considerable, the cost of maintenance is next to nothing, and the charge only the interest of the money laid out." It is calculated that the amount of water power utilized in the factories of France is equal to 20,000 h. p., though from the bad construction of the machinery it is supposed to be under estimated, and that the real power of the water is at least double.


KŒCHLIN'S TURBINE.
Fig 1
Fig 2.
Fig 3.
PASSOT'S TURBINE.
Fig. 4.
Fig 5.
Fig. 8.
Fig 6.
FARCOP'S STEAM VALVE.
9
7.
Fig. 10
CAIL & DEROSNE'S STEAM VALVE.
11.
12.
13
14
15.
16
17.
10 Feet
5 Feet

Many endeavours have been made by men of science to improve this state of affairs, and latterly, a great deal of attention has been directed to the turbine. Under the general name of turbine are included water wheels formed on very different principles, and which have nothing in common but the property of all turning on vertical shafts. M. Burdini, Mining Engineer, first imagined and made known, under the name of turbine, machines which received the water in the upper part of a vertical cylinder or drum, and eject it from the lower part; the water is guided by vertical channels in the rim of the drum, which must have a height equal to half the entire height of the available fall of water.

M. Fourneyron has occupied himself a good deal with turbines, and the model of one erected at the Mills of St. Maur, near Paris, was exhibited. In Fourneyron's turbine the drum is always made rather narrow. The water glances obliquely in horizontal jets on the whole contour of an internal vertical cylinder, and penetrates in every direction the compartments of the wheel, which in turning just touches this external cylinder, and follows by passing the curved buckets or chambers inclosed in the horizontal bases, and escapes horizontally from the external rim of the drum.

The construction of turbines suggests the most complicated problems of hydraulics, and theory has not yet afforded the means of solving them *à priori*, practice alone gives any solution at present. The greatest difficulties in the turbine are in the details of execution. The water to produce the maximum effect must enter without shock, and leave without velocity. M. Fourneyron has constructed several turbines, but he has not made known the proportions which he gives to them. From the experiments of M. Savœry, it was established that even with falls so slight as one foot, up to 3, 10, 15 and 25 feet, the disposable work transmitted by the turbine reached from 7 to 8-tenths of the motive power.

Turbines, of all hydraulic wheels, are those which under the smallest volume of water utilize the greatest quantity. The water which propels them does not press on the axis. The high and variable speed which can be given to them, without sacrifice of power, allows the abandonment, in many factories, of a quantity of mill-work and heavy spindles, for the purpose of accelerating the movements. Another property of the turbine, and perhaps the most important, is that of working when it is completely immerged in the stream a fraction of the absolute power at least as great as when working above. This allows, at all times, the whole fall of a stream to be turned to account. From this property, M. Arago has conceived the plan of establishing a complete system of turbines on the Seine, in order to provide for the supply of water to Paris.

M. Fontaine Baron has sent to the Exposition a turbine of 18 h. p., which much resembles that of M. Fourneyron, though differing in some details, and particularly in the direction given to the chambers or buckets. M. Fontaine, who lives at Chartres, has already constructed thirty or forty in that part of France, where the corn trade is a principal one. M. Taffe has frequently applied a register to M. Fontaine's machine, and certified the useful effect to be 79 per cent.

Kœchlin's Turbine.

M. A. Kœchlin also exhibited a turbine patented by him, the construction of which consists of two hollow conical centres surrounded with helical blades *a* and *d*, the upper one *d*, is fixed and serves as a guide for the flow of water on to the blades of the lower one *a*, called the turbine; by the force of the current, the water causes the turbine to revolve, and wit it the vertical shaft on which it is keyed and the bevelled wheels above. Both the fixed and moveables turbine are placed within the mouth of a tube, the orifice of which is contracted in such a manner as to allow the proper quantity of water to pass through, that is due to the velocity arising from the difference of two levels of water above and below the turbine. The advantages of Kœchlin's turbine are, that the turbine may be placed at any point taken in the height of the fall according to circumstances, the inferior column may be prolonged at will. Also, the action of the water acts simultaneously by the pressure of the inferior column, and from this combination the inventor has called his machine the double-acting turbine. This system of construction offers advantages which will be appreciated by those who are aware of the great expense of millwork for foundations.

It is sufficient for these turbines to place below the surface of the lower level the conduit for conveying the descending current, with a regulating sluice at the end, and to fix the stay block which receives the arbour or point of the shaft in the interior of the tube at the most convenient height, taken between the surfaces of the two levels. In this manner, it is always easy instantaneously to run the wheel dry, and so keep it underhand. The turbine is also provided with a sluice for its supply, and when it is required to be put in motion it is opened to give passage to the water, and the receiver is first allowed to be filled completely up to above the turbine, when the discharge sluice is opened and the water allowed to flow out in quantity and relation to that of supply, so that the column within the receiver is always kept to one level.

Reference to the Engravings, *Plate XIII.*

Fig. 1, vertical section of the turbine through A B of fig. 2.

Fig. 2, transverse elevation taken through C D of fig. 1.

Fig. 3, horizontal section through E F of fig. 1.

The same letters are used for the same parts in each of the three figures.

a, water wheel called the turbine; *b*, shaft of the turbine; *c*, block or step supporting the axis *b*; *d*, guide or *fixed turbine*, supplied with helical curves which serve to give to the fluid vein the desired direction; *e*, case of the turbine; *f*, upper channel; *g*, lower channel; *h*, sluice of the canal *f*, to regulate the flow to the turbine; *i*, sluice of the canal *g*; *k*, float; *l*, upper collar of the shaft *b*; *m*, support of the collar *l*; *n*, bevel wheels and shaft of transmission, supported by another collar, which like the former is secured to the support, *m*.

Fig. 1 represents the water of the upper channel *f*, in communication with the lower channel *g*, passing through the guide *d*, the turbine *a*, and the case *e*, which may properly be called the channel of junction. It is by passing through the turbine *a*, that the water impresses on it a rotary movement in the direction indicated by the arrow *a'*, fig. 3, a direction which would be inverse if the guides as well as the vanes of the turbine were inclined in the opposite direction.

Passot's Turbine.

M. Passot also exhibited one of his turbines (see figs. 4, 5 and 6, Plate XIII.), the construction of which is founded upon using reacting wheels, and produced by the effect of centrifugal force. They are composed of cylindrical vessels fixed to vertical arbours, and supplied at the circumference with orifices intended for the introduction or ejection of the water. The modification which M. Passot has introduced into the old reacting wheels, and which he claims as his invention, consists of having suppressed or got rid of the internal partitions and reduced the old wheels to their only true essential elements—a motive cylinder to contain the motive fluid, with surfaces to receive its action, and corresponding orifices for discharge. The surfaces and the orifices are exactly included between two concentric circumferences, that is to say, that he carefully retrenches all other surface or projection capable of impressing the water with the angular movement of the wheel before having reached the parts destined to receive its action, as well as the orifices of discharge. "I form the new wheel." says M. Passot, "simply by placing either in the interior or exterior of a cylindrical drum, according as I want the pressure of the fluid to be exerted on the interior or exterior, curved vanes in the arc of a circle, such as *a*, *b*, *c*, *d*, figs. 1 and 2, then I make orifices of discharge, by removing from these vanes and from the cylinder the part in form of a wedge *a*, *b*, *d*, and the motion is effected by virtue of the pressure on the faces *c d*, *c' d'*, *c'' d''*.

Fig. 1.

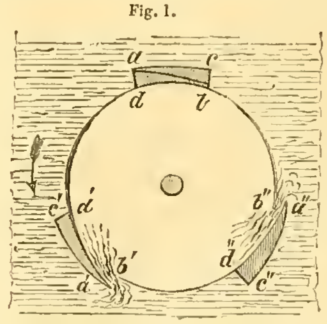
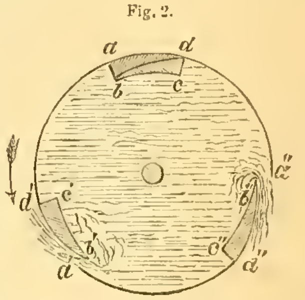


Fig. 2.



"While the machine is very simple, its properties are very remarkable. When the wheel turns without load or work under a given difference of level or fall, its vanes take exactly the theoretical velocity due to the fall. It is no longer the same when in any manner the form of the new wheel is altered so as to approach those formerly known; all partitions, projections, and asperities which are either within or without two concentric circumferences, considerably diminish the theoretic velocity of rotation due to the fall, on account of the continual shock of these bodies in motion against the water in repose. Then it is not surprising if the useful effect of reacting wheels when experimented upon has never risen above 50 per cent., that is to say, about the rate of breast wheels of the usual varieties.

"The expenditure of water in fig. 2, with the internal action is sensibly independent of the greater or less reaction of the wheel. In fig. 1, with external action this cannot take place on account of the counter pressure arising from the formation of an eddy in the interior; but this counter pressure is however much less than might be supposed. I have demonstrated that when a fluid forms an eddy in the interior of a cylinder, the effects of the centrifugal force show themselves differently according to the different inclinations of the projections or orifices made on the circumference.

"In No. 1 the orifices are disposed in the direction in which the centrifugal force can least influence the expenditure of water. Thus the coefficient of theoretical expenditure due to the work, during the experiments on the turbine, which I constructed at Bourges, has been found very little different from that which agrees with the openings of ordinary sluices disposed so as to avoid contraction on three of the sides. The wheel which turned in work, with about half the velocity due to the fall, and the coefficient was 0·70 to 0·79."

Explanation of the engravings of Passot's turbine, *a*, *b*, *c*, fig. 5, plan of the wheel. A, B, C, fixed base of cast iron. M, N, cover acting as a sluice to regulate the expenditure of water. *p*, *q*, block of wood carrying the step of the arbour or shaft. E, V, male and female screw serving to regulate the cover by means of the rod T, *t*, passing through the hollow shaft. L, *l*, lever to raise the whole motive system by means of the pivot.

M. Poncelet adopting an arrangement the reverse of that of M. Fourneyron, has proposed a system of turbines of the nature of the horizontal wheels used in the centre and south of France. The water enters by a spout placed on the outside, stretches the vanes, and is discharged by two openings made towards the centre. M. Cardelhac has constructed at Toulouse turbines on this plan, and Messrs. Mellet and Sarrus, of Lodeve, have exhibited one with the same arrangement. The principal part of their turbines consists in a case of particular form, provided with three openings, of which one is for the water to enter, and the two others to allow it to escape after its action on the wheel. In consequence of the spiral form of this casing, the water arrives on the wheel placed in the interior without any shock, and with a velocity due to half the height of the fall. Each of these veins or streams of water acts at the same distance from the axis, as if it were isolated and independent of the other; its velocity is transformed into pressure by insensible degrees, and without any loss of power. Messrs. Mellet and Sarrus have already put up several of these turbines in the South of France with good results. They come cheap, one for an ordinary grist mill costs 40*l*., one of 12 or 20 horse power, well finished, and of good material, 120*l*.

There was at the exposition another hydraulic machine, which the maker, M. de Lamolere, calls a piston wheel. This machine receives water like a breast wheel. The water brought by means of a plunging fan, falls into a bucket, where it stretches a wooden valve, fitted with leather. It passes through this valve, which is followed by a second also. These successive valves turn horizontal shafts, which then give movement to the factory.

Steam Engines.

It is noticed that the specimens of steam engines exhibited were more remarkable for variations of form than for novelty of principle. We shall proceed to describe them in their natural order, considering first the furnaces.

Heating Apparatus.

M. Arnoux exhibited a furnace for burning the poor coals of the north of France, using a jet of steam of four atmospheres forced through a hole about an ⅛th of an inch in diameter into a passage about two or three inches in diameter, so as to increase the draft in the engine chimney. In the steamers on the Upper Seine M. Cochot has greatly increased the draft of the boiler, and consequently the production of steam in a given time, by means of jets in the chimnies.

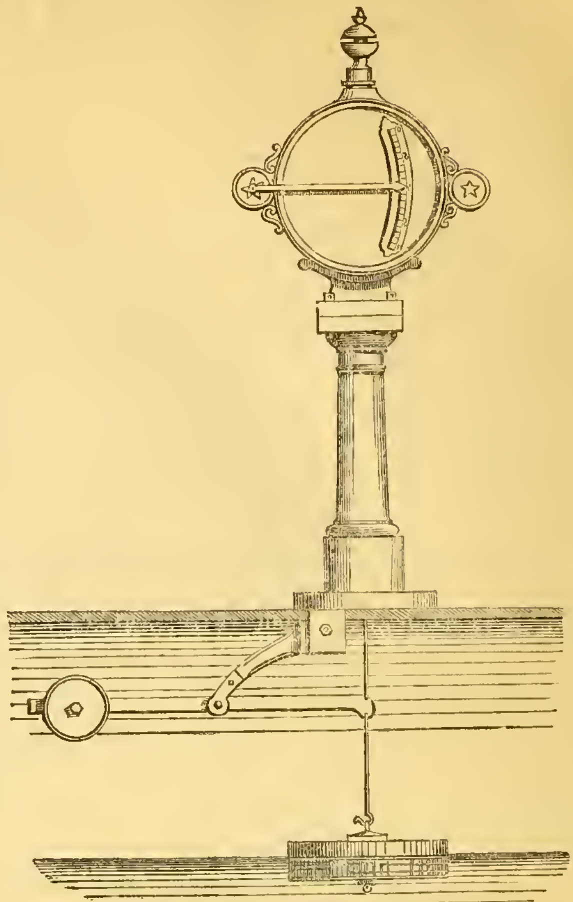
M. Wissoc, C. E., exhibited a hollow bar grating, having, moreover, a double bottom so disposed as to send into the interior of the fireplace all the heat which otherwise would be lost in the ash-pit. Messrs. Galy-Cazalat, Martres, and Montaigut, also exhibited economic gratings, which have been a good deal employed.

M. Sorel exhibited, under the name of slide grate, a contrivance adapted to the fireplaces of boilers, in order to cleanse them instantaneously. This is a kind of iron harrow, which with straight teeth cleanses the grates underneath. To obtain forward, backward, and side movements the apparatus is suspended by means of a lever, and can be moved in any direction. The Minister of Marine has directed this to be tried in the navy.

Boilers and Safety Valves.

M. Durenne exhibited a highly finished locomotive boiler.

A number of safety valves were exhibited to prevent explosions in steam engines. They were generally floating ones, to indicate the quantity of water in the boiler.



M. Bourdon exhibited a water level indicator, of various forms, with an alarm whistle, one of them is shown in the annexed engraving; it consists of a small column mounted on the top of the boiler with a flat circular box of cast iron. In the interior is a lever, to the extremity of which is hooked a wire suspending a float, the other end of this lever is adjusted on a steel spindle, with an index fixed on it externally corresponding with the lever, pointing to a graduated arc to indicate the level of the water within the boiler; on the top of the column is an alarum whistle to notify when the water has become too low for safety. Three indicators of this kind are applied on the great boilers of the steam engine at Marly.

Messrs. Destigny and Langlois exhibited a clock work governor, which also gives the alarm in case of danger by ringing a bell. M. Bernard, of Rouen, had a similar one.

A great number of the usual knick knacks in the way of safety valves were exhibited.

Self-regulating Expansion Slide Valve.

M. Farcot has improved the self-regulating expansion slide valve of Mr. H. H. Edwards (given in our Journal, Vol. VI. p. 49). The principal improvement consists chiefly in using two slides instead of one. This is a description of the plan. The principal means of distribution is the slide valve A, (fig. 6, plate XIII.) on which are placed two slide plates *d d*, pierced with several openings corresponding with other openings made in the back of the valve and communicating with the chambers *b b*. When the openings of the slide plates are put opposite to the openings in the back of the valve the steam enters the steam passages *b b*, and can reach the passages *o o*, which open into the piston when they are uncovered by the alternate movement of the slide valve A. The slide plates *d d*, are carried along with the valve, so long as they are not stopped, either by the guide rods *f f*, which touch the extremity of the steam chamber *b*, or by the brackets *i i*, when they meet the tappet *c*. The length of the guide rods *f f*, is calculated so as to place the openings in the slide plates opposite those in the valve, each time that the latter, in its alternate movement arrives at the end of its course. The tappet *c*, fig. 7, is a double cam which, according to its angular position, catches sooner or later the brackets *i i*, and consequently intercepts sooner or later the communication of the steam passages *b b* with the steam chest and also with the steam cylinder. It is therefore by varying the position of the double cam that the duration of the expansion is varied. In order that the lengths of introduction may be equal on each side of the piston, independently of the obliquity of the cams which transmit its motion, the curves of the two sides of the double cam are not alike, they are made expressly for each side of the piston. When the steam piston is ready to begin its stroke, the valve is at five-tenths or half of its course, and can no longer continue to carry one of the brackets *i i*, of the slide plate *d d*, towards the double cam *c*, than during the latter five-tenths of the stroke, which correspond with the first five-tenths of the stroke of the steam piston.

If then the openings of the steam passages *b b* are not closed at five-tenths of the stroke of the piston, the steam will enter the whole time, and the piston will move without expansion. It is only then in five-tenths, that by means of the slide valve represented in fig. 9, that the expansion can be varied. This latitude is quite enough for the greater number of engines when they are required to be worked to economize fuel.

To vary the expansion during the whole course of the stroke of the piston, it must be also during the whole course of the stroke of the piston that the brackets *i i* move towards the double cam *c*, and consequently the slide valve which carries them. This effect is produced by the arrangement fig. 8, where the expansion is made by two slide valves. The slide valve A′ begins its stroke at the same time as the piston, by means of an eccentric placed at right angles to the eccentric which regulates the first slide valve A, as the slide valve of fig. 6.

The arms of the double cam *c* are so formed as to produce equal introductions on each side of the piston. The two slide plates and the two slide covers with several openings easily allow the steam to pass, which can thus reach the piston at a pressure very near that of generation. They rapidly intercept the passage at the moment when the expansion is required to begin. They allow the expansion to be varied by hand or by the governor during the progress of the engine. The lengths of introduction which they procure are at will equal on each side of the piston, or unequal, if regard is had to the surface lost by the piston rod. In fine, by means of the superimposed slide valves, fig. 7, the two slide plates or the two slide covers can introduce from 0 to 19—20, and if more rapid closings are required than those given by the circular eccentric, it is obtained by means of eccentrics with bosses.

Circular Expansion Valve.

Messrs. Cail and Derosne exhibited a circular steam valve which permits the expansion to be varied in such a manner as to regulate the expenditure of steam proportionally to the resistance. The following are the details in reference to the engraving Plate XIII.

Fig. 10, vertical section of part of the cylinder and of the circular valve. *a*, disc of the valve to regulate the entrance of the steam into the cylinder; *b*, valve; c, vertical rod for turning the valve; *d*, valve seat; *e*, valve box or case; *f*, passage to top of the cylinder; *g*, passage to the bottom of cylinder; *h*, eduction pipe; *j*, steam orifice, and *k*, eduction orifice, both communicating with the passages *f* and *g*; *l*, small axis, having on the lower part a pinion working into a toothed quadrant on the top of disc.

Fig. 11, plan of valve box taken above A B, showing a racket wheel graduated and fitted on to the top of pinion axis *l*.

Fig. 12, section of valve and box taken through A B. *m m*, steam orifices in the disc communicating with similar orifices in the seat; *o*, steam pipe.

Fig. 13, view of the valve seat. *p p′*, steam orifices communicating with the passages *f* and *g*, and the same size as *m m*.

Fig. 14, horizontal section of the valve through C D; and fig. 15, through E F.

Fig. 16, view above the valve; and fig. 17, view below the valve.

MINERALS.—MINERAL SUBSTANCES OTHER THAN METALS.

Building Stones.—France has a great variety of mineral productions, which are variously applied in building. Sometimes it is the dark and dull freestone (*grès*) of St. Etienne, sometimes the freestone of the Vosges, employed in the rebuilding of Strasburg Cathedral, which takes a deep and delicate sinking and retains its arris. This doubtless influenced the elaborate style of sculpture which has been employed upon it. The limestones of the secondary and tertiary formations are also employed. Of the former, are those employed in building Besançon, Nancy, Luneville, Metz, Dijon, Bourges, Poitiers Niort, Rochelle, Bayeux, and Caen, which latter quarries long supplied England, as they do many countries. The monuments of Rouen, Antwerp, &c., are of Caen stone. Chalk, which is easily worked and hardens on exposure to the air, has been successfully used at Orleans, Angers, Tours, Saumur, and Angoulême. The limestones of the tertiary formations, soft enough to be easily wrought, and yet having sufficient resistance for monumental purposes, has contributed to the architectural beauty of Paris, Bordeaux, and Marseilles, three of the greatest cities in France. Plaster stone, or gypsum, is found abundantly. The north of France is supplied from the Paris quarries, the south mainly from the deposits of the Saone and Loire, the Puy de Dôme, Cote d'Or, aad the neighbourhood of Aix and Carcassone. It is used for building purposes and for manure. Lime is everywhere abundant; some of the argillaceous strata near the plane of separation of the formations are particularly well adapted for hydraulic cements. The most famous are those of Pouilly, Metz, the Nivernais, &c. Brick clay is chiefly turned to account in the northern departments.

The volcanic lava of Auvergne furnishes flagstones, the use of which has, however, been abandoned for the footpaths of Paris, on account of their want of strength and homogeneity, and of their consequently irregular wear.

Granite is used for paving and for monuments. The Cherbourg granite is used for curbstones and footpaths. The gray granite blocks of Laber in Brittany have been employed in the pedestal of the Luxor obelisk, as the porphyroid granite of Corsica has in the surbase of the Vendôme column.

Although numerous marble quarries are found in France the difficulty of carriage much restricts their use. The northern quarries of Avesnes supply marbles for the fronts of shops and chimney pieces. The richest and most varied are those of the Pyrenees, used in the Bourse, the Chamber of Deputies, Treasury or Hotel of Finance, Madeleine, the Hotel of the Quai D'Orsay, &c.

Slates are supplied from two quarters, the quarries of Angers, (Maine and Loire,) and those of Fumay, (Ardennes). The former, worked to nearly a hundred yards in depth, supply slates of superior quality, as well with regard to their uniform schistose character as their fine and unchangeable texture. The value quarried annually is calculated at about £80,000.

Firestones are obtained from the Loir and Cher; millstones from la Ferté-sous-Gouarre; grindstones from the Dordogne, the Vosges, and the Marne.

Suitable pottery clays are to be found in many places, at Creil, Montereau, Sarguemines, where the pottery manufacture is carried on. The neighbourhood of Limoges affords kaolin or porcelain earth.

The pyritous clays of the Soissonnais supply alum, copperas, and a residuum for manure.

Bitumen mines are now in considerable demand.

The Paris basin has many resources. It includes among them building limestone and hard gypsum, fine and hard stone for façades, millstones, slabs, flagstones, quartzose sand for glasshouses, brickclay (Auteuil, Vaovres, &c.), pottery clay (Montereau, Creil), &c.

The value of building materials wrought in France annually is estimated approximately at £2,400,000, of this amount £1,600,000 or £2,000,0000 is the regular produce of quarries in constant work. These quarries are 18,000 in number, employing 70,000 men. Of course the quarries most worked are those around the chief towns and most populous departments. Thus at the head of the list figure the department of the Seine and those around it, the Seine and Oise, Seine and Marne, &c.; then the department of the Gironde, supplying Bordeaux; that of Calvados, which includes the limestones of Caen and the granites of Cherbourg; the North, which supplies common marbles; the Puy de Dôme, volcanic lava, &c.

The number of mineral substances exhibited at the exposition was rare, and those principally worked up for ornament.

Marbles.—France is very rich in marbles. The Romans availed themselves of this stone in their monuments at Nimes, Aix, Arles, Orange, Vienne, &c. During the middle ages the quarries were abandoned, and recourse was had to Spain, Italy, and the East. Charlemagne, Francis I., Henry IV., and Lewis XIV., brought into work a part of the strata exploited by the Romans. In the internal decorations of the Louvre and the Tuileries Lewis XIV. greatly availed himself of French marbles. Again neglected, these quarries have in the present century resumed their operations, and more than sixty departments are reckoned up in which are found marbles, varied in colour and beauty, and suitable for all purposes except statuary. This is the only kind wanting. The French sculptors have tried indigenous marbles, but have been obliged to abandon them for those of Carrara and Seravezza. Some ancient statues, however, were made of French marble, as the Venus of Arles, recovered from the Rhone without injury, after a submersion of fifteen hundred years. The marble of St.

Beat, on the banks of the Garonne is the best marble used in French sculpture, but it is objected to as being of a dirty white, particularly subject to deterioration on exposure to the external air, and it can only be used, therefore, for decorations in rooms.[1]

The principal deposits of marble now wrought are those of the High and Low Pyrenees, the High Garonne, the Arriége, the Aude, the Hérault, the Vosges, and Straits of Calais. M. Géruzet, of Bagnères de Bigorre (High Pyrenees), sent the most beautiful and varied marbles this year. The marbles of Aspan, the stalactite marbles, and the campanamarante marbles were those most admired. M. Géruzet has set up on the Adour a marble work, which has 150 saws constantly at work, besides 10 rough saws for cutting out the blocks, 7 lathes, 1 circular saw, a straight moulding frame, 4 machines for making flat slabs, and 1 machine which makes twelve rosettes at the same time. M. Géruzet has obtained all the prizes usually awarded and the Legion of Honour. M. Fraisse, of Perpignan, exhibited various marbles, including white marble very near statuary, and white saccharoid marbles, inlaid with sky blue, veined, yellow, grey, dark brown, and breccia of all colours. A saw mill, moved by water, has been set up by him. M. Philippot, of Perpignan, had works in breccia and dark cherry (Griotte) marble of beautiful colour. Messrs. Tarride and Layerle-Capel of Toulouse sent *grand antique* marble, and Messrs. Belhomme and Ducos of Toulouse statuary marble. Among the marbles of M. Fournier de St. Amand of Villeneuve-sur-Lot were a table and vase in white marble, and a chimney piece of dark cherry marble, and another in lumacelle marble, all worked by the convicts in the county jail. M. Elie Corbier of Anduze (Gard) had some black marbles, as had M. Bernard of Grenoble, and M. Perroncel of Mure (Isère). M. Henry of Laval (Mayenne) had black and veined marbles. This proprietor has, on the Mayenne, a factory where 230 blades are at work. Messrs. Landeau, Noyers & Co. of Sablé (Sarthe) had compact black and veined marbles, wrought by new machinery of their own invention. M. Sappey of Vizille, Isère, sent some white marble tables, and M. Lemesle rough blocks of alabaster. The quantity of marble imported into France is 6,000 tons, valued at £20,000, and coming principally from Tuscany being white statuary marble, and from Belgium being a madreporic grey and white marble, known as St. Anne marble, and used for furniture, slabs in coffee houses, &c. The value of French marble exported is £6,000.

Lithographic Stones.—M. de Lasteyrie was the first to introduce lithography into France from Bavaria, whence also the stone was first exclusively obtained. The Société d' Encouragement, influenced by the increasing use of this article, offered a prize for the discovery of lithographic stone in France, and in 1821 it was given for the quarry found at Bellay in the Ain. In 1833 the supply being insufficient, the Society offered a fresh prize. Three years after several competitors presented themselves for the quarries of Châteauroux, Tanlay (Yonne) and the Ain. In 1837 the prize was awarded to the Châteauroux stones, of which the supply was considerable, and the price 30 per cent. below that of the Bavarian, and the quality much superior. Stones from Solenhofen, near Pappenheim, in Bavaria, are still imported, being preferred as free from spots, cracks and other defects often found in those of French origin. Two hundred tons of these stones are imported annually. Messrs. Auguste and Paul Dupont of Châteauroux, were at the head of the exhibitors this year. They have set up a factory of 50 horse power. Several proprietors of the department of the Gard sent for the first time.

Slates.—Anjou supplies some of the best roofing slate to the annual value of £80,000, also Britanny, the Ardennes, Corrèze, Lower Seine and Dauphiny. Those of Angers are considered the best, because they are very fine, very hard, little acted on by the air, and are in thin and light layers. The Rimogne Slate Company (Ardennes) employs a steam engine, three hydraulic machines, and 300 workmen, and produces annually 27 millions of slates. The slates are worked by M. Moreau's machine.

Millstones.—The best millstones are from the silicious beds around La Ferté-sous-Jouarre in the Seine and Oise. Their reputation is so great that the English and Americo-English send agents every year to La Ferté to purchase. The adoption of the English mode of grinding corn has much modified the exploitations of millstones. M. Gueuvin, Bouchin and Co. are large manufacturers—they employ between 400 and 500 men, and produce annually 700 millstones, and about 100,000 pieces of stone for making millstones. Their stones are wrought by machinery. Naylies and Co. supply French millstones, English millstones, and small millstones. Several machines for the manufacture of millstones and their putting up were in the Exposition.

Here may be mentioned the manufacture of agate burnishers, polishers, &c., for the use of gilders, binders, &c. These articles were formerly derived derived from Germany.

Artificial millstones of silex and flat emery stones for cutlers, polishers, &c., were exhibited by Messrs. Perrot and Malec, of Paris.

[1] For an explanation of marbles see the Dictionary of Marbles given in this Journal, vol. ii. p. 452.

A COMPENSATING PENDULUM.

At a meeting of the Société Philomatique, M. Egger, Professor of Greek Literature in the Faculty of Arts, communicated a method of constructing compensating pendulums, in which the two metals employed are connected by joints, and which have, in consequence, the advantage of being entirely free from all want of homogeneousness, arising from soldering. This method is founded upon the following principle:—Let a, be the hypoteneuse of a right angled triangle, and b, one of the sides adjacent to the right angle. If these two lines are represented materially by metallic rods of different kinds, the third side h, will retain a constant length, provided the lengths of a and b, and their respective coefficients δ, and δ^1, satisfy the following conditions:—

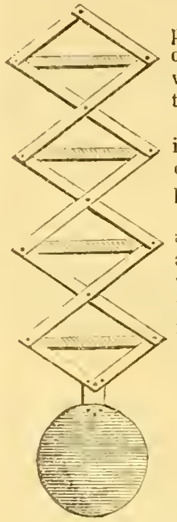
$$a^2 - b^2 = a^2 (1 + \delta)^2 - b^2 (1 + \delta^1)^2,$$

whence, in neglecting the very small fractions of the second order,

$$a^2 \delta - b^2 \delta^1 = 0, \text{ or } a : b :: \sqrt{\delta^1} : \sqrt{\delta}.$$

If, for example, the hypotenuse a, is of iron, and the side b, of brass, we shall have $\delta^1 : \delta :: 19 : 12$, very nearly, whence

$$a : b :: \sqrt{19} : \sqrt{12} :: 5 : 4, \text{ very nearly.}$$



Thus we shall obtain a sufficiently perfect compensation by a hypotenuse of iron = 5, and one side of brass = 4, whence it follows that the other side will be represented by 3, which we will assume as the height.

Nothing is more easy to construct than this figure; it is the celebrated triangle with which Pythagoras discovered the proposition of the square of the hypotenuse.

To apply it, suppose we place together four triangles, so as to form a lozenge, of which the sides are iron, and = 5, while one diagonal of brass = 8: the second diagonal, (the matter of which is of no importance,) will = 6, whatever may be the temperature. Now let us imagine a series of these lozenges arranged together firmly, one above the other in the same vertical plane; and to this effect, suppose iron bars the length of each = 5, first united two by two, in the form of a cross, and joined by their middles, then let the different couples be united and joined together by their ends, so that all the centres shall be in the same vertical line; and let the adjoining couples be separated from each other by horizontal brass bars each = 4. The total height of this system will remain constant, and equal to 3, multiplied by the number of lozenges: this height will be the length of the pendulum.—*L'Institut.*

An Analysis of Gothic Architecture. By Raphael and J. Arthur Brandon, Architects. London: Richardson. Parts 1 and 2.

The object of the Messrs. Brandon in this attempt is to present a really practical work to the profession, composed of examples of good authority, illustrated by original designs from actual measurements. It is intended at the same time to be comprehensive and cheap, and will include about 120 plates, which from what we have already seen, will contain upwards of six hundred subjects and details. It is to comprise windows, doorways, porches, buttresses, pinnacles, parapets, gables, piers, arches, capitals, bases and church furniture. In every case the details are amply and copiously given, the centres of the tracery, and a scale. We observe that in the numbers before us, which include many examples in the Norman, decorated and perpendicular styles, that instead of being confined to cathedrals and collegiate churches, advantage has been taken of the parish churches in the country, often little known and perhaps not generally accessible, but which frequently afford valuable lessons. Thus in the ten plates, we find the names of the churches of Orpington, Sutton at Hone, and Northfleet, in Kent, Chesham Bois, and Chenies, Bucks, St. Alban's Abbey, St. Michael's, Herts; Waltham Abbey, Essex; Basingstoke and King's Worthy and Nateley, Hampshire. In each case we find plans and ample sections of the mouldings, and generally every information which can be useful or acceptable to the practical architect or enlightened amateur.

THE NEW PALACE AT WESTMINSTER.

MR. BARRY'S *Report respecting the Localities in the New Houses of Parliament which may be adapted for the reception of Works in Sculpture.*

In the Report which I made to the Commission in February 1843, (See Journal, Vol. VI. 1843, p. 173,) I made mention of all those portions of the interior of the New Palace where, in my judgment, painting and sculpture could, with propriety and effect, be united with the architecture of the building; and, having reconsidered the subject, I am still of opinion that the union of the three sister arts could not be satisfactorily carried to a greater extent within the building than I then expressed. I may, however, mention that, in addition to the statues of royal and military personages, which I recommended to be placed in the niches forming part of the architectural decoration of the several halls, those of eminent men of this country who have at various periods distinguished themselves in the advancement of art, science, and literature, but whose services have not hitherto been specially recorded by any public acknowledgment, might form part of the series.

The following is an enumeration of the niches provided for such purposes in the several parts of the building:—In Westminster Hall, 12; in the Victoria Gallery, 106; in the Queen's Porch, 4; in the House of Lords, 18; in St. Stephen's Hall, 12; in the Central Hall, 68; making altogether 220 niches, averaging seven feet in height. Those in the Victoria Gallery, Queen's Porch, and House of Lords, might be of bronze gilt, but in order to avoid false lights and effects, the gilding should be matted or unburnished. In the other parts of the building above adverted to, the statutes might be of coloured marbles, in harmony with the prevailing tone and colour of the architectaral decorations.

With respect to monuments which may hereafter be decreed by Parliament to be erected at the public expense, to the memory of not only those eminent men who have distinguished themselves in the civil and military services of their country, but also of those who have promoted its honour and advantage in the cultivation and advancement of art, science, and literature, no building can, in my opinion, with greater propriety or effect, be appropriated for their reception than the Palace of the Legislature, whose site is hallowed by the most interesting historical recollections connected with it from the most remote periods. Such monuments might be arranged with considerable effect, both within the building, as well as in the New Quadrangle, which I have already suggested as an addition to it, on the site of the New Palace Yard; and in order that due importance and effect may be given to them, they should not, in my opinion, be confined by, or form part of, the architectural arrangement of the design of the interior; but should be wholly detached from the walls, and be restricted either to the statues of the men they are designed to commemorate, or simply to mural monuments and tablets, with likenesses of the deceased in the form of busts or medallions, with suitable inscriptions; but all allegory, and its absurdities, should be carefully avoided.

Within the building, the monuments should be exclusively confined to *statues*, which might be so arranged in the respective halls, as to accord with the degree of eminence of the men they are designed to commemorate; the Central or Octagon Hall being reserved for the most eminent.

In the Quadrangle, statues might be placed in front of the buttresses of the building on each of its four sides, and mural monuments and tablets placed under an arcade to be formed on two of its sides. Monuments thus placed, although in the open air and constantly open to the public, might, from being within the precincts of the palace, be placed under such a constant and efficient supervision, as would preserve them from defacement or injury. In order to avoid discordancy, and a want of proper degree of symmetry in the statues generally, I would propose, that they should all be of the heroic size; that their pedestals should be of the same height and nearly of the same bulk; that monumental simplicity and breadth of treatment should be prescribed for the statue; and that all the pedestals should be designed upon the same general principles, as to composition and style: but with a view of avoiding a monotonous repetition, they should be varied in design according to the taste of the artist, and be enriched with historical bas-reliefs, illustrating any important events that it might be deemed expedient to record in the life of the individual in whose honour the monument is erected. The statues should invariably be of bronze, on account of the imperishable nature of that material; those on the exterior of the building might be left of the natural colour of the metal, but in the interior, where the light will be much subdued, I would recommend that they should be coated with matted or unburnished gold, as being best calculated to render the statue most effective, and allow of its being seen to the greatest advantage. The pedestals might be of Purbeck marble, or of some other limestone of equal hardness and depth of colour; and those in the interior of the building should be polished. The sculpture upon the pedestals might be executed either in the stone of which they are made, or in tablets of bronze securely fixed to the stone-work, which should be gilt or left of its natural colour as suggested for the statues, according to the situation of the monument, whether placed internally or externally.

The principle which I would adopt for the location of the monuments generally, is that of confining them to such portions of the building only as might at all times, without inconvenience, be open to the public, under proper and efficient control, and such regulations as might be deemed expedient. This principle, and the amount of accommodation that could be provided for public monuments, as well as their arrangement, is illustrated in the accompanying plan; by which it appears that Westminster Hall might contain 58 statues; St. Stephen's Hall, 16; the Central or Octagon Hall, 24; the Corridors leading to the Houses of Lords and Commons, 20; and the Public Corridors and Waiting Rooms connected with the Committee Rooms, 69; making in all, accommodation for 187 statues.

The Crypt of St. Stephen's Chapel, which is proposed to be restored, and to which convenient access will be made from Westminster Hall, would also afford accommodation for about 11 monuments.

The Cloister of the Chapel, which is also to be restored, and will be connected with the Hall and the Crypt, might afford accommodation for 13 statues, placed externally; and a surface of wall for mural monuments and tablets, under cover, 330 feet in length, and 20 feet in height. The accommodation in the proposed Quadrangle on the site of New Palace Yard, would be for 56 statues; and for mural monuments and tablets, under cover, a surface of wall 369 feet in length, and 16 feet in height.

Thus the entire number of public monuments that the building and its quadrangles could accommodate would be, in isolated monuments or statues, 270; and in mural monuments and tablets, about 400; or in the whole, 670 monuments of all kinds. In Westminster Abbey, the number of monuments of all kinds, forming a collection commenced (with a few exceptions) from the end of the thirteenth century, amounts to 357; of which 63 are table and other monuments, with figures in a recumbent or devotional attitude; 15 are isolated statues in an erect position; 98 are mural monuments, with sculpture for the most part allegorical; 122 are tablets with inscriptions only; 20 are busts; 8 are brasses let into the pavement; and 31 consist of table monuments, slabs, and stones, with sculpture either decomposed or defaced to such an extent as to be nearly obliterated. A very few of these monuments have been erected at the public expense.

In St. Paul's Cathedral, the number of monuments, being a collection of the last fifty years, amounts to 43; of which, 14 are isolated statues of the men they are designed to commemorate; 5 are historical reliefs; 3 are partly historical and partly allegorical; and 21 consist wholly of allegory. Of this number, those which have been erected at the public expense amount to 36. From the above statement of the existing monuments in St. Paul's Cathedral and in Westminster Abbey, it may safely be inferred, that the accommodation afforded by the New Palace of Westminster, for public monuments alone, would suffice for ages to come: and if the feeling which now very generally prevails in favour of the exclusion of all monuments from places set apart for divine worship, which, from their character, are not calculated to excite in the mind of the beholder emotions of piety and devotion, (in which number would be included, above 200 in Westminster Abbey, and with two exceptions, the entire collection at St. Paul's Cathedral,) should ultimately lead to their removal, the New Palace of Westminster might afford accommodation for those of a public character, either in the open arcades, or in galleries to be provided above them in the proposed additional quadrangle, on the site of the New Palace Yard. But whether this removal and transfer of monuments should or should not ultimately take place, it might perhaps be worthy the consideration of Parliament, whether it would not be advisable, both for the sake of encouraging Art, and evincing a renewed and grateful remembrance of services rendered to their country, to order statues to be erected in the New Palace of Westminster, at the public expense, to the memory of a certain number of the most eminent of its public characters and benefactors of bygone times, in order that a collection of monuments, to the memory of all whom the country delights to honour, may be at once commenced, and be ever after maintained and increased within the walls of one and the same public edifice.

Extract from the Report of the Committee appointed to examine the Localities in the New Houses of Parliament which may be adapted for the Reception of Works in Painting and Sculpture.

Your Committee, to whom was referred the duty of conferring with the architect, and examining the plans of the approaches and halls connected with the New Houses of Parliament, and of reporting to the Commission their opinion as to those localities which might be most advantageously selected with reference to position, space and means of lighting, for the reception of works of art in painting and sculpture respectively; and, further, of reporting, as the progress of decoration must necessarily be gradual, in what order of succession the localities above referred to should be selected for the purpose, and what particular mode of decoration would be best suited to each:

Have the honour to report that they have conferred with the architect, and have examined the plans and actual state of the edifice intended for the accommodation of the Houses of Parliament, with a view to the objects of the inquiry committed to them, and thereupon have to submit the following statement:—

The Landing Hall of the Royal Staircase will be 32½ feet by 30 feet, and the height to the point of the groining 23 feet 6 inches. It will be lighted by two windows on the north side of the hall, 11 feet 6 in. high, by 6 feet 4 in. wide, and 8 feet 6 in. from the floor. There will be three panels for painting (ending in pointed arches) on the east, west, and north sides, 4 feet from the floor, 11 feet wide, and 18 feet 3 in. high to the point of the arch.

The Guard-room will be 38 feet square, and 30 feet high. It will be lighted by four windows on the south side, 15 feet 6 in. high and 4 feet wide, and 3 feet 3 in. from the floor. There will be panels or margins round doors on the north, east, and west sides. The height of the margin (on each side to the top of the door) will be 12 feet by 2 feet 10 in., and the upper horizontal portion will be 15 feet long by 2 feet 10 inches. There will be six doors so surrounded with panels and six sets of margins. There will be also eight lunettes (above the horizontal margins, and above the windows), with pointed heads, 14 feet 8 in. wide by 8 feet high to the point of the arch.

The Robing-room will be 38 feet by 33, and 23 feet high, the ceiling being flat. It will be lighted by four windows on the south side, the same size and height from the floor as in the Guard-room. The throne, to be placed opposite two doors from the Guard-room, will be 7 feet wide. There will be seven panels 8 feet from the floor; the height of all will be 10 feet 6 in.; the several widths will be as follows:—Of three on the west side, one will be 9 feet wide, and two will be 4 feet wide. Two on the east side will be 14 feet wide. Two on the north side will be 10 feet wide. If a cove, first proposed, where the walls and ceiling meet, were done away with, a frieze 3 feet high, extending round the whole circuit of the room, might be painted or adorned with bas-reliefs.

The Victoria Gallery will be 130 feet long, 45 feet wide, and 48 feet high. It will be lighted by windows on the east and west sides, eight on each side. They will be 19 feet high and 10 feet wide, and 23 feet from the floor. There will be seventeen panels for pictures, all 10 feet high. Thirteen will be 12 feet wide, and four at the ends will be 9 feet 6 in. wide. They will be 8 feet from the floor.

The buttresses, or piers, in the Victoria Gallery are angular, presenting two faces, with niches in each, so that statues placed in them would be almost turned back to back. Before the angles of the piers insulated statues might be placed. The base of the statues in the niches would be 8 feet from the ground. The utmost width of the niches in the Victoria Gallery will be 22 inches, consequently, statues placed in them should be strictly architectonic.

If insulated statues should be introduced in front of the piers they might be more freely treated, and might, if required, be about 8 feet high; the architect thinks that they should be at a height of not less than 5 feet from the floor.

At the north end of the Victoria Gallery, on the east and west sides, will be two lobbies. There will be one panel in each 7 ft. 6 in. wide by 12 feet high to the point of the arch. There will also be two lunettes in each, with pointed heads, 7 ft. 6 in. wide by 5 feet high (to the point), and 11 feet from the floor. These panels and lunettes will be lighted from the gallery.

In the House of Lords there will be 18 niches 7 feet high. 12 windows proposed to be ornamented with stained glass, and carved work for the throne, and for one large and two small doors.

The width of the niches (about 2 feet only) being inconsiderable in proportion to their height, as usual in Gothic buildings, your committee are of opinion that statues placed in them should be strictly architectonic in their style and treatment.

There will be three panels at each end, with pointed heads, 9 feet wide, and 15 feet high to the point; they will be 26 feet from the floor. These panels the architect now thinks might be filled with paintings, and as the windows are proposed to be ornamented with stained glass, he is of opinion, that the luminous and unshining surface of fresco would be best adapted.

In the Central Hall there will be 68 niches for statues, and, if required, 24 insulated statues on pedestals.

The Corridor, leading from the Central Hall to the House of Lords, will be 15 ft. 9 in. wide, and 21 feet high. It will be lighted by windows, east and west, 12 ft. 6 in. from the floor. There will be eight panels for painting 9 ft. 4 in. wide by 7 feet high, they will be 4 ft. 3 in. from the floor. There may be 10 insulated statues on pedestals.

The Corridor, leading from the Central Hall to the House of Commons, is similar in all respects.

Of the Waiting Halls (one on the same floor as the Central Hall, &c., the other on the floor above), the upper will be 33 feet square, and 22 feet high. It will be lighted by four windows, on the north and west sides, 14 ft. 6 in. from the floor. There will be eight panels for pictures (two on each side) 8 feet high, and 5 ft. 7 in. wide. They will be 4 feet from the floor.

The dimensions of the lower Waiting Hall are 33 feet square, and 22 feet high. It will not contain any panels for pictures. Beyond the lower Waiting Hall a surface, at present occupied by decorative sculpture, might afford a good panel for painting.

N.B. The Waiting Halls and Corridors above mentioned will be always open to the public.

St. Stephen's Hall will be 92 feet long, and 55 feet high. It will be lighted by 10 windows, on the north and south sides, 25 feet high, 11 feet wide, and 22 feet from the floor. There will be five spaces for pictures, on each side, 15 feet wide, 12 feet high, and 8 ft. 9 in. from the floor. There will be one panel, with pointed head, at each end of the Hall, for painting, 16 feet high, 10 feet wide, and 29 feet from the floor.

The Conference Hall, in the centre of the river front, on the principal floor, will be 53 feet long, 27 feet 6 in. wide, and 20 feet high. It will be lighted on the east side by three windows 16 feet high, 6 feet 4 in. wide, and 3 feet from the floor. There will be a space for painting on the west side 53 feet long by 10 feet high, and 7 feet 6 in. from the floor; and space for painting, on the north and south sides, 27 feet 6 in. long, 10 feet high, and 7 feet 6 in. from the floor. There will be four spaces for pictures on the east side 10 feet high, two being 10 feet wide, and two 4 feet wide, and 7 feet 6 in. from the floor.

The smaller corridors generally will be 10 feet wide. The panels for painting will be 4 feet 6 inches from the ground. The height of the panels will be 6 feet; the length may be of considerable extent. At the ends of such corridors, above doors, there will be several panels for painting or sculpture 7 feet 6 in. wide by 5 feet 6 in. high. They will be lighted from the side windows.

From the limited distance from which the spectator can see paintings in the smaller corridors, your Committee are of opinion that the spaces are not adapted for important decorations.

The architect has stated, that considerable extent of surface may be appropriated for painting in the Committee-rooms on the river front, which are very numerous, and when unoccupied, might be open for the admission of the public daily. They are of various, but all of large, dimensions; they are not less than 20 feet high, and are lighted from the east by either two or three windows of ample dimensions.

Your Committee are of opinion that these rooms, being subordinate parts of the building, cannot, with propriety, be employed for the reception of works in the higher departments of art.

The same observation is applicable to the refreshment-rooms, which might possibly be ornamented in an appropriate manner.

In inspecting the present state of the building your Committee remarked, that the architect has taken the precaution, recommended by the Commission, (17th March, 1843,) of interposing a layer of asphalte on the horizontal surface of the walls, between the ground floor and the superstructure, with a view to intercept the ascent of damp. Your Committee also observed, that in order to protect the back of paintings from damp, the architect has sunk the panels, intended for the reception of paintings, several inches in the wall, so as to allow of the introduction of a hydrofuge cement, as a ground-work for the preparation on which the pictures are to executed.

Your Committee cannot but acknowledge that they have experienced some disappointment at finding the extent of surface available for painting in fit situations not so great as they could have hoped. In the best situation, the Victoria Gallery, the panels are only 12 feet by 10, the width of the Gallery being 45 feet. As figures would require to be larger than nature to produce a due effect, even from a lesser distance, it follows that a space of 12 feet is not adapted for any extensive composition.

In St. Stephen's Hall the spaces for painting being 15 feet long, and the width of the Gallery 30 feet, the objection is less strong; but it may be remarked, that at a distance of 30 feet, the eye can conveniently embrace a painting 20 feet long.

The design of St. Stephen's Porch, and the adjacent portions of the building, are not sufficiently matured to enable Mr. Barry to say whether any spaces will be available for paintings in those situations.

Extract from the Report of the Committee appointed to inspect the Works of Decorative Art exhibited in King-street, St. James's, in April and May, 1844.

Your Committee have examined the specimens of Arabesque-painting, of Mosaic, of Marquetry, and of Casting in Brass and Iron, which have been sent in by persons desirous of being employed in the embellishment of the Houses of Parliament.

They have recorded their judgment on the comparative merit of many of the works in question: but for the reasons specified in the Report of this Committee on the specimens of Carved Wood and Painted Glass, they have thought it expedient in general to enumerate the names only, without further distinction, of the exhibitors whose works have received the commendation of the Committee.

In the department of Arabesque-painting the artists so noticed in the detailed Report of the Committee are Mr. Collmann, Mr. Goodison, and Messrs. F. and J. Crace.

In the department of Mosaic Pavements the exhibitors so noticed in the detailed Report of the Committee are Messrs. Singer and Co. Messrs. Minton and Co., Mr. Milnes, and Messrs. Chamberlain and Co.; and in Marquetry, Messrs. Austin and Rammell.

In the department of Ornamental Metal -work the exhibitors so noticed in the detailed Report of the Committee are Messrs. Messenger and Sons, Messrs. Bramah and Co., and Mr. Abbott.

Among the Decorative Painters, Mr. Johnson did not comply with the terms announced in the notice put forth by the Commission, and his name has, therefore, not been inserted in the foregoing list; it is, however, the opinion of the Committee that the specimens which he has sent evince considerable taste and ability.

Mahon.	B. Hawes, Jun.
Colborne.	George Vivian.
T. B. Macaulay.	Thomas Wyse.

Whitehall, May 17, 1844.

The Commissioners, having had reason to suppose that some of the persons who have exhibited works of decorative art may have employed other hands, or even the assistance of foreigners, in the execution of such works, have resolved that those persons who may be selected for employment in those branches of decoration shall, if the Commissioners think fit, be required to produce specimens of their art, to be completed under such conditions as the Commissioners may think necessary.

PUBLIC WORKS AT AND NEAR LIVERPOOL.

Probably there are no places in the kingdom, not even excepting the metropolis, where a larger amount of money is in process of expenditure in the construction of public works than there is at this moment in Liverpool and Birkenhead. Almost in every direction on both banks of the Mersey huge preparations meet the eye; and, without entering into details, which would necessarily occupy much space, some idea of their extent may be gathered from an outline of the expenditure. In some of the following items the estimates include the cost of land. In Liverpool there are the following works now in progress:—Assize Courts (corporation), cost 80,000*l.*; New Gaol (corporation), cost 100,000*l.*; Albert Dock and Warehouses (dock committee), 600,000*l.*; New North Dock Works, including land and junction with Leeds Canal (dock committee), 1,500,000*l.*; reservoirs, Green-lane, and corresponding works (highway commissioners), 50,000*l.*; Industrial Schools at Kirkdale (select vestry), 30,000*l.*; Gas Extension (New Gas Company), 140,000*l.*; Shaw-street Park (private shareholders), 2,500*l.*; making a gross total of 2,500,000*l.* All this is, of course, independent of many other works, some in progress and others in contemplation, with prospects of almost immediate commencement. Amongst those in progress may be reckoned Prince's Park, now forming by Mr. Richard Vaughan Yates, at the south end of the town; the New Presbyterian Church in Myrtle-street; the Female Orphan Asylum, the Catholic Female Orphan Asylum; the New Northern Hospital (towards which Mr. W. Brown recently contributed 1,000*l.*); St. Martin's Schools, the Catholic Magdalen Asylum at Much Woolton, and St. Mary's Catholic Church, in Edmund Street. Besides other works in contemplation, we may mention the Daily Courts, on the site of Islington market (now discontinued); the intended additional railway tunnel to the north end of the town, by the Liverpool and Manchester Railway Company; an additional merchandize station for the Grand Junction Railway Company; the enlargement of the Lime-street terminus; and some improvements on the Bridgewater property. These various works altogether will probably absorb not less than another million. So that, in the whole, between three and four millions of money will have to be raised and expended before the various present designs for the promotion of charity, the convenience of commerce, and the improvement of the town, are completed. But, if much is going on in Liverpool in this way, more, in proportion to population and means, is doing on the Cheshire side of the water, at Birkenhead. Here indeed a town is rapidly rising, which will not be excelled in useful or ornamental elements by any place in the kingdom; and the progress of which, in buildings, as well as inhabitants, during the last four or five years, has been unprecedented. The magnitude of the public works in progress at Birkenhead may be inferred from the following abstract, which is taken from the estimates:—New Market (Commissioners), 20,000*l.*; Town-hall (Commissioners), 10,000*l.*; Park (Commissioners), 25,000*l.*; Docks in Wallasea Pool (Commissioners, as trustees), 400,000*l.*; Dock Warehouses on the margin of Wallasea Pool (private company), 600,000*l*; Tunnel from Monk's Ferry to Grange-lane (Chester and Birkenhead Railway), 20,000*l.*; making a gross total of 1,075,000*l.*; and, further, a proposal has been made, which is now under the consideration of the Finance Committee of the Liverpool Corporation, to buy the freehold of all their Wallasea estate, and pay for it in ready money! Besides the works named as being in progress, a cemetery and infirmary are contemplated, to which may be added a design for the erection of one or more churches. On the two former we believe it is intended to expend about 15,000*l.* In these items we have said nothing about the sums being expended in sewerage and laying mains for water and gas; they are very large, and in this present year they will exceed any of the past. After these statements, it will be admitted, we think, that there are very few, if any, places where the progression in works of a public nature is greater than in Liverpool and Birkenhead; and that, if there is any rivalry between them, it should only be as to which shall best accommodate the public.—*Manchester Guardian.*

MISCELLANEA.

Two Rudders.—We have for some time noticed and much admired the two new iron steam-vessels built by Mr. John Laird, of Birkenhead, and now plying with passengers between Liverpool and Woodside. The "Queen" and the "Prince" are each about 110 feet in length, 22 feet beam, and have engines of 60 h. p. They are of handsome model, and sit on the water on an even keel; each end, when they are stationary, represents a fine bow with a sharp projecting cutwater—a portion of which, within the outer edge is a moveable door that may be instantly loosened to act as a rudder, or firmly fixed (when that end becomes the bow) by means of a dropping bolt, so as to complete and make good, even to a nicety of joint, the thin after portion of the cutwater. The great advantage over all previous plans of two rudders, and we believe only one or two single boats have been built with two rudders (in which each rudder was left naked and unprotected), is that the outer edge of each bow-formed extremity, or cutwater, is of standard iron, sufficiently strong to avert the consequence to the rudder, of the cable getting athwart hause, of a bump, or running foul of any floating object, a pier or the like—which was generally fatal to the rudder in the former plans,—and at the same time not so thick as to act to any conceivable extent as a stop-water when that end becomes the stern, and it stands abaft the rudder like a stancheon or outer stern-post. In the old plans the rudder, which became the cutwater, was liable to be carried away on a slight concussion with any object, or even by the sea through which it was forced. In the present plan the outer-standing part of the cutwater evidently not only protects it from the first of these casualties, but ploughs a way for it, so that it is less liable to be thrust from side to side, or carried away in a sea-way, a danger which is, of course, increased by the velocity of the ship. Mr. Laird, therefore, very appropriately denominates this main feature of his invention (for which he has taken out a patent) "a guard."—'Liverpool Standard.'

The New Building Act has at last passed into a law, as we have already occupied many pages of our Journal on the subject, during its progress through parliament this and last year, we must refer our readers, who may be desirous of understanding the nature of the act, to the act itself; it is far too long for us now to attempt an abstract.

The Royal Exchange and the City.—The Royal Exchange is gradually getting out of the hands of the workmen. The sculpture has been placed in the portico, and the figure of Commerce in the centre of the relief is bold and striking, though the other figures are rather ambiguous. The motto on the base of the statue of Commerce is appropriate, "The earth is the Lord's and the fullness thereof;" but on the frieze the barbarism has been allowed of placing a Latin inscription recording the foundation of the original building in the time of Elizabeth, and its reconstruction in the reign of her present Majesty. The coats of arms, boldly sculptured, are also placed in their respective positions. The encaustic painting, by Prince Albert's German minion, Herr Sang, is advanced, and the shops are being fitted. The pavement is said to be better laid with regard to effect than has been the practice of late years. The Mercers' Company, part proprietors of the Royal Exchange, have at last thought of having their own hall put in a respectable condition, and the chambers and gateways in front of Merchant Tailors' Hall promise another improvement in the neighbourhood of the Exchange. The Gresham Club begins to show itself, and preparations for placing the King William statue are in a forward state.

A Terra-Cotta Church.—Near Bolton-le-Moors a beautiful church has recently been built, entirely of terra-cotta—burnt clay—inside, outside, tower, and basement, all of the same materials. A correspondent says—"The church is situated about a mile from Bolton, near the Haugh (called the Huff). It is built of a kind of fine clay, found near the spot, between the beds of coal, in Mrs. Fletcher's mines; it is subjected to a great pressure, and then burnt. The colour is rather good—a kind of tawny. The situation, too, is very pretty. The architecture (by Sharp, of Lancaster) is very florid Gothic—too much so, perhaps, for the form of the arches, which cannot be of a much later date than Edward III.; but I speak doubtingly. The interior is enormously decorated—the roof of dark stained oak; the floor is of tile, inlaid with numbers of crosses; the steps of the communion encaustic tile; and all other matters to match. The seats are open, not formed into pews. The building, which, I believe, is not yet dedicated, forms a lovely object in the landscape."—'Liverpool Mercury.'

The Admiralty have issued orders to build, by contract, two second-rate iron steam-frigates—one to work with paddle-wheels, and the other to have a screw propeller. They are each to be 203 feet in length, 37 feet in breadth, about 1,300 tons burden, and 500 horse power.—'United Service Gazette.'

Large Rolling Mill in America.—The 'Danville Democrat' says that the Montour Iron Company are about erecting, at that place, a new rolling mill, which will be the largest and most extensive establishment of the kind in the United States, and which will probably cost 100,000 dollars. It is calculated that it will turn out annually about 10,000 tons of manufactured iron, a large portion of which is to be railroad iron; it will contain twenty-two puddling furnaces, consume all the iron manufactured at three furnaces of the same company, give employment, directly and indirectly, to about 500 hands, and is to go into operation early next spring.

Iron Trade.—We learn, from an official return, that the iron trade on the continent has been rapidly extending, and that the following is very nearly the relative proportion of the pig and bar iron manufactured in the different States:—Prussia, 199 furnaces, worked with charcoal, employ 8,674 workmen, and produce about 120,000 tons of cast iron, equal in value to 730,000*l.* Wrought iron, in bar and plate, is made at 538 forges, employing 6,049 workmen, and producing 73,000 tons, of the value of 230,000*l.* Bavaria, 44 furnaces, producing 9,000 tons of cast iron, and 141 forges, producing 5,750 tons of wrought iron. Wurtemberg, 6,400 tons of cast, and 2,500 tons of wrought iron. Grand Duchy of Baden, 7,000 tons of cast, and 4,750 tons of malleable iron. Saxony, 7,500 tons of cast, and 4,650 tons of wrought iron. Electorate of Hesse, 4,150 tons of cast, and 900 tons of malleable. Grand Duchy of Hesse, 7,150 tons of cast, and 2,400 tons of malleable. Duchy of Nassau, 14,330 tons of cast, and 1,300 tons of bar iron, and 2,375 tons of different other sorts of iron, in bars, cast and wrought iron work. Duchy of Brunswick, 2,150 tons of cast, and 7,180 tons of wrought iron, or work in cast iron. United States of Saxe Weimar, Eisenach, Saxe Meiningen, Aohalt, Scharzbourg, Hohenzollern, Sigmaringen, Renss, Waldeck, produce 4,035 tons of cast, and 2,240 tons of bar iron, or works in cast iron. German Luxemburg, 7,700 tons of cast iron. Total production of the States of the Zollverein—cast iron, 191,156 tons; wrought iron, or works in wrought and cast iron, 107,324 tons. In proportion to the population these quantities are not great, since it amounts to about 15½ lb. for each person throughout the Confederation. In France where this manufacture is yet but imperfectly developed, it amounts to above 22 lb.; in Belgium it is about 36 lb.; while in England it is as high as 55 lb. to 56 lb. for each person. All, or nearly all, the Zollverein States are engaged in the iron manufacture.—'Railway Chronicle.'

A "New Rig."—Mr. H. Dempster, of Kinghorn, the inventor of the "new rig," left Berwick-upon-Tweed, by himself, in his famed model yacht, the 'Problem,' late in the evening of the 31st of July, to steer for Newcastle-upon-Tyne; and although he had neither compass, chart, light, nor even a pump on board, still, in the dark, he passed inside of the Fern and Coquet Island, and arrived here early next morning. Such a voyage in so small a vessel, must speak in favour of his experiment. The advantages of Mr. Dempster's invention, which he has published, are as follow:—The 'Problem' is capable of being made to turn round, as if on a pivot, without even a sail being altered—attention to shifting of the helm when she takes a sternway, being all that is necessary to perform the evolution. The vessel can, with ease, be propelled stern foremost, and tacked or wore in that direction. The fore and aft triangle-sails go round without touching a mast. It is in these sails where the principal advantage rests in the rig. Under them a vessel properly managed, will never miss stays in the heaviest sea, or in the highest wind. They are well constructed for lying-to, backing, filling, or box hauling: and it is his opinion that these two sails may be applied to the largest size fishing boats, particularly those that from their size are incapable of being rowed, but are obliged to set and haul their lines under sail. The hull of the vessel is angular, being 120 degrees at the central point below.—'Newcastle Advertiser.'

Windsor Castle.—It has just been determined by Her Majesty's Commissioners of Woods and Forests to take down the old and dilapidated houses in the Lower Ward of Windsor Castle, the residence of the Military Knights, and known as the Lower Foundation. It is in contemplation to form a noble terrace on the site of these houses, to be open to the public, affording extensive and highly picturesque views over St. Leonard's and the Great Park. It is also in contemplation, we understand, to restore the Salisbury Tower, agreeably to the original plans of the late Sir Jeffry Wyatville, and as they were approved of by George IV. When this has been accomplished it will afford a convenient residence for three of the military Knights on the Lower Foundation. The remaining two knights on that foundation will have apartments provided for them at the upper end of Henry VIII's. gateway. No one unacquainted with the locality of the Royal residence can form an idea of the splendid view which will be thrown open from the upper grounds of the Castle by these arrangements being carried into effect. It is hoped that amongst other improvements, the unsightly and ruinous Horse-shoe cloisters will be razed to the ground, so that the terrace may be extended beyond the Bell-tower. It will then only remain to restore the Garter-tower, in order to effect one of the greatest improvements ever produced in this portion of the erections connected with the Castle. Several of the houses in Thames-street (portions of which are built over the old ditch of the Castle) have been recently purchased by the Crown, and the materials sold. The whole of the remainder of the houses on the Castle side of the street will also be purchased as soon as the necessary arrangements are made, from time to time, with the owners of the property, by the Commissioners of Woods and Forests. The northern and eastern terraces will then be extended round the Castle.

A Monument to the Memory of the late Dr. Southey is about to be erected in the Cathedral of Bristol, from the design of Mr. Baily, the sculptor. We perceive, by the "Western Advertiser," that at a public meeting held for the purpose of raising subscriptions, some objections were made to the design, as it was considered to be inapplicable for a Gothic structure, it was ultimately agreed to leave the nature of the monument to future consideration. A suggestion has been made, which we consider a very excellent one, that every thing of an architectural character should be suppressed, and that the whole be merely sculptural, a simple statue on a plain pedestal, to be placed near the entrance of the old Lady Chapel, or against one of the piers of the Nave of the Cathedral.

RAILWAYS AND CANALS.—In the appendix to a statement issued on behalf of the Grand Canal Company of Ireland, in the matter of the proposed railway to Cashel, there are given some curious details as to the effect of railways on canal property. Thus the Grand Junction Canal, which forms the first 90 miles of water communication between London and Birmingham, had, in the three years immediately preceding the opening of the railway, an annual revenue from tolls, ranging from £174,722 to £198,000, regularly increasing. Since the railway was fully in operation, this revenue has varied from £121,139 to £113,012. The Rochdale Canal is 33 miles long, and throughout the entire distance the Manchester and Leeds Railway runs parallel to it. In the three years previous to the opening of the railway, the tolls ranged from £62,059 to £59,258; in the last three years they have varied from £31,533 to £27,165. The Kennet and Avon Canal, and the Wilts and Berks Canal, are both affected by the Great Western Railway, and the tolls of the former have fallen since the railway was opened, from 46,703*l*. to 32,045*l*., and of the latter, from 19,328*l*. to 8,477*l*. The Forth and Clyde Navigation has gone down from 62,516*l*. to 42,218*l*., and the Union Canal, which connects Edinburgh with the Forth and Clyde Canal, has had its net profits reduced by railways from 12,000*l* to 4,284*l*. The market price of canal stock has, of course, suffered in proportion. Thus, shares in the Grand Junction Canal have fallen from 330*l*. to 148*l*. per share; Warwick and Birmingham, from 330*l*. to 180*l*.; Worcester and Birmingham, from 84*l*. to 55*l*.; Kennet and Avon, from 25*l*. to 9*l*.; and Rochdale, from 150*l*. to 61½*l*.; while Coventry Canal shares, which at one time were as high as 1,200*l*. per share, have fallen as low as 315*l*.

A Bridge of a novel and magnificent description, or rather a double bridge, one over the other, it is said, is about to be thrown over the Rhine, at Cologne. It will have twenty-five arches; and its extreme height will be 141 feet above the shores. The lower bridge will carry a railroad, to connect the Berlin and Cologne line with the terminus of the Rhenish railway. The upper bridge will be for other carriages, horsemen, and foot-passengers. In that part of the piers which extends between the two bridges, cannon will be placed, for the double purpose of breaking up the ice on the river, and defending the city.

EXTRACTION OF PALLADIUM IN BRAZIL.—The extraction of palladium, from the auriferous sand of Brazil, consists in fusing it with silver, and consequently, forming a quaternary alloy of gold, palladium, silver, and copper, which is granulated by projecting it into water. By treating this alloy with nitric acid, the gold is separated from the other metals which are soluble in the acid; the silver is precipitated by a solution of common salt in the state of insoluble chloride, which being separated, the copper and palladium are precipitated by plates of zinc. The pulverulent deposit of these metals is redissolved in nitric acid, and the solution precipitated by excess of ammonia, which re-dissolves the oxide of copper and of palladium. When the ammoniacal solution of these metals is saturated with hydrochloric acid, a double chloride of palladium and ammonia is deposited in the state of a crystalline yellow powder, and this, when calcined in a crucible, is readily decomposed, and leaves spongy palladium.—Mining Journal.

MARKET WESTON CHURCH.—We have much pleasure in bringing to the notice of our readers a successful application of science in restoring to a perpendicular position the north wall of Market Weston Church. The church is supposed to have been erected in the fourteenth century. From age and casualties the north wall had declined outwardly 19 inches from the perpendicular, and threatened the utter destruction of the building. Under the superintendence of Mr. Cottingham this wall (the weight of which had been calculated at 240 tons) has been brought up to the perpendicular, by the process of expanding by heat three bars of iron, 2½ inches in diameter, which traversed and connected both walls of the church. These bars (which had screws worked on one end of them and projected beyond the south wall) were inclosed in cast iron boxes filled with lighted charcoal. When the bars were fully expanded by the heat, the screws were wound up firmly to the undamaged south wall. The charcoal boxes were then removed, and the process of cooling commenced. Gradually the bars contracting equally with their previous expansion, compelled the whole mass of the wall to follow the irresistible power now exerting itself, and in four successive operations the whole wall rose to its original perpendicular.—Bury Post.

DAGUERREOTYPE PLATE ENGRAVING.—At the Paris Academy of Sciences, a paper from M. Fizeau was read on some experiments made with a view to obtain photographic designs on paper from a daguerréotype plate engraved by chemical means. hhe problem consists in acting upon the daguerréotype impressions by an agent which eats into the dark parts, without affecting the light parts of the plate; or, in other words, which attacks the silver in presence of the mercury, without affecting the latter. A mixed acid, composed of nitric, nitrous, and chloridic acids, has this property. The operation should be performed with the aid of heat. The formation of the chlorure of silver, which is an insoluble salt, would soon check the action of the acid, if it were not removed by an ammoniacal solution. After this first process, the plate would be engraved too slightly for good impressions to come off; the plate is therefore rubbed over with linseed-oil, and then wiped, so as to leave the oil only in the hollow parts. The prominent parts are then gilt by the galvanic process, and the reliefs being protected by gold, the hollow parts can be deepened at the will of the operator.

EXPLOSIONS IN POWDER MILLS.—M. Vergnaud is of opinion that these explosions are not produced by sparks from the crushing of the silex, but by electrical sparks resulting from peculiar circumstances, which he proposes to investigate.

ICE.—As we are henceforth to have this cooling luxury regularly supplied to us, and its great superiority, both in clearness and thickness, over the home article (owing to the precarious nature of our winters and other causes) is acknowledged by all who have tried it, a short notice of its uses, the manner of keeping it, and of cutting and securing it in America, may prove interesting. Ice has become a great article of export in America. Sixty thousand tons are annually sent from Boston to southern parts, the East and West Indies, &c.; and as saw-dust is solely used in packing, a large trade is also carried on in that article. The ice-houses, near the lakes and ponds, are immense wooden buildings, capable of holding 10,000 to 20,000 tons each; some of them, indeed cover half an acre of ground. They are built with double walls,—that is, with an inner wall all round, two feet from the outer one; and the space between is filled with saw-dust,—a non-conductor—making a solid wall, impervious to heat and air, and of 10 feet in thickness. The machines employed for cutting the ice are very beautiful, and the work is done by men and horses, in the following manner:—The ice that is intended to be cut is kept clear of snow, as soon as it is sufficiently thick to bear the weight of the men and horses to be employed, which it will do at six inches; and the snow is kept scraped from it until it is thick enough to cut. A piece of ice is cleared of two acres in extent, which at a foot thick, will give about 2,000 tons. By keeping the snow off it freezes thicker, as the frost is freely allowed to penetrate. When the time of cutting arrives, the men commence upon one of these pieces, by getting a straight line through the centre each way. A small hand-plough is pushed along the line, until the groove is about a quarter of an inch in width, and three inches deep, when they commence with the 'marker'—an implement drawn by two horses,—which makes two new grooves parallel with the first, 21 inches, the guage remaining in the first groove. It is then shifted to the outside groove, and makes two more. The same operation goes on, in parallel rectangular lines, until the ice is all marked out, into squares of 21 inches. In the meanwhile, the plough is followed in these grooves, drawn by a single horse, a man leading it; and he cuts up the ice to a depth of six inches. The outer blocks are then sawn out, and iron bars are used in splitting them. These bars are like a spade of a wedge form. In dropping them into the grooves the ice splits off, and a very slight blow is sufficient to separate them; and they split easy or hard, according to the weather in a very cold day. Ice is very brittle in keen frost; in comparatively softer weather, it is more ductile and resistible. Platforms, or low tables, are placed near the opening made in the ice, with an iron slide reaching from them into the water; and a man stands on each side with an ice-hook, very much like a boat-hook, but made of steel, with fine sharp points. With these the ice is hooked with a jerk that throws it on the platform on the sides, which are of the same height. On a cold day everything becomes covered with ice, and the blocks are each sent spinning along, although they weigh two cwt., as if they weighed only a pound. The slides are large lattice-work platforms to allow the ice to drain, and three tons can thus be easily run in one of them by one horse. It is then carried to the ice-houses, discharged upon a platform in front of the doors, and hoisted into the building by a horse. Forty men and twelve horses will cut and stow away 400 tons a day. If the weather be favourable, 100 men are sometimes employed at once; and in three weeks the ice-crop, about 200,000 tons, is secured. Some winters it is very difficult to secure it, as a rain or thaw may come that will destroy the labour of weeks, and render the ice unfit for market; and then it may snow and rain upon that, before those employed have time to clear it off: and if the latter freezes, the result is 'snow-ice,' which is of no value, and has to be planed off. The operation of planing proceeds in nearly the same manner as that of cutting. A plane guaged to run in the grooves made by the "marker," which willl shave the ice to a depth of three inches at one cut, is drawn by a horse, until the whole piece is regularly planed over. The chips are then scraped off. If the ice is not then clear, the work is continued until the pure ice is reached, and a few nights of hard frost will make it as thick below—inch for inch—for what has been taken off above. The ice is transported on railways. Each ice-house has a branch railway from the main line; and is conveyed in properly constructed box-waggons to Boston—a distance of (as the locality may be) 10 to 18 miles. The tools, machinery, &c., employed, and the building the houses, and constructing and keeping up the railroads, &c., are very expensive; yet the facilities are such, through good management, that ice can be furnished at a very trifling cost per pound; and a failure of the ice-crop in America would be a great calamity.—'Liverpool Standard.'

LORD ROSSE'S TELESCOPE AT BIRR CASTLE, IRELAND.—The colossal tube, in length about 50 feet, and in diameter nearly 8 feet, is now suspended in its permanent position, between two walls of solid masonry, built to correspond with the architecture of the castle. It is attached at its lower extremity—where the speculum, weighing four tons, is to be placed—by a massive universal joint of beautiful workmanship, and weighing nearly three tons; and its counterpoise, about seven tons weight, is so skilfully contrived and adjusted that it easily adapts itself to every alteration in any required elevation or depression of the instrument. The speculum is in process of being ground, which, together with the subsequent polishing, would occupy perhaps a fortnight; so that in about a month or six weeks from the present time the whole is expected to be completed.

THE TRIDENT.—Messrs. Boulton, Watt & Co., have received orders from Government to make a pair of oscillating engines of the collective power of 350 horses for the above frigate, she is of iron, and was built by Messrs. Ditchburn and Mare.

LIST OF NEW PATENTS.

(From Messrs. Robertson's List.)

GRANTED IN ENGLAND FROM JULY 26, TO AUGUST 22, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

Joseph Martin Kronheim, of Castle-street, Holborn, engraver, for "certain Improvements in stereotyping." Being a communication.—July 29.

William Ford, of Lawn-end, South Lambeth, drain tile maker, for "Improvements in the manufacture of tubes for draining land and for other purposes, and in drain tiles."—July 30.

Edward John Dent, of the Strand, in the county of Middlesex, chronometer maker, for "Improvements in ships' compasses."—July 30.

Arthur Powell and Nathaniel Powell, of Whitefriars Glass Works, glass manufacturers, for "Improvements in the manufacture of quarries and other panes of glass for windows."—July 30.

Thomas Warne, of Blackfriars-road, pewterer, and beer-engine manufacturer, for "certain Improvements in engines, machinery, or apparatus for raising, drawing, or forcing beer, ale, or other liquids, or fluids."—July 30.

Joseph Bentley, of Liverpool, gun-maker, for "certain Improvements in fire-arms."—July 30.

Elizabeth Cottam, of Winsley-street, Oxford street, Middlesex, for "Improvements in heating what are called Italian irons."—July 30.

Pierre Armand, le Comte de Fontainemoreau, of Skinner's-place, Sise-lane, in the City of London, for "certain Improvements for coating or covering metals and alloys of metals."—July 31.

Benjamin Tucker Stratton, of Bristol, agricultural mechanist, for "Improvements in welding sheet iron for ship building and other uses.—August 1.

John Reed Hill, of Chancery-lane, engineer, for "Improvements in a press or presses, machine or machines, for letter-press printing.—August 2.

William Edwards Staite, of High-street, Marylebone, for "certain Improvements in the processes and apparatus for preparing extracts and essences of vegetable and animal substances."—August 3.

Thomas Middleton, of Loman-street, Southwark, engineer, for "certain Improvements in machinery for the manufacture of artificial fuel."—August 5.

Julius Jeffreys, of Clapham, gentleman, for "Improvements in respirators."—August 6.

Thomas Greenshields, of Oxford, architect, for "Improvements in the manufacture of salt."—August 6.

William Cormack, of Dalgleish-street, Commercial-road, chemist, for "a new method or plan for purifying coal-dust."—August 15.

John Whitehead, Junior, of Elton, Lancaster, dyer and finisher, for "certain Improvements in the process of finishing fustians or beaverteens, satin tops, and other similar cotton fabrics."—August 15.

Thomas Heaton, of Chorley, Lancaster, colliery agent, for "certain Improvements in hydraulic machinery, which is also applicable to raising other liquids."—August 15.

Alexander Ewing, of Dumbarton, Scotland, glass splitter, for "certain Improvements in the manufacture of crown glass."—August 15.

Wilton George Turner, of Gateshead, Durham, doctor in philosophy, for "an improved mode of directing the passage of, and otherwise dealing with, the noxious vapours and other matters arising from chemical works in certain cases."—August 22.

NOTICE OF THE PRINCIPAL ASTRONOMICAL DISCOVERIES OF LAPLACE.

By M. Arago.

Translated from the French for the Civil Engineer and Architect's Journal.

[The accompanying translation gives, from the pen of M. Arago, a sketch not only of the labours of Laplace but also of the progress of astronomy in France. It is extracted from the *Annuaire du Bureau des Longitudes*, which has just appeared.]

Introductory Note of M. Arago.

Being appointed to draw up the report of the Committee of the Chamber of Deputies, which was directed in 1842 to enquire into a proposal of the Minister of Public Instruction, relative to printing at public expense the works of Laplace, I thought it right to lay down a succint analysis of the principal discoveries of our illustrious countryman. Many persons having expressed, perhaps with too much kindness, a wish that this analysis should not be huddled up among the crowd of legislative documents, but that it should appear in the Annuaire, I have availed myself of the opportunity of developing it so as to render it less unworthy of public attention. The scientific part of the report, as presented to the Chamber of Deputies, will be found here complete, the rest it seemed might conveniently be retrenched. In this note I will preserve a few lines of the report, intended to describe the objects of the proposed bill, and to make known the arrangements which have been adopted by the three powers (of the legislature).

"Laplace endowed France, Europe, and the learned world with three magnificent compositions, the *Traité de Mécanique Céleste*, the *Exposition du Système du Monde* (Exposition of the System of the Universe), and the *Théorie Analytique des Probabilités*. In the present day no copy of this latter work is to be found among the booksellers of Paris. The edition of the *Mécanique Céleste* itself will soon be exhausted. We have therefore seen with pain the period at hand when those devoted to the study of the transcendental mathematics, would have been forced, from want of the original work, to obtain from Philadelphia, New York, or Boston, the English translation which the skilful geometrician Bowditch has given of the grand work of our fellow countryman. Let us, however, be able to state that such fears were without foundation. To reprint the *Mécanique Céleste* is for the family of the illustrious geometrician a pious duty, and Madame de Laplace, so rightfully, so profoundly attentive to everything which can enhance the lustre of the name she bears, had determined on encountering the financial outlay. A small estate, near Pont l'Evêque, was to change hands, and the literary world in France would not have been deprived of the satisfaction which it feels in reckoning its astronomical treasures as part of the national language. The approaching republication of the works of Laplace rested on a guarantee not less certain. Yielding at once to filial feeling, to the noble impulse of patriotism, and to the enlightened enthusiasm for brilliant discoveries with which more serious studies had inspired him, General de Laplace had long since prepared to become the publisher of the seven volumes which must immortalize his father. These are glories too elevated, too splendid for the limits of private transactions; to governments belong the glories of preserving them from indifference or forgetfulness, of presenting them constantly to sight, of spreading them through a thousand channels, of making them available in fine for the general good. Doubtless the Minister of Public Instruction felt these views, when, on the occasion of an addition of the works of Laplace being rendered necessary, he requested you to substitute the great French family for the personal family of the illustrious geometrician. We give, gentlemen, our full and entire adhesion to this proposal—it emanates from a national feeling which can find no opponents within these walls."

Astronomy is that science in which the human mind may most justly place its glory. This incontestible pre-eminence is owing to the elevation of its ends, the grandeur of its means of investigation, the certainty, the utility, the unheard of magnificence of its results. From the beginning of society the study of the movements of the stars has constantly occupied the attention of governments and people. Many great captains, illustrious statesmen, eminent writers, philosophers, and speakers of Greece and Rome took their delight in it. We must, however, be allowed to say that the astronomy truly worthy of that name is quite a modern science, dating only from the sixteenth century.

Three great and brilliant phases have marked its progress. In 1543 Copernick broke with a firm and bold hand the greater part of the antique and venerated scaffolding with which the illusions of sense, and the pride of eyes had filled the world. The earth ceased to be the centre and point of the heavenly movements, and was obliged modestly to rank among the planets, while its material importance among the whole bodies which compose our solar system was brought down to that of a grain of sand.

Twenty-eight years had gone by from the day when the canon of Thorn died, holding in his failing hands the first copy of a work which was to shed on Poland such pure and brilliant glory, when Wittenberg saw the birth of a man fated to produce a revolution in science not less fruitful and yet more difficult. This man was Kepler. Endowed with two qualities, seemingly mutually opposed, a volcanic imagination, and an obstinacy unthwarted by the most fatiguing numerical calculation, Kepler divined that the movements of the stars were connected together by single laws, or using his own expression, harmonic laws. These laws he undertook to develope. A thousand fruitless attempts and errors in figures, inseparable from colossal labour, did not prevent him a single moment from moving resolutely toward the end he thought he could foretell. Two and twenty years were employed in this research without any reason for affliction. In truth, what are two and twenty years labour to him who may be the legislator of worlds, who will inscribe his name in ineffaceable marks on the front page of an immortal code, and who may cry in dithyrambic language, without any one being able to contradict it, "The lot is thrown; I am writing my book; it will be read by the present age or by posterity—what matters that?—it can wait for its reader. Has not God waited six thousand years a contemplator of his work?"

To seek out a physical cause capable of making the planets run through closed curves; to place in power the principle of the maintenance of the world, and not in solid props and in the crystal spheres our ancesters had dreamed; to extend to the revolutions of the stars the general elements of the mechanism of terrestrial bodies, such were the questions which remained to be solved after Kepler had published his discoveries. Very distinct outlines of these great problems are to be found here and there among ancients and moderns, from Lucretius and Plutarch down to Kepler, Boulliaud and Borelli. To Newton, however, we must award the merit of the solution. That great man, like many of his predecessors, introduced among the celestial bodies a tendency to approach, or attraction, and drew from the laws of Kepler the mathematical character of that power, carried it out to all the material molecules of the solar system, and developed his brilliant discovery in a work which, even now, is the eminent offspring of human intellect.

The heart collapses when in studying the history of science we find such a magnificent intellectual movement effected without the aid of France. Practical astronomy added to our inferiority. The means of research were in the beginning carelessly given to foreigners, to the detriment of natives full of knowledge and zeal. After, superior minds contended bravely but fruitlessly against the want of ability in our workmen. During this time, Bradley, on the other side of the channel, more fortunate, gained immortality by finding out aberration and mutation. In these admirable revolutions of astronomical science, the quota of France in 1740 was limited to the experimental determination of the flatness of the earth, and finding out the variation in weight. These were two great things, our country however had a right to require more, for when France does not hold the first rank she has lost her place. That rank, momentarily lost, was brilliantly regained, and we owe it to four geometricians.

When Newton, giving to his great discovery a generalization which the laws of Kepler did not command, imagined that different planets were not only attracted by the sun, but further, that they were reciprocally attracted, he placed amid the heavenly space causes which inevitably would disturb the whole. Astronomers could then see with the mere eye that in no part of the world, near or far, would the Keplerian law and curve be adequate to the exact delineation of phenomena; and that the simple and regular movements with which ancient dreamers had been pleased to provide the stars, would feel numerous, considerable, and perpetually changing perturbations. To foretell many of these perturbations, to point out the direction, and in a few very rare cases to determine the numerical value, that was the end intended by Newton when he thought of writing his Mathematical Principles of Natural Philosophy. Notwithstanding the incomparable wisdom of its author, the Principia only gives a sketch of the planetary perturbations. If that sublime sketch never became a complete view it can never be imputed to want of ardour or of determination; the efforts of the great philosopher were ever superhuman, and the questions which he did not solve were insolvable in his day. When the continental mathematicians entered the field, and endeavoured to place on an immoveable base the Newtonian system, and to perfect theoretically the astronomical tables, they really found in their way difficulties by which the genius of Newton had been driven back.

Five geometricians, Clairaut, Euler, D'Alembert, Lagrange, and Laplace, divided among them the world which Newton had brought to light. They explored it in every quarter, penetrated into regions which might have been thought inaccessible, and pointed out numberless phenomena which had escaped observation; in fine, and that is their immortal glory, they bound up in one principle, one single law, the most mysterious and most subtile of the heavenly movements. Geometry moreover had the boldness to provide for the future, and ages as they go on scrupulously ratify the judgments of science.

We shall not have to take account of the magnificent labours of Euler, on the contrary, we shall draw here a rapid analysis of the discoveries of his four rivals, our fellow countrymen.[1] If a star, the moon for example, only gravitates toward the centre of the earth, it would mathematically describe an ellipse, and would strictly follow the law of Kepler, or what is the same thing, the mechanical principles laid down by Newton in the early chapters of his immortal work. Now let us put in action a second power; let us take into account the attraction of the sun upon the moon; instead of two bodies, in fine, we may take three, and the Keplerian ellipse will only give a rough idea of the movement of our satellite. Here the attraction of the sun will tend to augment the dimension of the former orbit, and will really augment them; there, on the other hand, it will diminish them. At certain points the solar power will act in the direction where the star is displaced, and the movement will become more rapid, elsewhere the effect will be inverse. In a word, by bringing in a third attractive body, the utmost complication and every appearance of disorder will succeed a simple and regular course on which the mind had complacently relied. If Newton gave a complete solution of the question of heavenly movements in the case of two stars attracting each other, he did not even analytically enter upon the infinitely more difficult problem of three bodies. The problem of three bodies, the name under which he became celebrated, the problem of determining the course of a star affected by the attractive action of two other stars was first determined by our fellow countryman Clairant. From that solution may be dated the important progress already made in the last century toward perfecting lunar tables.

The most beautiful astronomical discovery of antiquity is that of the succession of the equinoxes. Hipparchus, to whom the honour of it belongs, pointed out all the results of that movement with perfect clearness. Among these results, two have had more particularly the privilege of drawing public attention. On account of the succession of the equinoxes the same starry groups and constellations are not perceived in the firmament on every night in each season. In the course of time, the actual winter constellations will become summer constellations, and reciprocally. On account of the succession of the equinoxes the pole does not constantly occupy the same place in the starry sphere. That star, brilliant enough, now very properly named the polar, was very far off from the pole in the time of Hipparchus, and it will again occur in some centuries hereafter. The name of polar has been, and will be successively given to stars very far off from each other. When we have the ill fortune in seeking an explanation of natural phenomena to get into a false path, every certain observation throws the theorist into new complications. Seven spheres cased in crystal would no longer do for the delineation of phenomena, when the illustrious astronomer of Rhodes had found out the procession. An eighth sphere was then wanted to account for the movement in which all the stars participate together. After having torn the earth from its pretended immobility, Copernik, on the contrary, provided in a very simple manner for the most minute particulars of the procession.

He supposed that the axis of rotation of the earth does not lie exactly parallel to itself, but that after every thorough revolution of our globe around the sun, that axis deviates by a minute quantity; in a word, instead of making the whole of the circumpolar stars move in a certain manner on meeting with the pole, he made the pole move to meet the stars. This hypothesis cleared the mechanism of the world from the greatest complication which the spirit of system had found out. A new Alphonso would then have wanted a plea for addressing to his astronomical conclave the profound, but badly interpreted words attributed by history to the king of Castile.[2]

If the conception of Copernik, improved by Kepler, had, as we have now seen, greatly perfected the mechanism of the heavens, there yet remained to be discovered the motive power, which yearly modifying the axis of the earth, made it describe, in 26,000 years an entire circle of about 50 degrees in diameter.

Newton divined that that power emanated from the action of the sun and the moon on matter, which in the equatorial regions arose above a sphere of which the centre would agree with that of the earth, and would have for a radius a line brought from that centre to one of the poles; thus he made the precession of the equinoxes depend on the flattening of the globe, and declared that on a spherical planet no precession would occur. That was true, but Newton did not arrive at the mathematical proof. Now that great man had introduced into philosophy the just and severe rule—"do not believe anything for true until it is demonstrated." The demonstration of the Newtonian ideas on the precession of the equinoxes was therefore a great discovery, and to D'Alembert belongs the glory. That illustrious mathematician has given a complete explanation of the general movement, in virtue of which the axis of the terrestrial globe returns to the same stars in 26,000 years. He has connected to with attraction the perturbation of procession found out by Bradley, and the remarkable oscillation incessantly undergone by the axis of the earth during its progressive movement, and of which the period, about eighteen years, is exactly equal to the time that the intersection of the orbit of the moon and the ecliptic, employs to go through the 360 degrees of the entire circumference.

Mathematicians and astronomers have been quite as fully occupied, and with reason, with the form and physical structure that the terrestrial globe may have had at the earliest epoch, as with the form and structure of the actual globe. When our fellow-countrymen Richer had discovered that a body, whatever its nature, weighs the less as it is further transported to the equinoctical regions, every one perceived that the earth, if it were originally fluid, must be puffed out at the equator. Huygens and Newton did more; they calculated the difference of the great and little axis, and the excess of equatorial diameter over that of the polar. Huygens founded his calculation on the hypothetical and totally inadmissible properties of attractive force; Newton on a theorem which required to be proved. The theory of Newton had a graver defect; it held the primitive and fluid earth to be in a state of complete homogeneity. When, in endeavouring to solve great problems, we give way to such simplifications, when to avoid difficulty in calculating we wander so essentially from natural and physical conditions, the results belong to an ideal world, and are nothing more than frolics of the mind. To apply analysis in a profitable manner to determine the figure of the earth every idea of homogeneity had to be got rid of, and every obligatory likeness between the forms of the superimposed and unequally dense layers; the case of a central kernel had also to be examined. This generalization made the difficulty tenfold, but did not however impede Clairaut and D'Alembert. Thanks to the endeavours of these two powerful mathematicians, thanks to a few essential developements due to their immediate successors, and particularly to the illustrious Legendre, the theoretical determination of the figure of the earth has acquired the desired perfection; and complete accord prevails between the calculated results and those of direct measurement. The earth has therefore been originally fluid, and analysis has enabled us to go up to the infancy of our planet.

In the time of Alexander, comets were with the greater part of the Greek philosophers simple meteors, engendered in our atmosphere. The middle age, without taking any trouble about their nature, made prognostics from them, and signs forerunning sinister events. Regiomentarius and Tycho Brahe placed them by their observations beyond the moon; Hevelius, Doerfel, &c., made them go round the sun; Newton laid down that they move under the immediate protective influence of that body, that they do not describe right lines but obey the Keplerian law. It required to be proved that the orbits were closed curves or that the earth sees the same comet on many occasions. This discovery remained for Halley. By carefully collecting in the recitals of historians and chroniclers, and in astronomical annals, the circumstances of the appearances of all the more brilliant comets, this ingenious savant pointed out by subtile and profound discussion that the comets of 1682, 1607, and 1531 were in truth successive appearances of one and the same star. This identity led to a result from which more than one astronomer drew back—that the time of an entire cometary revolution varied much, and that the variation might go from two years to seventy-six. Were such great differences attributable to perturbations caused by planetary action? The reply to this question would bring comets into the category of ordinary planets, or for ever keep them out. It was difficult to be calculated, but Clairaut found out the means of effecting it. Success might seem doubtful, but Clairaut gave proof of the greatest boldness, for in the course of 1758 he undertook to determine the period in the following year when

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[1] We may be asked, perhaps, why we reckon Lagrsnge among French geometricians. In two words we give our answer:—he who was named Lagrange Tournier, two of the most truly French names capable of being conceived, who had for maternal grandfather M. Gros, and for paternal great grandfather a French officer born in Paris, who never wrote but in French, and held in our country the highest dignities for nearly thirty years, it seems, although born at Turin, must be considered as a Frenchman.

[2] Yielding to just presentiments on the majestic simplicity which, sooner or later, was to become the attribute of the heavenly movements, Alphonso cried out—"If I had been called to the council of God when he created the world things would have been better ordered."

the comet of 1682 would re-appear; he marked out the constellations and stars which it would meet in its career. It was not one of those long-winded predictions which astrologers and other fortune-tellers formerly very cleverly combined with the tables of mortality, in such way as not to be put to the lie in their own lifetime; the event was to happen, and it concerned nothing less than to create a new era in cometary astronomy, or to cast on science a discredit from which it would for a long while suffer.

Clairaut found by very long and learned calculation that the action of Jupiter and Saturn ought to retard the movement of the comet; and that the duration of its entire revolution, compared with the preceding, would be augmented 518 days by the attraction of Jupiter and 100 by the attraction of Saturn, being a total of 618 days, or more than a year and eight months. Never did any astronomical question create a more lively or more natural interest; every class of society awaited the re-appearance foretold with equal anxiety. A Saxon labourer, Palitszch, was the first to see it. From that moment, from one end of Europe to the other, a thousand telescopes nightly marked the points of the path of this star among the constellations. The path was always within the limits of calculation, that which Clairaut had laid down beforehand. The prediction of the illustrious mathematician was accomplished both in time and space; astronomy had made a great and important gain, and with the same blow beat down, as often happens, a vile and inveterate prejudice. From the time when it was laid down that the return of a comet may be foretold and calculated, these bodies finally lost their former prestige. The most timid men felt as little trouble about them as about the equally calculable eclipses of the sun and moon. The labours of Clairaut had therefore in the end, and with the public, yet more good fortune than the learned, ingenious, and witty arguments of Bayle.

The firmament offers to reflecting minds nothing stranger or more remarkable than the equality of the mean angular movements of revolution and rotation of our satellite. On account of this perfect equality the moon presents always the same side to the earth. The hemisphere which we now view is precisely that which our forefathers viewed at the most distant epochs, and the same which our children's latest offspring will observe. The final causes used with so little reserve by certain philosophers to account for a great many natural phenomena were in that particular case without possible application. How could we in fact pretend that men could have any interest whatever in incessantly looking at the same halfsphere of the moon, and never looking at the other halfsphere? On the other hand a perfect mathematical equality between elements without necessary connection, such as the movement of translation or rotation of a given heavenly body did not less shock the idea of probability. There were besides two other numerical coincidences quite as extraordinary; an identical orientation, relatively to the stars, of the equator and orbit of the moon, and movements of precession of these two planes exactly equal. This aggregate of singular phenomena, discovered by J. D. Cassini, constituted the mathematical code of what was called the libration of the moon. The libration was yet a vast and very melancholy lacuna in physical astronomy, when Lagrange made it depend on a circumstance in the figure of our satellite not observable from the earth, when he completely combined it with the universal principles of gravitation. At the time when the moon solidified, she took under the influence of the earth, a form less regular and less simple than if any foreign attractive body had been in proximity. This action did not prevent the lunary equator from being everywhere swelled out, but prominence of the equatorial diameter turned toward the earth, became four times more considerable than that of the diameter, which we see perpendicularly. The moon would then exhibit to an observer situated in space and who could examine it transversely, a body elongated towards the earth, like a pendulum without a point of suspension. When a pendulum is moved from verticality, the action of gravity brings it back, and when the great axis of the moon departs from its habitual direction, the earth equally compels it to return. Here then is that strange phenomenon thoroughly explained without referring to an equality in some kind miraculous, between two movements of rotation and translation entirely independent. Men will never see more than one side of the moon. Observation had taught us this, now we know moreover that it is owing to a physical course, calculable and visible only by the eye of the mind; that it is owing to the lengthening experienced by the diameter of the moon, when that star passed from the liquid to the solid state under the attractive influence of the earth. If originally a little difference had existed between the rotary and revolving movements of the moon, the attraction of the earth would have brought these movements to a rigorous equality. This attraction would in like manner have sufficed to get rid of little want of coincidence between the lines resulting from the intersections of the lunary equator and orbit with the plane of the ecliptic. The work in which Lagrange connected with so much good fortune, the laws of libration to the principles of universal gravity, so capital in its matter, is not less remarkable in its form. After having read it, every one will comprehend that the term "elegance" may be applied to a mathematical treatise.

We have been content in this analysis to glance over the astronomical discoveries of Clairaut, D'Alembert, and Lagrange; we shall be rather less concise in speaking of the works of Laplace. After having enumerated the multiplied powers, which must result from the mutual action of the planets and setellites of our solar system, Newton, the Great Newton, dared not to undertake to grasp their whole effects. Amid the labyrinth of augmentations and diminutions of speed, of variations of form in the orbit, of changes of distances and inclinations which these powers would evidently produce, the most learned geometry itself would not have found out a firm and faithful guiding clue. This extreme complication gave birth to a discouraging thought. Powers or forces so numerous, so variable in position, so different in intensity, did not seem able to maintain their balance but by a kind of miracle. Newton went so far as to suppose that the planetary system did not contain in itself elements of indefinite conservation; he believed that a powerful hand must intervene from time to time to repair the disorder. Eular, although more advanced than Newton in the knowledge of planetary perturbations, did not any more admit that the solar system was so constructed as to last eternally. Never did a greater philosophical question present itself to the curiosity of men. Laplace attacked it with boldness, constancy and good fortune. The profound and long continued labours of that illustrious mathematician, established on firm evidence, that the planetary ellipses are perpetually varying; that the extremities of their great diameter traverse the heavens, and that independently of an oscillatory movement, the planes of the orbits sustain a displacement, by the effect of which their traces on the plane of the terrestrial orbit are every year directed toward different stars. Amid this apparent chaos there is one thing which remains constant, or which is only subject to small periodical changes, and that is the great axis of each orbit, and consequently the period of revolution of each planet; and that is the quantity which should most have varied according to the learned preconceptions of Newton and Euler.

The universal gravitation suffices for the preservation of the solar system; it maintains the forms and inclinations of the orbits in a mean state around which the variations are slight; the variety does not produce disorder, and the world exhibits harmonies and perfections which Newton never conceived. That depends on circumstances which calculation disclosed to Laplace, and which on cursory inspection would not appear to exert so great an influence. For planets moving themselves in the same direction, in orbits of slight ellipticity, and in planes little inclined to each other, substitute different conditions, and the stability of the world will be put in question anew, and in all probability a fearful chaos would ensue.

Although since the labours to which we have referred, the indurability of the great axes of that planetary orbits may have been better demonstrated, that is to say, by means of more extension in analytical approximations,[3] it does not the less remain one of the admirable discoveries of the author of the Mécanique Céleste. Dates on such subjects are not a luxury of erudition: the paper in which Laplace communicated his results on the invariability of the mean movements or of great axes is of 1773; it was in 1784 only, that he deduced the stability of the other elements of the system, of the small mass of the planets, the slight ellipticity of their orbits, and the similitude of direction in the circulatory movement of these stars around the sun.

The discovery of which I have just given an account, no longer allowed us, at least in our solar system, to consider the Newtonian attraction as a cause of disorder; but was it impossible that other powers might combine with that and produce the gradually increasing perturbations which Newton and Euler feared? Positive facts seem to authorize such fear. Old observations as compared with the modern revealed a continual acceleration in the movements of the moon and of Jupiter; a diminution not less manifest in the movement of Saturn. From these variations resulted the strangest conclusions. From the presumed causes of these perturbations to say of a star that its velocity increased from age to age, was to declare in equivalent terms that it came nearer to the centre of movement. The star on the contrary would depart from that same centre, when its velocity slackened. Thus, singularly, our planetary system seemed destined to lose Saturn,[4] its most mysterious ornament; to see that planet accompanied by the ring and seven satellites, gradually buried in the unknown regions, where the eye armed with the most powerful telescopes has never

[3] On this subject may be consulted two beautiful papers by Lagrange and Poisson.

[4] Then regarded as its outermost member.—Translator.

penetrated. Jupiter, on the other hand, that globe by the side of which our's is so trifling, would have gone by an inverse march and involved itself in the incandescent matter of the sun; men would at last have seen the moon throw itself on the earth. Nothing doubtful or systematic entered into these sinister forebodings. Uncertainty could only affect the precise dates of the catastrophes. It was however known that they would be very far off: so that neither technical dissertations nor the animated descriptions of certain poets interested the public. It was not so with learned societies. There they viewed with regret our planetary system on the road to ruin. The Academy of Sciences called the attention of mathematicians of all countries to these threatening perturbations. Euler and Lagrange entered the arena. Never did their mathematical genius throw brighter lustre; however the question remained undetermined. The inutility of such efforts seemed to leave room for resignation only, when from two obscure corners, contemned by analytical theory, the author of the *Mécanique Céleste*, clearly raised the laws of those great phenomena. The varying velocity of Jupiter, Saturn and the Moon had thenceforth evident physical causes, and returned to the category of common perturbation, periodical and dependent on gravity, while the so much dreaded changes in the dimensions of orbits became a simple oscillation, kept within very narrow limits, in fine by the almightiness of a mathematical formula, the material world was made firm on its base.

I cannot leave this subject without at least naming the elements of our solar system, on which depend the variations of speed, of the Moon, Jupiter and Saturn, so long unexplained. The bulk of the movements of the earth around the sun is effected in an ellipse of which the form on account of perturbations is not always the same. Those changes of form are periodical; sometimes the curve without ceasing to be elliptical, approaches the circular, and sometimes departs from it, according to the oldest observations the eccentricity of the terrestrial orbit has diminished from year to year; hereafter and later it will increase within the same limits, and according to the same laws. Now Laplace has proved that the mean circulatory speed of the moon around the earth is connected with the form of the ellipse described by the earth around the sun; that a diminution in the eccentricity of this ellipse inevitably produces an augmentation in the speed of our satellite and reciprocally; and in fine that this cause is enough to account numerically for the acceleration in its course, which the moon has exhibited from the earliest times down to our epoch.

The origin of the inequalities of speed in Jupiter and Saturn will, I hope, be as easy to conceive. Mathematical analysis has not succeeded in representing by finite terms the value of the disturbances which each planet encounters in its orbit by the action of all the others. This value exhibits itself in the present state of science under the form of an indefinite series of terms, which rapidly diminish in extent as they are removed from the first term. In calculation we neglect those of the terms, which by their rank, correspond with quantities below errors of observation, but there are cases where the rank in the series, does not alone determine whether a term may be great or small; certain numerical relations between the primitive elements of the disturbing and disturbed planets may give to terms, generally negligible, sensible values. This case occurs in the perturbations of Saturn originating with Jupiter, and in the perturbations of Jupiter originating with Saturn. There exists between the mean velocities of these two large planets, commensurable simple relations; five times the velocity of Saturn very nearly equals twice the velocity of Jupiter, terms which without this circumstance, would have been very little, acquire considerable value. Thence results in the movements of the two stars, inequalities of a long period, perturbations, the complete development of which requires more than 900 years, and which wonderfully represent all the contradictions disclosed by observers. Are we not surprised to find in the commensurability of the movements of the two planets so influential a perturbing cause, and to find it dependent on this numerical relation; "five times the movement of Saturn is nearly equal to twice the movement of Jupiter," the definitive solution of an immense difficulty which the genius of Euler had not been able to overcome, and which left it in doubt whether universal gravitation was sufficient to explain the phenomena of the firmament? The delicacy of the conception and its results, are in this case equally worthy of admiration.

We have just explained how Laplace demonstrated that the solar system can only sustain slight periodical oscillations around a certain mean state. Let us now see, in what manner he succeeded in determining the absolute dimensions of the orbits. What is the distance of the sun from the earth? No scientific question has occupied men more. Mathematically speaking nothing is more simple; it is enough as in surveying to take from the ends of a known base visual lines to the inaccessible object; the rest is an elementary calculation. Unfortunately in the case of the sun the distance is great, and the bases which may be measured on the earth, are very small. In such case slight errors of sight exercise enormous influence over the results. In the beginning of the last century Halley remarked that certain interpositions of Venus between the earth and the sun, or to employ a consecrated expression, the passages or transits of the planet over the solar disc, would supply every observatory with the indirect means of fixing the position of the visual ray, much superior in exactness to the most perfect direct methods. Such was the occasion in 1761 and 1769 of the scientific voyages in which, without speaking of Europe, France was represented in the Isle of Rodriguez by Pingré, in St. Domingo by Fleurieu, in California by the Abbé Chappe, and at Pondicherry by Legentil. At the same time England sent out Maskelyne to St. Helena, Wallis to Hudson's Bay, Mason to the Cape of Good Hope, Capt. Cook to Tahiti, &c. The observations in the Southern hemisphere, compared with those in Europe, and particularly with the observations, which Father Hell, a famous Austrian astronomer, went to make at Wardhuus, in Lapland, gave for the distance of the sun, the result which has since figured in all the treatises on astronomy and navigation. No government hesitated to furnish learned societies with the means, at whatever cost, of suitably establishing their observers in the most distant regions. We have already remarked that the determination of projected distance appeared imperiously to require a great base, and that small bases would not have sufficed. Laplace then solved this problem numerically without any sort of base; he deduced the distance of the sun, from observations of the moon, made in a single and the same place.

The sun is the cause of perturbations to our satellite, which evidently depend on the distance of that immense inflamed globe from the earth. Who does not see that these perturbations would diminish if the distance augmented, and on the other hand, would increase if the distance diminished; that distance in fact regulates the greatness of them. Observation gives the numerical value of these perturbations; theory on the other hand developes the general mathematical relation which connects them with the solar distance and other known elements. When we have reached this term, the determination of the mean radius of the terrestrial orbit becomes one of the easiest algebraic operations. Such is the happy combination by means of which Laplace solved the great and celebrated problem of the parallax; thus did this ingenious mathematician find for the mean distance of the sun from the earth, expressed in radii of the earthly globe, a number little different from that which had been deduced from so many laborious and costly voyages. According to the opinion of very competent judges, it might perhaps be that the result of the indirect method was worthy of the preference.

The movements of the moon were to our great geometer a fertile mine. His penetrating gaze knew how to find out their unknown treasures. He cleared them from all that hid them from vulgar eyes, with a skill and constancy equally worthy of admiration. We shall be excused for quoting a new example. The earth governs the moon in its course. The earth is flattened. A flattened body does not attract like a sphere. There must therefore be in the movement, we had almost said, in the allure of the moon, a sort of impress of the terrestrial flatness. Such was at the first blush the thought of Laplace. It remained to be determined, and in that lay all the difficulty, whether the characteristic traits which the flattening of the earth would communicate to our satellite, were sensible enough, apparent enough not to be confounded with errors of observation; it was also requisite to find the general formula of this kind of perturbation, in order to be able, as in the case of the solar parallax, to extricate what was unknown. The ardour and analytical power of Laplace surmounted all these obstacles. At the close of a task which had exacted infinite attention, the great geometer found in the lunar movement, two perturbations, clear and characteristic, depending on the terrestrial flattening. The former affected the portion of the movement of our satellite, which is particularly measured by the instrument known in our observatories under the name of the meridian lunette; the second, developing itself nearly in a north and south direction, could only be manifested in observations by a second instrument, the mural circle. These two inequalities of very different values, measured with two instruments entirely distinct, connected with the cause which produced them by the most different analytical combinations, have however led to the same flattening. The flattening thus deduced from the movements of the moon is not, it must be well understood, the particular flattening corresponding with such or such country; the flattening observed in France, England, Italy, Lapland, North America, India or the Cape; for the earth having suffered at various times and in various places, considerable elevations, the primitive regularity of its curve has been notably disturbed; the moon, and that it is which renders the result inappreciable, should give and has effectively given the general flattening of the globe, a sort of mean between the various de-terminations obtained with enormous expense, infinite labour, and by means of long voyages undertaken by the astronomers of all the countries in Europe.

I would add some short remarks of which the basis is borrowed from the author of the *Mécanique Céleste;* and which seem very proper to throw into relief, to bring into full light, what the methods of which I have just sketched the leading features, contain that is deep, unexpected or almost paradoxical. What are the elements which had to be put in parallel, to arrive at results expressed with the precision of the smallest decimals? On the one hand, mathematical formulæ deduced from the principle of universal gravitation; on the other certain observed irregularities in the returns of the moon on the meridian. An observer who from his birth had never left his closet, who had never seen the heavens except through the narrow north and south opening, in the vertical plane of which the principal astronomical instruments move; to whom nothing had ever been revealed concerning the stars moving above his head, except that they attract each other according to the Newtonian law, would however by means of analytical science, have succeeded in discovering that his humble and narrow dwelling belonged to a flattened, ellipsoidal globe, of which the equatorial axis exceeded the polar and rotary axis by one three hundred and sixth; he also, isolated and immovable, would have found his true distance from the sun.

It is to D'Alembert that we must go up, as I have recalled in the beginning of this notice, to find a satisfactory mathematical explanation of the phenomena of the precession of the exquinoxes; but our illustrious fellow-countryman, and Euler, also, whose selections came after that of D'Alembert, left completely on one side certain physical circumstances which however it would seem could not be neglected without inquiry. Laplace supplied this omission. He showed that the sea notwithstanding its fluidity and the atmosphere, notwithstanding its currents, both influence, the movements of the axis of the earth or the equator, just as if they formed solid masses adhering to the terrestrial spheroid.

The axis around which our globe makes an entire turn every four and twenty hours, does it constantly pierce the terrestrial spheroid at the same material points? In other terms the poles of rotation, which from year to year correspond to different stars, are they also displaced on the surface of the earth? In the affirmative case, the equator is moved like the poles, the terrestrial latitudes are variable, no country, during the course of ages, will enjoy even as a mean, a constant climate; the most different regions may turn by turn become circumpolar. Adopt the contrary supposition, and every thing assumes a character of admirable permanence. The question which I have just raised, one of the capital ones in astronomy, can only be solved by single observations, so long as the ancient latitudes are uncertain. Laplace provided for this by analysis: the learned world was taught by the great geometer that no cause connected with universal gravitation ought sensibly to displace, on the surface of the terrestrial spheroid, the axis around which the world appeared to turn. The sea far from being an obstacle to the constant rotation of our globe around the same axis, would on the contrary bring back this axis to a permanent state, by reason of the mobility of its waters and the resistance which their oscillations encounter. All that I have said as to the position of the axis of the world must be extended to the duration of the movement, the rotation of the earth, which is the unity, the true standard of time. The importance of this element led Laplace to seek numerically whether it was affected by internal circumstances such as earthquakes and volcanoes. Need I say that the result was in the negative.

The admirable work of Lagrange on the libration of the moon seemed to have exhausted the matter, it was not however so. The movement of revolution of our satellite around the earth, is subjected to perturbation and inequalities, styled secular, and which were unknown to Lagrange, or neglected by him. These inequalities in the long run place the star, without speaking of whole circumferences, at a half circumference, or a circumference and a half from the position which it would otherwise occupy. If the rotary movement did not participate in such perturbations the moon in the course of time would successively present to us all the parts of her surface. This event will not happen, as the halfsphere of the moon now invisible will be invisible for ever. Laplace has shown indeed that the earth by its attraction, introduces into the rotary movement of the lunar spheroid, the secular inequalities which exist in the revolving movement. Such researches show the power of mathematical analysis in all its brilliancy. Synthesis would have led very difficulty to the finding out of truths so deeply hidden in the complicated actions of a multitude of forces.

We should be unpardonable if we forgot to place in the first rank, among the works of Laplace, the perfecting of the Lunar Tables. This perfecting, in truth, had for its immediate end the rapidity of distant maritime communications, and that which is of infinitely greater value than any mercantile consideration, the preservation of seamen's lives. Thanks to unparalleled sagacity, unbounded perseverance, and ardour always youthful and influential on his able fellow labourers, Laplace solved the problem of the longitude, more completely than any had dared to hope in a scientific point of view, more exactly than the nautical art required in its greatest refinement. The ship, the plaything of the winds and storms, has no longer to fear being left adrift in the immensity of the ocean. An intelligent view of the starry sphere will teach the pilot, everywhere and always, what is his distance from the meridian of Paris. The extreme perfection of the actual Lunar Tables gives to Laplace the right of being reckoned among the benefactors of mankind.

In the beginning of 1611 Galileo thought he found in the eclipses of the satellites of Jupiter a simple and rigorous solution of the famous nautical problem. Active negociations even were thenceforth commenced to introduce the new mode on board numerous vessels of Spain and Holland. The negotiations failed. From the discussion the evidence was obtained that the exact observation of the satellites would require powerful telescopes, and such telescopes could not be employed in a ship tossed about by the waves. The method of Galileo appeared at least to preserve all its merits on dry land, and to promise geography great improvements. These hopes were however found to be premature. The movements of the satellites of Jupiter are not nearly so simple as the immortal inventor of this method of taking the longitude supposed. It has required three generations of astronomers and geometers to labour with firmness in the determination of their strongest perturbations. It has required in fine that Laplace should bring in the midst of them the torch of mathematical analysis to give the tables of these little stars all the precision, requisite and desirable. New nautical ephemerides give five or ten years beforehand the indication of the hour at which the satellites of Jupiter will be eclipsed and reappear. The calculation does not yield in exactness to direct observation. In this group of stars considered apart, Laplace found perturbations analagous to those which the planets sustain. The promptitude of the revolutions reveals among them in a sufficiently short space of time changes which centuries alone would develope in the solar system. Although the satellites have a diameter hardly appreciable, even under the best telescopes, our illustrious fellow-countryman determined their masses. He discovered in fine in their movements, simple and extremely remarkable relations between the relative positions of these little stars, and which are called the laws of Laplace. Posterity will not blot out this designation, they will think it natural that the name of such a great astronomer should be written in the firmament alongside of that of Kepler.

Let us quote two or three of the laws of Laplace. If, after having added to the mean longitude of the first satellite the double of that of the third, we subtract from the sum triple the mean longitude of the second, the result will be exactly equal to 180 degrees, or half a circumference. Would it not be really extraordinary if the three satellites should have been placed originally at distances from Jupiter, and in respective positions, which were constantly and rigorously to maintain the before-named conditions? Laplace replied to this question by showing that there is no occasion the law should be rigorous in the origin. The mutual action of the satellites must have led to the present mathematical state, if once the distances and positions complied with the law in an approximate manner. This first law is equally true when the synodic elements are employed. It thence evidently results that the three first satellites of Jupiter can never be eclipsed at once. We see what we must believe as to a recent observation so much celebrated, and during which certain astronomers saw momentarily none of the four satellites around the planet. That in no wise authorises us to suppose them eclipsed: a satellite disappears when it projects itself upon the central part of the luminous disc of Jupiter, and also when it passes behind the opaque body of the planet.

Another very simple law is this, to which are subject the mean movements of the same satellites of Jupiter. If we add to the mean movement of the first satellite double the mean movement of the third, the sum is exactly equal to thrice the mean movement of the second. This numerical conjunction, perfectly correct, would be one of the most mysterious phenomena of the system of the world if Laplace had not proved that the law could only have been applied at the origin, and that the mutual action of the satellites had sufficed to make it rigorous. The illustrious geometer, pushing his researches to their minutest ramifications, arrived at this result. The action of Jupiter co-ordinates the rotary movement of the satellites, in such manner that, without regard to secular perturbations, the duration of the rotation of the first satellite, plus twice the duration of the rotation of the third, forms a sum constantly equal to thrice the duration of the rotation of the second.

By a deference, modesty, and timidity, without any plausible grounds, our workmen, in the last century, had given up to the English the monopoly of the construction of astronomical instruments. Thus let us openly acknowledge it, at the time when Herschel on the other side of the channel made his beautiful observations, there existed in France no means of following them and developing them; we had not even the means of verifying them. Happily for the scientific honour of our country, mathematical analysis is a powerful instrument. Laplace proved it so well that on a solemn occasion he foresaw from the depths of his study, and minutely announced, what the skilful astronomer of Windsor was going to see by making use of the largest telescopes which had ever come from the hand of man. When Galileo, in the beginning of 1610, directed toward Saturn a very weak telescope recently made by his own hands, he saw that this planet is only an ordinary globe, without however being able to give an exact account of its real form. The expression tri-corpus, by which the illustrious Florentine philosopher summed up his reflections, implied an idea completely erroneous. Our fellow-countryman Roberval was much more happily inspired; but from want of having given a detailed comparison of his hypothesis and his observations, he abandoned to Huygens the honour of being considered the author of the true theory of the phenomena which this admirable planet presents. Everybody now knows that Saturn is composed of a globe 900 times larger than the earth, and of a ring. This ring does not touch the inner globe at any point, it is everywhere removed 20,000 miles. Observations carry the breadth of the ring to 30,000 miles. The thickness is certainly not 250 miles. Except an obscure streak, which, going through the whole extent of the ring, divides it into two parts of unequal breadth and dissimilar brightness, this strange colossal bridge without piers had never presented to the most experienced and most able observers either spot or pertuberance capable of deciding whether it were immovable or gifted with a rotary movement. Laplace considered that it was little probable, if the ring were immovable, that its constituent parts should resist, by their simple adherence, the attractive and continual action of the planet. A movement of rotation suggested itself to his mind as the conservative principle, and he determined the requisite speed; the speed thus calculated is equal to that which Herschel deduced later from extremely delicate observations. The two parts of the ring, being placed at different distances from the planet, could not fail to be affected from the action of the sun with different movements of precession. The planes of the two rings should thus, it seemed, be generally inclined to each other, while observation incessantly shows them confused together. It was then requisite that a cause should exist capable of neutralizing the solar action. In a paper published in Feb. 1789, Laplace found that this cause must be the flattening of Saturn, produced by a rapid rotary motion of that planet, of which Herschel announced the existence in August 1789. It will be remarked how the eye of the mind can, in certain cases, supply the most powerful telescopes, and lead to astronomical discoveries of the highest order.

Let us descend from heaven to earth. The discoveries of Laplace will be found neither less important nor less worthy of his genius. The tides, that phenomena which an ancient in despair called "the tomb of human curiosity," have been, by Laplace, connected with an analytical theory, in which the physical conditions of the question figure for the first time. Thus calculators, to the great benefit of our maritime coasts, hazard themselves now in foretelling several years in advance the circumstances of hour and height of great tides, without any further disquietude as to the result, than if it concerned the phases of an eclipse. There exists between the phenomena of the flow, ebb, and alternative actions which the sun and moon exercise on the liquid stratum which covers three quarters of the globe, an intimate necessary connection, in which Laplace, making use of twenty years observations at Brest, determined the value of the mass of our satellite. Science now knows that 75 moons would be requisite to form a weight equivalent to that of our earthly globe, and this is due to the attentive and minute study of the oscillations of the ocean. We only know of one means of adding to the profound admiration which all attentive minds will doubtless feel for theories susceptible of such consequences. An historical quotation will supply us with it: we will recall that in 1631, in his celebrated Dialogues, the illustrious Galileo was far from seeing the mathematical connections whence Laplace deduced such beautiful, such evident, and such useful results that he charged as *ineptia* the loose conception of Kepler of attributing to lunar attraction a certain part in the daily and periodical movements of the waves. Laplace did not confine himself to extending them so widely, to perfecting in a manner so essential the mathematical theory of the waves; he considered further the phenomenon under quite a new light; it was he who first treated of the stability of the equilibrium of the sea. The systems of solid or liquid bodies are subject to two kinds of equilibrium, which must be carefully distinguished. In the former, in firm or stable equilibrium, the system slightly removed from its primitive position, incessantly tends to return to it. In the unstable equilibrium, on the other hand, a slight shock in the beginning may, in the long run, become enormous. If the equilibrium of the waves is of the latter kind, waves engendered by the action of the wind, by earthquakes, and by sudden movements at the bottom of the sea, might, in the end, raise themselves to the height of the highest mountains. The geologist would have the satisfaction of seeking in these prodigious oscillations for rational explanations of a great number of phenomena, but the world would be exposed to new and terrible cataclysons. People may be comforted; Laplace has proved that the equilibrium of the ocean is stable, but on the express condition, elsewhere established by certain facts, that the mean density of the liquid mass be inferior to the mean density of the earth. For the actual sea always remaining in the same state, let us substitute an ocean of mercury, and stability will have disappeared, and the liquid will frequently leave its bounds to devastate continents even in the snowy regions lost in the clouds. Do we not remark how every analytical research of Laplace has shown, in the universe and in our globe, conditions of order and durability.

It was impossible that the great geometer, who had so well succeeded in the study of the ocean tides, should not study the tides of the atmosphere; that he should not subject to the delicate and definitive proofs of rigorous calculation, the opinions, generally spread, touching the influence of the moon on the height of the barometer, and on other meteorological phenomena. Laplace, in truth, has devoted a chapter of his beautiful work to the examination of the fluctuations which the attractive force of the moon can effect on our atmosphere. It results from these researches that at Paris the lunar flux measured on the barometer is nowise sensible. The value of this flux, obtained by the discussion of a long series of observations, has not exceeded two hundredths of a millimeter, ($\frac{1}{1200}$ of an inch,) a quantity inferior to those for which it is possible to answer in the actual state of meteorological science. The calculation to which I have just referred may be adduced in support of the considerations to which I had recourse in another article of the Annuaire, when I endeavoured to establish that if the moon modifies, more or less, according to its different phases, the height of the barometer, it is not by attraction.

No one was ever more ingenious than Laplace in laying hold of the relations and intimate connections between phenomena apparently different; no one showed more ability in drawing important conclusions from these unexpected comparisons. Toward the end of his days, for instance, he upset by a stroke of his pen, with the help of a few observations of the moon, the cosmogonic theories of Buffon and Bailly, so long in vogue. According to these theories the earth moved towards an inevitable and approaching congelation. Laplace, who never contented himself with a vague expression, endeavoured to determine by numbers the great speed of cooling in our globe, which Buffon had so eloquently, but so gratuitously announced. Nothing could be more simple, better connected, or more demonstrative, than the chain of deductions of the celebrated geometer. A body lessens in its dimensions when it cools. According to the most elementary principles of mechanics, a rotary body which contracts must inevitably turn faster and faster. The day at all periods has had for its duration the time of the earth's rotation; if the earth cooled down the day must incessantly shorten. But there is a means of discovering whether the duration of the day has varied: it is to examine in each century what has been the arc of the celestial sphere which the moon has traversed during the time that the astronomers of the period called a day, during the time that the earth employs to make a revolution on itself; the speed of the moon being in truth independent of the duration of the rotation of our globe. Now take with Laplace, in known tables, the slightest values, if you like, of the dilatations or contractions to which solid bodies are subject from changes in temperature; then search in the annals of Greek, Arab, and modern astronomy to find the angular velocity of the moon, and the great geometer will from these data bring the invincible proof that in 2000 years the mean temperature of the globe has not varied the hundredth part of a centigrade degree. There is no effect of eloquence which can resist the authority of a similar argument, the power of such figures. Mathematics have in all times been implacable adversaries of scientific romances.

The fall of bodies, if it were not a phenomena of every moment, would excite justly, and in the highest degree, the astonishment of men. What is more extraordinary, indeed, than to see a mass inert, that is to say deprived of will, a mass which can have no propensity to move in one direction more than another, precipitate itself towards the earth as soon as it ceases to be upheld. Nature engenders the weight of bodies by ways so concealed, so much beyond the reach of our senses, and the ordinary resources of human intellect, that the philosophers who, in antiquity, thought they could explain everything mechanically, according to the simple evolutions of atoms, excepted weight. Descartes tried what Leucippus, Democritus, Epicurus, and their schools had thought impossible. He made the fall of terrestrial bodies depend on the action of a whirlwind of very subtile matter circulating around our globe. The real improvement which the illustrious Huygens added to the ingenious conception of our fellow-countryman were far, however, from giving clearness and precision to it, those characteristic attributes of truth. Those appreciate very ill the direction, the bearing of one of the greatest questions in which the moderns have engaged, who see Newton come forth victorious from a contest in which his two immortal predecessors had succumbed. Newton no more discovered the cause of gravitation than Galileo had done. Two bodies near each other approach. Newton did not seek the nature of the power which produced this effect. The power exists, he calls it by the name of attraction, but with the warning that the term from his pen implies no fixed idea touching the mode of physical action, according to which gravitation arises and is brought into action. Attractive force once admitted as a fact, Newton follows it up and studies it in terrestrial phenomena, in the revolution of the moon, planets, satellites, comets, and, as we have already said, he produces from this incomparable labour the mathematical, simple, and universal characters of the forces which preside over the movements of all the stars which compose our planetary system. The loud applauses of the learned world did not prevent the immortal author of the Treatise on Natural Philosophy from hearing isolated voices pronounce, as the occasion of universal attraction, the words "occult qualities." This word made Newton and his most devoted and enthusiastic disciples give up the reserve which they thought it their duty to observe. Then were banished to the class of the ignorant those who considered attraction as an essential property of matter, as the mysterious index of a sort of charm; who supposed that two bodies could act upon each other without the intermediation of a third body: then this power became in every place either the resultant of the effort made by a certain fluid (ether), to escape into the free regions of space, where its density is at its maximum, towards the planetary bodies around which it exists in the greatest state of rarefaction, or either the consequence of the impulse of some fluid medium.

Newton never explained himself categorically on the manner in which an impulse, the physical cause of the attractive power of matter, could arise, at least in our solar system. But we have now very strong reasons for believing that in writing the word impulse the great geometer was thinking of the systematic ideas of Varignon and Natio de Duillier, later restored and perfected by Lesage; these ideas, in fact, had been communicated to him before publication. According to Lesage's ideas, there are in the regions of space corpuscles moving themselves in all possible directions, and with excessive rapidity. The author gave to these corpuscles the name of ultra-mondane corpuscule. Their aggregate composed the gravific fluid, if, however, the designation of fluid could be applied to a collection of particles having no connection together. An unique body, placed in the middle of such an ocean of movable corpuscles, would remain in repose, since it would be equally pushed in every direction. On the other two bodies would move towards each other, for their regardant surfaces would no longer be struck, in the direction of the line which would join them, by the ultra-mondane corpuscles; for there would then exist currents of which the effect would no longer be destroyed by counter currents. It is easily seen that two bodies placed in the gravific fluid would tend to approach, with an intensity which would vary in the inverse ratio of the square of the distances. If attraction is the result of the impulsion of a fluid, its action should employ a finite time in passing through the immense spaces which separate the heavenly bodies. The sun would then be suddenly annihilated, so that after the catastrophe, mathematically speaking, the earth would still feel its attraction for some time. The contrary would happen on the sudden birth of a planet; a certain time would transpire before the attractive action of the new star would be felt on our globe. Several geometers of the last century believed that attraction was not instantaneously transmitted from one body to another; they even gifted it with a very slight velocity of propagation. Daniel Beruouilli for instance, wishing to explain how the highest tide arrives on our coasts a day and a half after the syzygies, that is to say, a day and a half after the epochs when the sun and moon have been most favourably situated for the production of this magnificent phenomenon, admits that the lunar action employed all this time (a day and a half) in transmitting itself from the moon to the sea. Such a low velocity could not be made to agree with the mechanical explanations of the weight of which we have spoken. The explanation, indeed, imperiously supposes that the proper velocity of the heavenly bodies is comparatively insensible to that of the gravific fluid.

Before having found that the actual diminution of eccentricity in the earthly orbit is the real cause of the acceleration observed in the movement of the moon, Laplace, on his side, had sought whether this mysterious acceleration did not depend on the successive propagation of attraction. Calculation for a moment made the supposition plausible. He showed that the gradual propagation of attraction would inevitably introduce into the movement of our satellite a perturbation proportionate to the square of the time lapsed, beginning with any epoch; that to represent numerically the results of astronomical observations, it would be by no means necessary to attribute to attraction low velocities; that a propagation eight million times more rapid than that of light would satisfy all these phenomena. Although the true cause of the acceleration of the moon be now well known, the ingenious calculation of which I have just spoken does not the less preserve its place in science. In a mathematical point of view, the perturbation dependant on the successive propagation of attraction which this calculation points out, has a certain existence. The connection between the velocity and the perturbation is such that one of the two quantities leads to the numerical knowledge of the other. But by giving to the perturbation the maximum value which observations allow when they are corrected by the known acceleration arising from the change of eccentricity in the earthly orbit we find for the velocity of the attractive force—fifty million times the speed of light. By recollecting that this number is a minimum limit, and that the speed of the luminous rays equals 200,000 miles per second, those philosophers who pretend to explain attraction by the impulse of a fluid, will see what prodigious velocities they have to satisfy. The reader will here again remark with what sagacity Laplace knew how to take advantage of the phenomena best adapted to throw light on the ardous questions of celestial physics; and with what good fortune he explored them, bringing forth numerical conclusions before which the mind becomes confused.

The author of the *Mécanique Céleste* admitted with Newton that light is composed of material molecules of excessive tenuity, and gifted in free space with a velocity of 200,000 miles per second. However we must warn those who would take advantage of this imposing authority that the principal argument of Laplace in favour of the system of emission was the possibility of subjecting everything in it to simple and rigorous calculation, while the undulatory theory presented to analysis, and still offers immense difficulties. It was material for a geometer who had so elegantly connected with attractive and repulsive forces, the laws of simple refraction to which light obeys in the atmosphere, and of double refraction which it obeys in certain crystals, should not abandon this path before having mathematically ascertained the impossibility of arriving in the same manner at plausible explanations of the phenomena of diffraction and polarisation. Besides the care which Laplace always took to push his researches as much as possible to numerical deductions will permit philosophers, who undertake a complete comparison of the two rival theories of light, to seek in the *Mécanique Céleste*, the data of many comparisons very striking and full of interest. Is light an emanation from the sun? does that star dart at every moment and in all directions, a part of its own substance? does it diminish gradually in mass or volume? The solar attraction of our globe would then become less and less considerable; the radius of the terrestrial orbit, on the other hand, could not fail to increase, and the length of the year would receive a corresponding augmentation. That is with every one the result of a first glance. By applying analytical calculation to the question, by descending thus to numerical applications by the help of the more precise results of observation as to the duration of the year in different ages. Laplace proved that in 2000 years a constant emission of light has not diminished the mass of the sun one two thousandth part of its primitive value.

Our illustrious fellow-countryman never proposed to himself anything vague or indeterminate. His constant object was the explanation of some grand natural phenomena, according to the inflexible rules of mathematical analysis. No philosopher, no geometer more carefully kept himself in check against the spirit of systematizing. No one feared more the scientific errors which imagination brings forth, when it is not circumscribed with the bounds of facts, calculation and analogy. Once, once only, Laplace cast himself like Kepler, like Descartes, like Leibnitz, like Buffon, in the reign of conjecture. His conception was then nothing less than a cosmogony.

All planets revolve around the sun from west to east, and in planes which form with each other very slight angles. The satellites move around their respective planets like the planets around the sun, that is to say, from west to east. The planets and the satellites, of which the movements of rotation can be observed equally turn on their centres from west to east. In fine the rotary movement of the sun is also affected from west to east. There is therefore a total of forty-three movements similarly directed. By the calculation of probabilities there are more than four thousand milliards to one against this similitude indirection of so many movements being the effect of chance. Buffon is, I believe, the first who has attempted to give an account of this singularity of our solar system. Wishing to abstain from resorting in the explanation of phenomena to causes out of nature, the celebrated academician sought a physical origin or what is common in the movement of so many stars; of so many stars, different in their size, forms, and distances, from the principal centre of attraction. This origin he thought he had found by making this triple supposition; a comet fell obliquely on the sun; it pushed before it a torrent of fluid matter; this matter, transported according to its different degrees of levity, more or less far from the sun, formed by concentration all the known planets. The bold hypothesis of Buffon is subject to insurmountable difficulties, I have already sufficiently illustrated them in my notice on comets. I may therefore confine myself to pointing out here in a few words the cosmogonic system which Laplace substituted for that of the illustrious author of the Natural History.

According to Laplace the sun was at a remote period, the central nucleus of an immense nebulosity which had a very high temperature, and extended far beyond the region where Herschel now moves. At that time no planet existed. The solar nebulosity was gifted with a general movement of revolution directed from west to east. On cooling down it could not fail to sustain a gradual condensation, and thenceforth to turn faster and faster if the nebulous matter extended originally in the equatorial region as far as the limit at which the centrifugal force exactly counterbalanced the attractive action of the nucleus, the molecules situated at that limit, should during the condensation separate from the rest of the atmospheric matter and form an equatorial zone, a ring turning separately and with its primitive velocity. It may be conceived that analagous separations would take place at different periods, that is to say, at various distances from the nucleus, in the superior strata of the nebulosity, and that they would give rise to a succession of distinct rings kept almost in the same plane, and gifted with different velocities. This once admitted, we easily see that the indefinite preservation of the rings would have required in their whole circumference a composition little probable. Each of them broke then in its turn into several masses which were endowed, as it is easily to be conceded, with a rotary movement in the common direction of revolution, and which on account of their fluidity assumed spheroidal forms. If we allow now that one of these spheroids may have swallowed up all those arising from the same ring, it will be sufficient to give it a mass superior to that of all the others. In each of the planets in the vaporous state of which we have just spoken, the mind recognizes a central nucleus gradually increasing in mass, and an atmosphere which presents at its successive limits, phenomena entirely similar to those which the solar atmosphere, properly so called had presented to us. We thus assist at the birth of the satellites and of the ring of Saturn. The system of which I have just given a sketch, has for its object to show how a nebulosity gifted with a general movement of rotation should in the long run transform itself into a very luminous central nucleus (the sun), and into a series of distinct spheroidal planets, distant one from another, all moving around the central sun in the direction of the primitive movement of the nebulosity; and how these planets would thus have around their centres movements of rotation similarly directed, how in fine the satellites, when formed, could not fail to turn on themselves and around the planets which carry them along, in the direction of the rotation of those planets, and of their circulating movement around the sun. We have just observed conformably with the principles of mechanics, the forces with which the particles of the nebulosity were primitively gifted, in the movements of rotation and circulation of the distinct and compact to which these particles had given rise by agglomeration. But in so doing we make only a single step. The primitive movement of rotation in the nebulosity does not result from simple attractions; this movement seems to indicate the actioo of an impulsive primordial force. Laplace is far from holding with respect to this the almost general opinion of philosophers and mathematicians. "He does not believe that the mutual attraction of bodies primitively motionless, would in the long run, reunite all these bodies in a state of repose, around a common centre of gravity." He maintains on the contrary, that three bodies without movement, of which two should be much larger in mass than the third, would not agglomerate into an homogeneous mass, but only in exceptional cases. In general the two larger bodies would unite together, while the third would revolve around the common centre of gravity. Attraction would thus become the cause of a kind of motion to which impulse would seem alone capable of giving birth.

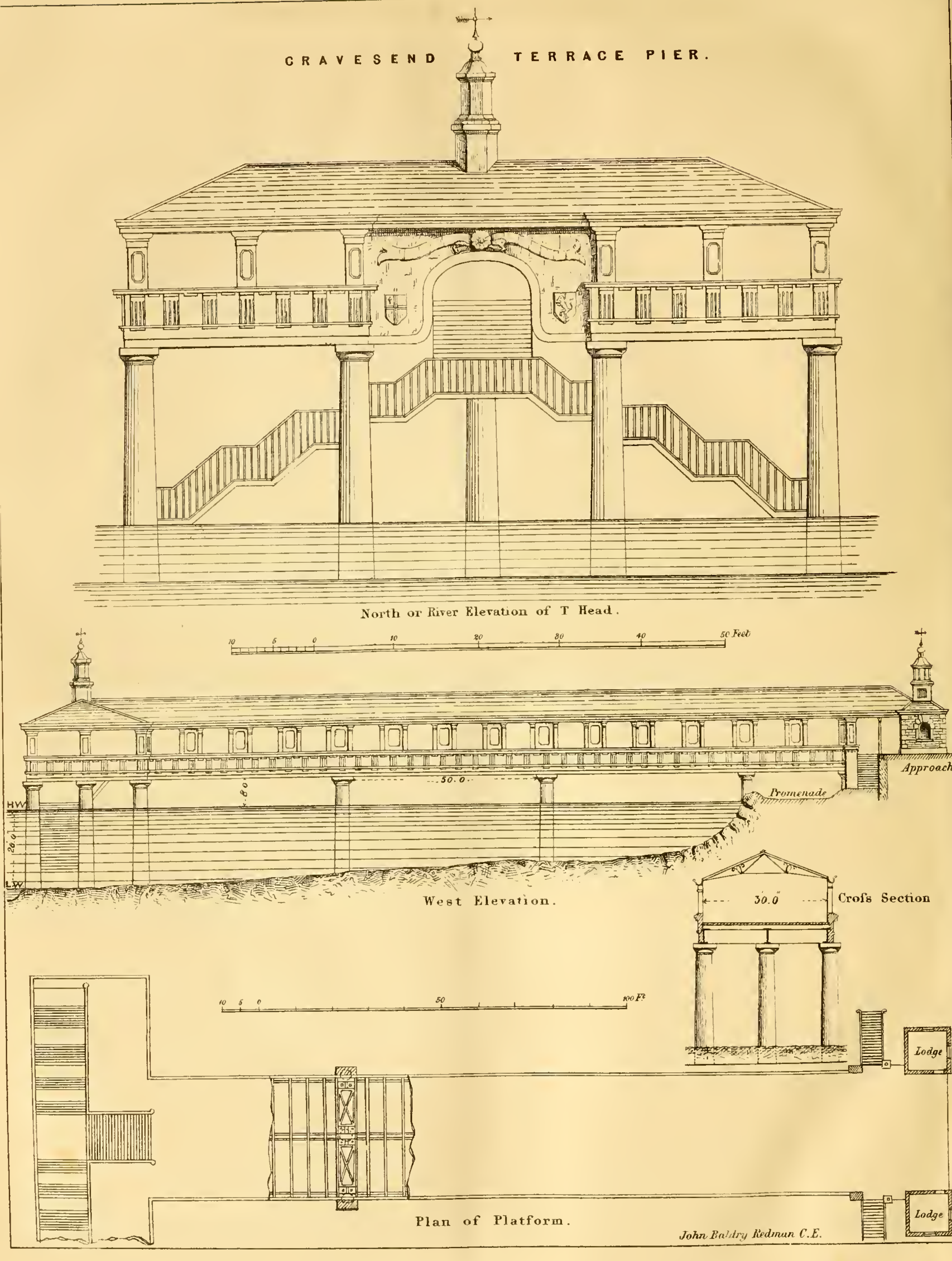
In might in truth be believed that in laying down this part of his system, Laplace had before his eyes the words which Jean Jacques Rousseau had placed in the mouth of the Savoyard curate, and which he endeavoured to refute. "Newton has discovered the law of attraction," says the author of *Emile*, "but attraction alone would soon reduce the universe to a motionless mass; to this law it has been requisite to add a projectile force to make the heavenly bodies describe curves. Let Descartes tell us what physical law has made his vortices turn round; let Newton show to us the hand which directed the planets on tangent of their orbits."

According to the cosmogonic ideas of Laplace, comets, in the origin, were not part of our system; they have not been formed at the expense of the matter of the immense solar nebulosity; they must be considered as small wandering nebulosities which the attractive force of the sun has deviated from their primitive path. Those of the comets which penetrated into the great nebulosity at the period of its condensation, and the formation of the planets, fell into the sun describing spirals, and would by their action, more or less, remove the planes of the planetery orbits from the plane of the solar equator, with which they would otherwise exactly have coincided. As to the zodiacal light, that stumbling block on which so many theories have fallen, it is composed of the most volatile particles of the primitive nebulosity. These molecules not having combined with the equatorial zones, successively abandoned in the plane of the solar equator, continue to revole at the distances at which they were primordially, and with their origioal velocity. The existence of this extremely rare matter, in the region occupied by the earth, and even only in that of Venus, seemed irreconcileable with the laws of mechanics; but that was when, by placing the zodiacal matter in the immediate dependence of the solar photosphere, properly so called, there was impressed on it an angular movement of rotation, equal to that of this photosphere, a movement by means of which its entire revolution would only require twenty-five days and a half.

Laplace presented "his conjectures on the formation of our solar system, with the mistrust which everything must inspire which is not the result of calculation and observation." Perhaps it is to be regretted that they did not receive greater developement, particularly in what regards the division of matter into distinct rings; perhaps it is unfortunate that the illustrious author has not sufficiently explained himself as to the primitive physical condition, the molecular condition of the nebulosity, at the expense of which were formed the sun, planets, and satellites of our system; perhaps it is to be regretted in particular that Laplace should have thought proper to pass so slightly over the possibility, evident according to him, of the movements of revolution, resulting from the action of simple attractive forces, &c. Notwithstanding these omissions, the ideas of the author of the Mécanique Céleste are nevertheless the only ones which, by their grandeur, coherence,, and mathematical character, can be truly considered as forming a physical cosmogony; the only ones which in the present day find a powerful support in the results of the recent labours of astronomers on the nebulosities of every kind with which the firmament is sprinkled.

In this analysis we have thought proper to concentrate attention on the *Mécanique Céleste.* The System of the World and the Analytical Theory of Probabilities would not require less developement The Exposition of the System of the World is the *Mécanique Céleste.* stripped of its grand panalopy of analytical formulas, through which, must indispensably pass every astronomer who, according to the expression of Plato, wishes to know "what figures" govern the material universe. It is in the Exposition of the System of the World that persons unacquainted with mathematics must seek an exact and sufficient idea of the methods to which physical astronomy owes its astonishing progres. This work, written with noble simplicity, exquisite propriety of expression, and scrupulous correctness, concludes with an abridgement of the history of astronomy, now classed, by an unanimous judgment, among the finest monuments of the French language. It has often been regretted that Cesar, in his immortal Commentaries, has confined himself to the relation of his own campaigns; the astronomical commentaries of Laplace extend to the origin of society. The endeavours made in all ages to snatch from the firmament new truths are there analysed with justice, clearness, and profundity; it is genius constituting itself the impartial appreciator of genius. Laplace alway remained at the head of this grand mission, and his work will be read with respect as long as the torch of science shall give forth light.

The calculation of probabilities, kept within proper limits, interests, in an equal degree, the mathematician, the experimentelists, and the statesman. From the period, already remote, when Pascal and Fermat


GRAVESEND TERRACE PIER.
North or River Elevation of T Head.
10 5 0 10 20 30 40 50 Feet
HW
LW
8.0
26.0
50.0
Approach
Promenade
West Elevation.
30.0
Crofs Section
10 5 0 50 100 Ft
Lodge
Lodge
Plan of Platform.
John Baldry Redman C.E.

nal laid down the first principles of it, it has rendered, and daily renders, eminent service. It is the calculation of probabilities, which after having regulated the best arrangements of Tables of Population and Mortality, teaches us how to draw from the figures, generally so badly interpreted, precise and useful conclusions; it is the calculation of probabilities which alone can regulate with equity the rates of premiums of insurance, subscriptions to tontines, poundage for superannuations, annuities, discounts, &c.; it is under its attacks that the lottery, and so many shameful snares set by cunning for ignorance and cupidity, have finally succumbed. To sum up all in one word, the Analytical Theory of Probabilities is worthy of the author of the *Mécanique Céleste.*

A philosopher, whose name recalls immortal discoveries, said to his auditor, who were too much fascinated with ancient and consecrated reputation, "Remember, that in matters of science, the authority of a thousand is not worth the humble reasoning of one." Two centuries have passed over the words of Galileo without diminishing their value, and without hiding their truth. Thus, instead of displaying a long list of illustrious admirers of the three splendid works of Laplace, we have preferred just to glance over some of the mighty truths which mathematics have there disclosed. Let us not, however, carry our strictness to excess, and since chance has brought into our hands a few unpublished letters of one of those men of genius to whom nature has given the rare faculty of seizing, at the first glance, the culminating points of objects, we may perhaps be allowed to extract from three, two or three brief and characteristic fragments on the *Mécanique Céleste* and the Treatise on Probabilities.

On the 27th Vendemiaire, in the year X, after having received a volume of the *Mécanique Céleste,* General Bonaparte wrote to Laplace, "The first *six months* which I have at my disposal, shall be devoted to the perusal of your fine work." It seemed to us that the words "the first *six months,*" take away the appearance of an ordinary complimentary letter of thanks, and contains a just appreciation of the importance and difficulty of the matter. On the 5th, Fremaire in the year XI, the reading of a few chapters of the volume which Laplace had dedicated to him, was for the General "a new cause of regret that the force of circumstances had placed in a career which separated him from that of science. At least," added he, "I earnestly desire that future generations, in reading the *Mécanique Céleste,* may not forget the esteem and friendship which I felt towards its author." On the 17th Prairial, in the year XIII, the General, then Emperor, wrote from Milan, "The *Mécanique Céleste* seems to me destined to shed a new lustre on the age in which we live." In fine, on the 12th August, 1812, Napoleon who had just received the Treatise on the Calculation of Probabilities, wrote from Witepsk the letter which we give verbatim. "There was a time when I should have read with interest your Treatise on the Calculations of Probabilities; now, I must confine myself to expressing the satisfaction which I feel every time that I see you publishing new works, which improve and extend the first of sciences, and contribute to the national glory. The progress and improvement of mathematics is intimately connected with the prosperity of the state."

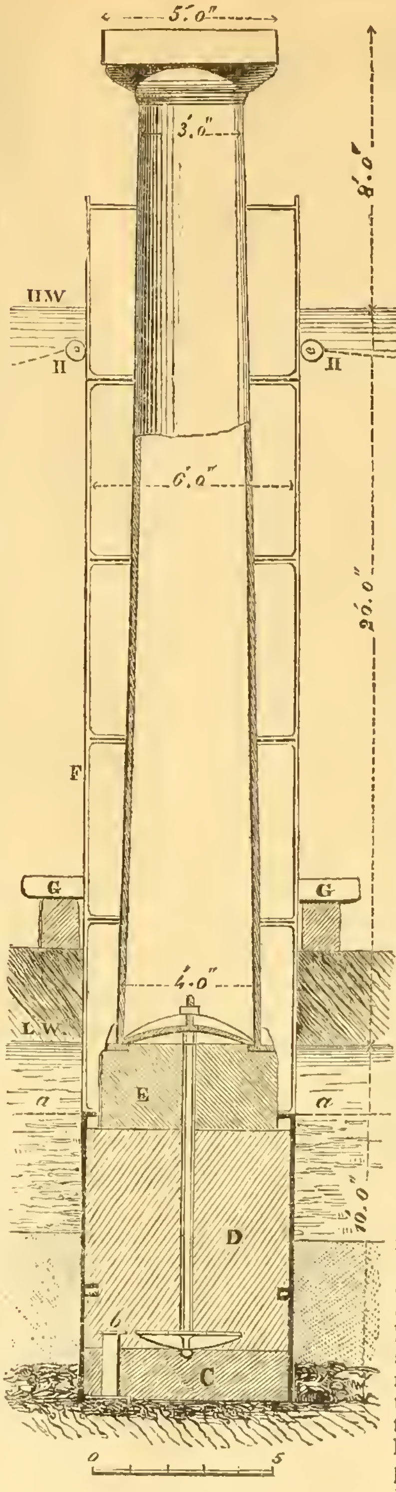
I have now arrived at the conclusion of the task I had undertrken. I shall be forgiven, I hope, for having shown in so much detail the principal discoveries which philosophy, astronomy, and navigation, owe to our mathematicians. It seemed to me that, by recalling the glorious past, I showed to my contemporaries the whole extent of their duties towards their country. In truth, nations in particular, should remember the old adage "*noblesse oblige,*" nobleness obliges.

GRAVESEND TERRACE PIER.

(With an Engraving, Plate XIV.)

In the Journal for February last we gave a general description of this work, which is being erected under the immediate direction of Mr. John Baldry Redman, Civil Engineer, and of its then state of forwardness, and we have now the opportunity of presenting our readers with drawings of the work, and a cut showing the construction of the foundations of one of the main columns.

The principal part of the work is completed, including the approaches, the foundations, main columns, girders and platform, and the offices or lodges at the entrance with the clock turret and belfry surmounting the same. The pilaster standards to support the roof are fixed, excepting those over the T head, and a large portion of the upper cornice forming the guttering to the roof; also the chief portion of the joists of the platform, and the architrave and frieze of the entablature on either side up to the T head, where some of the staircase bearers are also fitted. The foundations of the columns, considering the locality, have been got down in a novel manner. The cut annexed exhibits a section of one of the foundations of the south side of



Reference.

H. W., high water level spring tides.

L. W., low water level ditto.

The lowest stratum is of chalk, with an overlaying bed of flints, the next above yellow sand, then silt, above which is mud which forms the bed of the river.

a a, the cylinders below this level were left in the ground and those above removed.

b, pipe connected with suction pipe of pump.

C, cement bottom.

D, brickwork in pozzolano.

E, stone base.

F, iron cylinders.

G, guide frame of timber.

H, chain guys.

the T head. The columns weigh each on an average 9½ tons, and are 28 feet long, 4 feet in diameter at the base and 3 feet at the top of the shaft, and were, as well as the cylinders and the rest of the heavy castings, placed in position by means of travelling machinery, as described in our former notice. The bases of the columns are level with low water of spring tides, standing upon a brick and stone foundation, which was got in in the following manner. Cast iron cylinders 6 feet in diameter and ⅝ in. thick, each ring being formed of four segmental plates, those of each ring breaking joint over one another, were sunk down through the bed of the river to the chalk substratum, excavating the ground from within them as they sunk, adding additional lengths as required; they thus formed caissons, or more properly miniature cofferdams, the top being kept always above the level of high water.

The plates varied in height, being 5, 4 and 3 feet, to form different heights to suit the variation in the ground; the joints of those lengths left in were formed with iron cement, as also the vertical joints of the temporary lengths, the horizontal ones being formed with felt and white lead and gaskins and grease, for the convenience of taking to pieces. The foundations of the first tier of columns next the abutment were got in in the same manner as the foundations of the abutment, wing walls, &c., viz. by excavating to the required depth and supporting the sides by timbering, the water from the river being kept out by a puddle bank. The cylinders of the 2nd and 3rd tier of columns were placed within large ones 7 feet in diameter, sunk about one-half the depth required for the foundation, they were kept as well as the inner cylinders above high water, and were supported by timber clamps to prevent them sinking with the others; the 6 feet cylinders placed within were thus relieved from a large portion of the pressure of the ground, leaving them more free to sink, and giving the opportunity of guiding them by wedging between the cylinders. The cylinders to the T head foundations were sunk without these outer cylinders; guide frames of timber were placed upon the shore and bolted to the piles of the temporary framework enclosing the area of the pier, keeping the cylinders in position below, the same object being gained above by means of a guide band of wrought iron, with friction rollers playing against the sides of the cylinders, and kept in position by chain guys with adjusting screws. This plan was adopted at the T head, the amount of excavation being less, and some of the cylinders of this portion of the pier were bottomed in three or four tides, and the excavation got out dry from the ground being less disturbed; for, in the other case, the larger cylinders, notwithstanding all the care taken to support them, followed the inner cylinders either by sliding through the clamps, or dragging down those temporary piles driven to the least depth.

When the cylinders were placed in position a weight of from 5 to 10 tons was placed on them, driving them from 4 to 5 feet into the mud, and the excavation being carried 12 inches below the sharp edge of the bottom cylinder, the weights were again applied.

The cylinders being sunk to the required depth upon the solid substratum, and the bottom levelled, a floor was formed of a couple of courses of dry bricks, and a thickness of 18 inches or 2 feet of brickwork, from thence brought up in Roman cement, with two courses of plain tiles also in cement to break joint. This precaution was taken to keep out the land springs, which in some of the foundations came up in considerable volume; the spring water was led up through the brickwork by an iron pipe bedded upon the dry bricks below, channels being led to it; the suction pipe of the pump being connected with it, by this means the water was kept below the work as it was got in; when the cement bottom was finished it was left a tide, the spring water flowing over it through the pipe, and the river water by plug holes in the cylinders; at low water the cylinder was again pumped dry, the pipe was then filled up with concrete, formed of fine Thames ballast and cement, to set quickly, and a blank flanch screwed on at top. In some cases it was necessary to bring up an additional length of pipe, and a larger body of brickwork, before stopping out the spring water. This on account of a larger supply, and with the outer foundations of the T head a large body of cement concrete was put in through the water until sufficiently high to get in the cement brick bottom, the springs from the chalk being very powerful at the extremity of the T head and varying with the tide, the concrete being put in at low water, when the springs were weakest.

The brickwork above the cement bottom was brought up in pozzolana mortar, iron hooping being introduced every fourth course laid crosswise to bond the whole together; a cast iron cross is in each foundation bedded in the brickwork, at the level shown; through this a 2 inch wrought iron bolt is led and built into the work, leaving a space of 4½ inches square around it for play, to assist in adjusting it in its place by wedges upon the completion of the brickwork, and the space around the bolt is filled with thin concrete. This hold down bolt passes through the Bramley Fall stone base, which forms the cap to the pier and upon which the column is bedded, the base flanch of which is let in for its thickness into the stone; the through bolt is screwed down upon the inner flanch of the column through the medium of a cast iron cross, the arms of which bed upon the flanch, the nut of the through bolt being screwed down against the boss of the cross.

Two lengths of cylinders are left in around the brick pier, thus forming a casing to it; the upper lengths of cylinders were unbolted at the second horizontal joint from the bottom when the work was up to that level; and when the stone was set and the column fixed, the temporary lengths of cylinder were drawn up over the shaft, the caps being cast separate and bolted permanently to the shafts upon the removal of the temporary cylinders.

The principal novelty in these foundations is, applying cast iron cylinders in such a way as to exclude the flow of a rapid tideway, thus enabling the men to work at nearly all times of tide, and when the bottom is once got in, at any time; thus dispensing with a large amount of pumping, which is proved by the fact that these foundations, at so great a depth and with so large a head of water, were kept clear of water by hand-pumps, and a steam engine dispensed with; with the greater number of the foundations but little difficulty was experienced in keeping down the water with single 6 inch pumps, but with the outer foundations of the T head a double-headed pump worked by a large gang of men was used, on account of the powerful springs before referred to, coming into some of the cylinders at certain times of tide at the rate of 80 gallons per minute, nor could the water in these cases be kept down beyond a certain point, viz. 12 to 18 inches above the bottom, for which reason it was found next to impossible to get in brickwork, although clamps of several bricks cemented together were tried, and the cement concrete was adopted, let down in buckets and upset after passing through the water, and trod down by the workmen at the same time.

It was usual to have a tier of three cylinders in hand at one time, and at one period at the T head four were in operation at once; but it was found advisable not to bottom more than one at a time, as, the experiment being tried, it was found that on tapping the springs in two cylinders at once there was a communication between the two, and if the pumps were not kept at work in each at the same time an increased supply ensued, from the water accumulating in the other cylinder, and the height of this column of water determining the force of the spring in the other cylinder.

The usual course was for one cylinder to be pitched and loaded, in another digging proceeding, and in the third for the builder's work to be in hand.

The cylinders or wells of brickwork used for foundations in India in sinking through sand, as described by Capt. Goodwyn at the Institution of Civil Engineers the session of 1842 (See Vol. 5, p. 164), are sunk with the water within them, and the iron cylinders used by Messrs. Walker and Burges for the Point of Air lighthouse, as described in the last number of this Journal, were only sunk when the tide had left the sand bank on which the foundations for that structure are formed; and we believe this is the first instance of cylinders being applied so as to exclude the tidal flow of a rapid river, making them effect the same object as a coffer dam; or that cylinders have before been applied for the purposes of foundations for a structure of this kind on so large a scale. In reference to these cylinders, it may be observed in conclusion that the principal difficulty experienced in sinking them was—The extreme accuracy required in placing them in position, and the still greater care required in keeping them there and upright, though this may be most certainly effected by a proper system of guides to keep the cylinder in position, but leaving it free enough to sink readily. In one or two cases, when these cylinders were first commenced, considerable difficulty was entailed from not attending sufficiently to this, as the cylinders got out of position, and in replacing them the ground got disturbed and caused *blows* through the sand stratum overlying the chalk, the mud and sand coming up into the cylinder; as, however, the work advanced, this was entirely obviated, and the excavation got out comparatively dry, and in the majority of cases without a *blow*.

Great care was requisite in fixing the columns, for each being placed on a separate base, rendered greater attention necessary in setting them. They are, considering these circumstances, remarkably level and lineable with one another. There are three columns in the width of the pier at each point of support, and they are 15 ft. apart from centre to centre, leaving a space of 10 ft. between the caps, which is occupied by a cross brace bolted to the caps; and the columns most exposed to vibration are farther secured by 2-in. wrought-iron diagonal tie-rods, bolted to lugs cast upon the columns and tightened up by gibes and keys; the iron girders supporting the platform and entablature are bolted to the caps of the columns, the bolt-holes being slotted and spaces left between the ends of the girders to allow of expansion and contraction of the metal, the large girders, six of which are 55 ft. and three 56 ft. in length, weigh eight tons each, they are parallel, 3 ft. in depth, and are cambered 1½ in. to allow for deflection; to diminish their weight the sectional area is reduced to a minimum at the ends in the thickness of the top and bottom flanches and connecting web; the seats were carefully fitted to the plane surfaces of the capitals by means of wrought fillet pieces rivetted to the seats; projections are cast on the upper side of the girders to receive the joists, which are fastened to them by clip-bolts, taking hold of the girder underneath the top flanch, thus obviating the weakening of the metal by bolt holes. All the large girders were proved up to a weight of 45 tons in the middle, with which they deflected on an average 1¼ in. coming back to their original curve; and the smaller girders up to 20 tons. The cast iron pilastre standards have a bearing upon the top of the girder by means of a bracketted projection with a clip embracing it, and the bottom of it abuts against the face of the girder on the outside: at the centres of the girders, where the bottom web is thickest, it also obtains a bearing, and is secured to the girder at the centre by one inch wrought-iron bolt, by this arrangement bolt-holes are almost dispensed with; the standards being hollow form the pipes to carry the water off from the roof, the projecting foot resting on the girder forming the shoot to deliver the same. The entablature, which is seven feet in height, and of cast iron, forms also the parapet to the platform, and is formed of three tiers of castings, bolted together and strengthened by feathers and brackets: this entablature when fitted has a bearing upon the capitals, and is kept in position laterally by bolts fixed to lugs cast upon the standards, with pipe washers to keep them in position; the bolt-holes are slotted so that the entablature may be affected by expansion or contraction without reference to the girders, or standards, provision being made for it at either end, at the south end next the abutment by a recess in the stone work: the entablature while fitting obtains a bearing upon the lower web of the girder, but when fixed will be unaffected by any deflection in the girders, supporting itself, and forming a horizontal line.

The parapet inside will be formed by a lining of corrugated iron; corrugated iron panels will also be formed between each pair of standards, and the intermediate openings will be closed at will by rolling corrugated iron shutters sliding behind the panels when open, rails being provided on the top of the entablature cornice for the rollers to run upon and guide rails attached to the underside of the gutters. The gutters are formed in two pieces, the water table being in one casting, and the moulded cornice attached to it by internal brackets bolted to each, the wrought-iron principals of the roof are secured to the water table of the gutter and trussed with wrought-iron, the whole is to be covered with 1¼ in. boarding grooved and tongued, and Welsh slating over all. The panels of the lighthouse and of the lodge turrets are formed of corrugated iron, the lodge roofs and turrets are covered with lead, surmounted with copper balls, vanes and spires. The whole length of the pier is 250 ft., breadth 30 ft., T head 90 ft. by 30 ft., projection into the river beyond high water mark is 200 ft.

From the lighthouse, which has been approved of by the Trinity Board, will be exhibited a powerful *plain* light for the benefit of shipping, probably a Bude light; and copper octagonal gas lamps will be suspended from the apex of the roof to light the pier. The whole of the ironwork will be painted stone colour with anti-corrosive paint.

From its locality, and the admirable approach to it from Harmer Street, this pier will no doubt prove an attraction to this quarter of the town, and form a conspicuous and handsome object from the river, and when it is stated that between 300,000 and 400,000 persons were landed and embarked at the two piers at Gravesend during the month of June, nearly as large a number in August, and almost 400,000 in July, of which enormous numbers there was a balance in favour of the present temporary erection at the west end of the Terrace Gardens, and which is only 10 feet in width, and from wear and tear becoming rather disabled, the necessity for such a work will be obvious.

All steam boats plying from the Blackwall Railway embark and disembark their passengers at the Terrace Pier, and the traffic will no doubt be increased upon the completion of the line of railway now nearly finished along the banks of the Medway Canal, connecting Gravesend with Rochester and Chatham, the Gravesend terminus of which is near the new pier. This would be more certainly effected if a connecting link were formed, close up to the pier, as was some time since proposed, and which is absolutely necessary if the steam boat companies wish to compete, with any chance of success, with the railway traffic which will one day ensue.

CANDIDUS'S NOTE-BOOK.
FASCICULUS LVIII.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. One very great objection against the uniting into a single design a number of shops or dwellings, intended to be occupied by different tenants, is that in the course of a few years it is apt to present a very motley and piebald appearance—to look as if cut up into so many slices, some of them spruced up and refreshened, others exhibiting every shade of dinginess and dirt. This ought to be guarded against by specific clauses in the leases; or, instead of being left to individual discretion and control, the white-washing and repainting the whole of such fronts should be the concern of the owner or landlord—be performed by him triennially, or according to some other stated term of years, and defrayed by a rate levied annually upon the occupiers, just as there is a general rate upon the inhabitants of a square for keeping up the garden in the centre of it. In this last mentioned respect matters are managed more comformably with common sense. Were they left to the option of individuals some pig-headed gentleman—for we have now no pig-tailed ones—might say, "I care nothing for the garden—you are welcome to let that part of it facing my windows run wild, or even cut down the shrubs. Let those who take pleasure in such things pay for them." Or perhaps people might insist upon the right to erect, in that part of the enclosure corresponding with the frontage of their own house, whatever tasty object they might fancy, so that in course of time the whole circumference of the garden might be dotted round with Chinese summer houses, Gothic alcoves, Greek cippi and columns, and be rendered a sort of architectural menagerie. Luckily no one has such right, and it were well if no one had the right of disfiguring an entire range of buildings by painting a single column and the half of one on each side of it, so that "his own" front looks like a miller standing in a row of chimney-sweepers. The Quadrant, in Regent Street, is just now exhibiting this *composite* miller-and-chimney-sweeper appearance: while some of the columns here and there look "as good as new," the rest are sadly the worse for wear and weather—at least in the opinion of those who judge of buildings by their complexion, and value them accordingly as they look "very neat and nice."

II. I wish that, instead of their complaining of the severity and illiberality of critics and amateurs, I could find architects setting an example of liberality by exercising it towards each other. Very seldom indeed do they bestow their praise heartily on any of the works of their living contemporaries; hardly ever, indeed, is it bestowed at all, except actually extorted from them, and then generally given with ungraciousness and grudingness. I do not say that they endeavour actually to depreciate the merits of others in the profession—they do not go quite so far as that, because it might be not exactly "safe" and "becoming," consequently would be indiscreet; but they generally take most especial care never to point out, or in any way call attention to, talent deserving to be encouraged and recommended to the public—which is of course not being illiberal but only ungenerous. Undoubtedly there are a good many in the profession who have reason to dislike criticism, being pretty certain that should it notice them and their works at all it would hardly be in favour of them; yet wherefore others should be nearly equally jealous of it is not quite so apparent. I have remarked that during the last ten years—in which interval architectural topics have found their way into periodical literature much more extensively than at any former period—several, whose names were hardly known at all to the public at the time, have been brought forward into notice, by remarks on their productions.

III. It certainly says very little either for Walpole's discrimination or taste, that with such examples as Eton College and Hampton Court just by, to say nothing of numerous others of ancient domestic and collegiate architecture which he must have been acquainted with, he should have patched up his house at Strawberry Hill with the most wretched "Carpenter's Gothic"—not only sheer absurdity as to style, but so thoroughly barbarous and uncouth in itself as almost to proclaim his ignorance, and convince us that he did not at all understand the mere elements and rudiments of the style which he set himself up as a judge of. It is true he endeavoured to avert criticism by affecting to speak disparagingly of his building, and as a mere plaything for his own amusement; but then the same excuse might be pleaded by any one, if not in justification of his taste, of his right to indulge it however bad. There would be nothing at all inconsistent at least in an ignorant man's saying, "I know what pleases myself! and so that I do but satisfy myself that is all I seek; I do not ask other people to approve of my taste, for it is quite matter of indifference to me whether they do so or not;" but for an *arbiter elegantiarum* in architecture to hold the same argument is strange indeed. His right to do as he did was most unquestionable; but the puzzling question is how, if he really possessed the taste the world gave him credit for, he came to do as he did in the first instance, and could aferwards endure to look upon the monster of his Frankenstein creation—"To please himself" is no answer, since there lies the puzzle. "To please himself" is merely acknowledging that, as it was a reflection *upon*, so it was the reflection *of* Walpole's own taste, when laying aside his superfine critical airs, he gave himself up to it without any ceremony. Those who are good judges of taste of a different kind generally take care to please themselves by reserving some of the choicest portions and titbits in the dish which they are helping their friends to. Again, it is but a lame excuse for both Horace Walpole and Strawberry Hill, to say that his means for building were limited, and would not allow him to do more; as a structure it might have been equally flimsy or more so, yet might have been made to exhibit correctness of design, and characteristic detail; at any rate to manifest some kind of feeling for art, and some real gusto, although in contradiction to all previous examples. Dallaway talks of a person's being able "to contemplate all that is fascinating in Gothic architecture at Strawberry Hill"!! This really outdoes George Robins himself in cool impudence and assurance. Can it be an error of the press—a blunder of the printer, who converted into "fascinating" what was intended for "farcical." Let us hope for the credit of criticism that such is the case.

IV. Mrs. Jameson seems to be ambitious of being anathematized by the Camdenists as an out-and-out Pagan, so enthusiastically does she descant on the Xanthian Marbles—those fresh accessions of heathenism and paganism to the stores of the British Museum;—which it seems shuts its portals against the antiquities and arts of our own country, as things of no importance and unworthy of being imported into it. Not the least puzzling part of the matter is that all this zeal in behalf of Paganism is, if not directly encouraged, connived at by his Grace of Canterbury, who is one of the trustees of the Museum. Therefore, if the Camdenists are in earnest in their holy horror of Paganism, let them now fly at the Archbishop, and take him soundly to task for countenancing such enormities. Were they to do that, they might at least obtain credit for sincerity and inflexible integrity, and until they do it, their denunciation of Paganism and the taste for it, looks only like mere make-believe and "gammon;" or else they must be of all cowards the most cowardly, blustering furiously against minor offenders but sneaking away from greater and more notorious ones. The Camdenists show themselves to be merely bullies, unless it be that they let it also be seen that they are great hypocrites into the bargain.

V. We have very little reason to despise the impure and grotesque specimens of the ancient orders in the Renaissance style, both here and on the continent, when we look at the numerous miserable applications of of "pure Greek architecture" at the present day; at those flagrant barbarisms in taste, *soi-disant* Greek porticos, or perhaps two columns and antæ, stuck up against buildings which are in all other respects thoroughly bare and poverty-stricken. Nevertheless, instead of being deservedly reprobated as the very bathos of design, things of the kind—and even some of the worst and most tasteless of them all—are frequently spoken of by *critics!* as if they were both of surpassing merit in themselves, and all the rest of the design in perfect accordance with them. Were we to judge from the number of "Grecian" porticos that might be reckoned up we might suppose that this country abounded in examples of genuine classical architecture, and that every little market town in the kingdom had at least one building rivalling in taste an Athenian or Roman "monument." At length there begins to be some hope of our being delivered from classicality of that sort, since its utter mawkishness and dulness have begun to produce satiety of it, and its mechanical routine to bring it into contempt. In most things of the sort it is utterly hopeless to look for any one artistic quality, or for aught whatever amounting to design. On the contrary, their chief or only characteristic is their being vulgar plagiarism of so truly tasteless a kind that it accuses those who are guilty of it of no feeling for—not even the slightest apprehension of the style which they hew and mangle after so barbarous a fashion. Anathema be on them!

VI. It is a most gross aspersion on the Royal Academy to say that they dislike High Art, for it is notorious that they invariably raise it as high as they possibly can—even to the very ceilings of their exhibition rooms.

VII. After the most unqualified admiration has been demanded for Windsor Castle, and has also been most liberally bestowed; after writers and guide-books have rhapsodized about it in their loftiest vein, piling up epithet on epithet till all meaning has been fairly smothered under the accumulated load; after all this, now comes the Athenæum and rudely tells us, that "saving St. George's Chapel, and some few other exceptions, the huge pile of buildings which constitute the present Windsor Castle cannot worthily be called architecture!" Truly this is plain-spoken enough—no puffing, no flattery here! Still, though I agree with the writer upon some points, I think that many of his—or, as I conjecture it should be, *her*—opinions are greatly overstrained. It is objected, for instance, that the work of restoration or remodelling was set about in a mistaken spirit and on erroneous principles; and that the edifice was more satisfactory in its former patched-up state, when without any attempt at disguise it told its story plainly, showing that it had grown up out of additions made from time to time, and bearing the impress of the architectural taste or fashion of their respective periods; whereas now, it is urged, "there is an attempt to cheat us into the belief that the present structure was the old one." Does the writer then mean to say that instead of making all the buildings of the upper ward uniform as to condition, and more consistent than formerly as to general character, it would have been better had what was not absolutely required to be altered been left untouched, and the new constructions been allowed to show themselves as such, however dissimilar they might be from any other portion? It is difficult to persuade ourselves that the critic can really have intended to say as much, yet no other conclusion can be drawn from it. Then again it is objected—surely very captiously—that the exterior is at variance with the interior, the former affecting severity as nearly as may be, while the other contains apartments fitted up in a style of luxurious comfort and refinement wholly unknown in those ages when castles were erected as strongholds and places. Such incongruity, however, is an inevitable, and therefore a natural and pardonable one. It is no more than what takes place in some ancient mansions that have been kept up in their pristine character externally, yet have been adapted within as nearly as possible to modern habits of living and notions of comfort. If nothing but the "genuine" is anywhere to be admitted,—nothing to be allowed that lynx-eyed hypercriticism can accuse as an anachronism, there ought perhaps to be neither library nor picture-gallery within the walls of Windsor Castle. It is undoubtedly a fault, and no small one, that the style indicated by the windows was not kept up with some tolerable degree of consistency in all the principal apartments, especially as it might have been done without any sacrifice of refinement or comfort, nay with no little increase of magnificence and grandeur. Even St. George's Hall itself possesses very little of either of the two last mentioned qualities,—in fact, has so very little of style, that it seems as if the architect had been more solicitous to *sup*press it, than to *ex*press it. To return to the exterior. Sir Jeffery erred in allowing the castellated or fortress character to prevail over the palatial. While the former is marked more strongly than there was any occasion for, the latter scarcely manifests itself, except in particular features here and there, such as the oriels of the east front, in designing which the architect seems to have been guided more by the principle of contrast than of unity. If those decorated projections show somewhat like modern embroidery upon the rough and austere groundwork of the general elevation, they do not do so the less from their openings being filled with plate glass, a piece of luxurious refinement which might plausibly enough be objected to as a glaring violation of costume in what affects the character of a feudal castle. In such case, however, the rigorous observance of architectural costume must give way to convenience and to common sense. It is evident, that at the present day, an ancient military castle or fortress cannot possibly be made use of as a residence without being expressly converted into one, and in consequence both acquiring features which distinctly mark habitation, and also losing somewhat of that uniform sternness which it possessed while intended only as a place of defence and a stronghold of defiance. Every structure so converted, from its original purpose to a widely different one, must partake of a mixed character, and such character accordingly becomes a natural and appropriate one. In this case the architect had to keep in sight the palace as well as the castle, the castle as well as the palace; the subject itself being a compound one, he could hardly treat it exclusively either the one way or the other. Still there can be no doubt that he might have treated it considerably better than he has done, and in such manner as to combine together somewhat more of energetic grandeur with an increase of that stateliness and richness which befit the abode of a sovereign.

VIII. Dr. Fulton does not seem to perceive that a favourite term of reproach with him, which he has flung one way, may recoil and strike what it was not aimed at. If a pediment can justly be likened to a cocked hat at all, it surely makes no difference in that respect how it be applied; being still a "cocked hat," it is just as much like one when over a portico as when over a window; consequently the authority for architectural "cocked hats" is of considerable antiquity, they having been worn by all the temples of Greece. No doubt the Doctor means no more than to stigmatize by a whimsical term what he considers a gross violation of architectural fitness, and the perversion of what was originally a feature of construction to one of mere decoration. It is certain that neither pediments nor columns were at first intended to serve for the parts of dressings to windows, as they are made to do in the Italian style. Yet it does not exactly follow that such after-application of them is a *mis*-application, utterly indefensible. If the principle be an erroneous one in itself, it must be as much so in one style as in another, consequently we ought in consistency to condemn a very great deal of the decoration employed in Gothic architecture, where we find a great many members primarily applied to answer some specific purpose of utility, converted into mere ornamental details. Here, too, we see small gables or *Gothic cocked hats* introduced, merely in representation, on the surface of walls, where they do not express any roof. We see weather-mouldings over doors within buildings, where, being unnecessary, they might be captiously objected to as being in bad taste. Even greater absurdities of the kind—if so they are to be stigmatized—might be pointed out, and those not a few; to wit, miniature buttresses and pinnacles in carved screens, together with embattled cornices. Nay, even the practice of enriching the surface of walls with panelling resembling the compartments and tracery of windows might be represented as an illegitimate one—a frivolous and unmeaning conceit. Let the Doctor, then, stop in time, for should he carry out his principles of criticism as fully and as consequentially as he might, he will bring down a horde of Goths upon him; and

When *Goth* meets Greek then comes the tug of war.

COMPETITIONS.—In reply to the advertisement offering premiums for the two best plans for laying out White Knight's Park, at Reading, for the erection of detached villas, about thirty designs were sent in. White Knights is one of the most beautiful places in England, and considerable skill was required to allot it so as to preserve its most striking features. To ensure a proper selection, the proprietor placed the decision in the hands of two known professional men, Mr. Mocatta and Mr. George Godwin, who after minutely investigating the plans adjudged the premiums to two which were afterwards found to be by Messrs. Scott and Moffatt, and Mr. John Barnett.

ROYAL ACADEMY. No. II.

"A NEGLECT to provide qualified persons," says Sir Joshua, "is a neglect of qualifications;" and never was this principle so exquisitely illustrated as in the case of this militia officer. A youth of great promise, who had gone regularly through the construction of the human figure, and knew every part of it, made the most beautiful drawing of the Discobolon at the Museum, which had ever been—he went to the gallant officer, Keeper of the Royal Academy, with the drawing, and a letter, for admission as a probationer, to draw for his ticket; the Keeper, with that profound investigation of look for which he is celebrated, after a minute or two, said, with a tone of superior sagacity, "You know nothing of outline." At that time, a copper outline had been introduced into the school, and the young men were all making a line round their figures the eighth of an inch thick at least; as the youth had been carefully instructed, to define one object's boundary by another, and not by a line, that he might learn to paint whilst he was drawing, he retired, wondering what the gallant Keeper could mean; on hearing this, his master Haydon, immediately wrote the gallant Keeper, "his refusal to admit the youth on such grounds was additional proof, if any were wanting, of his (the Keeper's) total incompetence for the important duties of his station."

In the drawing presented, there was not a single incorrectness. The boy had made separate studies of head, hands, and feet, and the drawing was finer than any Wilkie, Haydon, Mulready, or Collins, made for admission as students. The public shall see the drawing in due time, but the boy came from Haydon,—that was the want of outline, and the politic Keeper knew he could not please the party, who put him where he is, more, than by insulting his pupil.

Disgusted at such infamous injustice, which was likely to affect, and did affect, the prosperity of the youth, Haydon applied to the late W. Seguier, who admitted him at once into the National Gallery, and there immediately he made a beautiful cartoon, the size of life, from Augustino Caracci's Galatea, so beautiful that it attracted the applause of the nobility, who considered it, what it was, a wonder for a boy of sixteen, and there, under the very eyes of the Keeper, who watched him daily, this youth proved his power of hand, his knowledge of construction, till at last the gallant Keeper used to slink by and not look at it at all! Worthy successor of Fuseli and Hilton!—gallant Ensign!—great painter of battles, where the dead and wounded are kept out of the way, that the lapdogs might not be frightened.

Every accusation against bodies, or individuals, should be substantiated by facts. Here there is a fact of unquestionable authority. To put, for a moment, the illustrious Jones' knowledge of the figure against the boy he disdained would set the Art in a roar of derision; at the same time every allowance must be made for the condition of the keeper's mind; what could a militia officer know of design? Conscious of his utter unfitness for his position; knowing himself to be the merest tool, to spare the eminent artist from the bore of teaching boys, yet exactly as he knew his own ignorance, ought he to have been diffident of wounding the feelings of a very talented youth, by a pompous display of what he was ignorant of.

Far be it from me to reproach any human creature with weakness of understanding; it is in God's awful power, in one moment, to strike the most gifted with raving madness, and hurl him to the earth, as a warning to presumption! but when a man was found too weak in mind for the duties of a militia regiment, and took refuge in painting as the least effort of the two; when a nobleman, who had himself risen, by the most obsequious servility to the minister of the day, from ignorance of the understanding required to be an artist, mistook this man's abject flattery, for genius in art, and backed his elevation to the honours of the profession, which made even Wilkie forget his prudence and policy, at the corruption he witnessed on his election; when, by the same injustice to superior men, this creature, as imbecile as he is vain, is pushed into a position of power, to spare the laziness of more able men, it is a duty to shave its head, to draw its teeth, to cut its nails, and brand noodle on its vacant brow, that its tricks in future may be as harmless as its pictures.

Sir Robert, with not the best breeding in the world, told Mr. Hume he was a good judge of impudence. Surely Sir Robert must have forgotten for the time who sat in the President's chair! who considered himself the illustrious successor of Reynolds? what? Hume acknowledged to the impudence of the devil himself; but surely, to witness the lowest artist in Europe, considering himself a fit inheritor of Reynold's honours, is a specimen of human audacity and impudence from which the devil himself would have shrunk!

It is perfectly ludicrous to suppose the Academy will long be able to resist the spirit of the time, if it do much longer, it will be buried in its overwhelming pressure. Two great causes of its being able to do so so long, is that, first, it has no *aplomb* as a national body; and next, the vent it so annually affords to the vanity and affections of high life.

The public and the press have alarmed it lately into better elections, but mediocrity is only on the watch for its opportunity, they have not yet extirpated the bad blood of 1768, when they received with open arms, to fill up their number, the expelled Directors of the Chartered Society, who being found to have torn out their minutes to conceal their corruption, and broken their words of honour to the Attorney-General to abide by his decision, were turned out by the disgusted Society, and embraced with rapture by the Royal Academy. The filthy slime of those crawlers stunk on the walls of Somerset House for more than sixty years, the smell was carried to Trafalgar Square, the slime itself is discovered now and then; yet I trust before I die to see the healthy and sweet blood of youth and genius entirely obliterate both.

Still there is a greater cause of its continued renovation and existence, and that is, I regret to say, the continued treachery of its greatest men.

1. Fuseli, on his return from Italy, wanted Prince Hoare and Northcote, to swear a solem oath never to belong to the Academy, they refused—and Fuseli was the first to go in.

2. Barry, hating and detesting the system, and swearing in his Correspondence, academies always brought art into contempt, suffered himself to be seduced by Sir Joshua to come in, and, muttering curses as he took his diploma, got expelled as he deserved! Then came Wilkie, gifted, modest, selfish, timid; he, too, affirmed, without being asked, the Academy was nothing to *him*, he, too, again and again declared, he would never belong to it, would never ask a vote if he did, and when the time came, he got into a fright, hurried to Haydon to ask what he should do, who, seeing his real motive, turned his back; terrified at insinuations he ought to have defied—he begged—he got in—was kicked and spat on, and died as complete a victim to disappointed ambition, as the art can afford. Now Chantrey appeared on the scene, proud, haughty, talented, money-getting and illiterate; hating poverty in proportion as the remembrance of his former struggles stung his pride; adoring wealth as he felt the station money gave him; envious of rising genius in sculpture, if it showed symptoms of poetry of conception, which he possessed not; detesting the Academy, because he foresaw before he could share its insolence, he must bend to its despotism; spitting with disgust on the shadow of an Academician's figure in the streets; applauding Haydon's attack to the very echo, following his footsteps to Spring Gardens, taking away a group in anger from the Academy to send it where Solomon had hung, threatening to throw his diploma for associate into the fire, when intreated to accept it, if not made Academician the next year—uttering vengeance if they placed him with the singers at the dinner—and affirming, if they did, he would leave the room. Laughing at, sneering at, ridiculing and calumniating the whole body to his friends; suddenly, in a morning's walk to Lord Ravensworth's, to see his bronzes with Haydon, he altered his whole tone. He kindly lectured Haydon on the injustice of his principles, he said he must relinquish them, and hoped Haydon would follow his example. In he went, and joined the men he despised—and ended by leaving them his vast fortune, that the Institution he had decried, because it would not reform, might be able to defy that very reform, he had all his previous life declared was essential.

Never was such an awful hit, of solemn sarcasm, at human consistency! Lastly comes the most amiable of God's creatures—too unconscious of his own great position, to feel its height, after beating the cursed monopoly on its own ground, and signing for ever its death warrant for exclusive employment; *he* consented to tear off the seal, erase the signature, and under the belief he could influence their decisions to be more in union with public duty, melted his individual eminence into their leaden mass, and resigned the very power of doing the very good he aimed at, by descending from his exalted height, from which alone he could have accomplished the public good he so naturally disired.

It is by this treachery of the human heart to principle, throughout the history of the species, man, that humanity has endured so much. What keeps the worst government so long in existence after their iniquity is acknowledged, but the instinctive treachery of the creatures to each other who wish to overthrow it.

Nothing could have kept the Academy so long tyrannising over the profession, but the treachery of those who panted for its reform.

Mediocrity bears genius a nausea from birth; it will lick the feet, kiss the chains, and hug the serfism of the tyranny it abhors and crouches under, rather than a leader of talent should extricate it from its slavery, and be afforded a chance of proving his own genius.

Mankind never bend to genius, but when their property or existence are at stake, and the danger to their selfishness is great enough to make them forget their hatred of his gifts; if they be saved by his inspirations, how they cheer, how they triumph, how they bend, how they exult, with almost as much enthusiasm and delight as they would follow him to the block or the gallows.

Our virtues are built on our vices, our power lies in our weakness, and next to the disgust at being born, is the disgrace of belonging to such a species.

Of all human farces enacted, commend me to the Academy dinner! It is unquestionably the most brilliant imposture in Europe? I have witnessed this "Comedie" for forty years!—the same speeches—the same healths—the same anticipation of great things, the same perpetuation of small ones—the same row of tip-toes—the same Lords, and ladies, and chancellors—the same wigs—the same clouds—the same bits of column, and curtain, and red coat—the same silks, the same satins—the same doing the amiable—the same doing the intellectual—the same doing the sentimental—the same doing the dandy and the beauty—the member and the mayor—the Peer and Prince—the same discussions during claret on the tone of Lady Mary's bonnet, and Lady Charlotte's cheek—the same heat, the same gossip—the same "Non Nobis," &c.,—the same "Hail Star," &c.—the same wine—the same ennui; when up they all get full of loyalty and fine arts—the ministers to their cliques, the members to their clubs, the artists to their indigestion and blue pill, those who have no centres cursing those who have, and retiring to sleep, if they can, with vengeance in their livers, believe they have advanced High Art? Tell me a vaudeville equal to this—tell me a Moliére, who can exceed it—tell me a delusion of Bedlam that can beat it. Would I abolish it? certainly not; abolish the Academy dinner, and the next shooting season, the artist would be shown to the housekeeper's table! Would I destroy the Academy? Not I—though it is a slavish organ of the vanities of fashion, it is a bulwark against its insolence! Reform it, my respectable, friends, cleanse it—sweep it—preserve it—scrape it—whitewash it—re-model and reconsider it laws, fit them for the time—new fashion its constitution—double the paltry salary of its officers—unite it with the people, and raise its importance, and the art will be saved and the Academy too.

It is at present, with all its faults, a beautiful charity for the afflicted, and perfection itself in providing objects for the use of its funds. Its charity will always be in request whilst its despotism is never controuled; and if Europe should wish to know the secret of providing the lazar house with patients, they have only to consult [the Hanging Committee of Trafalgar Square.

To conclude, it is hoped this just and necessary exposure of the Keeper will shew him the responsibily of his position. There is no youth so sensitive to cruelty as a student in art, and there is nothing so cruel as a wanton exercise of power, because you possess it, at the expense of the pride and delicacy of a youth of talent, who, after days and nights of anxiety and diligence, brings, with a beating heart, the result of his labours for the judgment of one, intrigue has placed above him, without one half his knowledge, and who, secure in his Keepership, and his imagined superiority, proves it not by cheering on a deserving boy, but by hooting him down, at the expence of his peace, and the best feelings of his being.

Mr. Seguier's kindness enabled the youth to regain his self-confidence, but had the Keeper of the National Gallery been an Academician, he would have backed the Keeper of the Academy, and prevented this boy from exhibiting his talents to the public. Luckily for art aud himself he was not, and this brings us to the question, in No. 3, how far Academicians ought to be allowed any position out of the Academy, or ought to have any chance given them, by the Minister, of extending their pernicious influence beyond their own walls, still reeking with the slime of the crawling creatures of sixty-eight.

TIMON.

ON THE PRESENT STATE, PROSPECTS, AND THEORY OF PAINTING.

SIR,—I congratulate you on the appearance of a second Timon; and I agree with much, and sympathise with more, of what he says; but he, who self-evidently is a man of talent, and of no common grade, must not be permitted to croak, nor does it become the Athenian more than his assumed disguise, which should have been a Spartan's garb.

Timon is a disappointed man, and so am I; yet methinks I say correctly that such men do not always see clearly, and attribute to the true cause much, very much, of their alleged neglect, and more of their lack of pelf: society, in all ages, has been charged, perhaps too loosely, with ingratitude to its benefactors, and I, having personally felt some of it, know the fact, and often have I seen it exemplified in some of my dearest friends, among whom I could tell names of no little worth; but we must not forget that such men toil over things often above their individual resources, and always of slow not every-day sale, the trader then, if I may use the term, must be—poor.

High art has confessedly been neglected, but what has not? Southey justly said, "It requires one man's life to develope a principle, and that of another to see it enforced;" and well may it be so, in this kingdom especially, where all is left to individual enterprise or commercial speculation; but, I say fearlessly, high art will rise, the second advent of painting is at hand; and, fostered by a British Parliament, enforced by a Royal Commission, that Commission, save one[1] defect, constituted more liberally than any which has existed before,—so free from all possible bias, the veriest caviller cannot charge upon it one fact or one probability of prejudice or favour; thus fostered, I say, and thus enforced, patronized by his Queen and her liberal-minded consort, British art shall daily advance, and, surrounded by a halo of native glory, shall astound the world. But to return: we want a practical board of works, and a free, open, unsophisticated yearly expositionè.

It is said more than two thousand works of merit were refused by the Royal Academy lately: this, indeed, is a disgrace, a real blot on the page of English history; nor does the beauty, the size, or the arrangement of the National Gallery lessen the stain. We have, however, achieved some improvement; those miserable efforts of a narrow mind which crept only into name and notoriety in the path of bigotry and fanaticism,—those cruel libels upon worth which called forth Byron's satire,—

"Europe's worst dauber England's best,—"

these have been removed by or under the present curator,—but no management can avail us much; never, never can this abortion of a National Gallery vie with the Louvre of the present day, and much less of that of Napoleon's; nor, indeed, can it vie with the Stafford gallery, or other private collections of mighty worth.

Let Timon look more to the defects of the system than of the men: let him doff the Cynic's garb and struggle on: I, for one, will twine a laurel round his head, for I am sadly wrong if I do not recognise the head which has earned one. But why so much gall in the ink? 'Twill flow without freely. Why so personal towards Sir Robert Peel? and, more, why so heavy on Eastlake?—both are men, and, "Humanum est errare." Peel is confessedly a lover of the arts: Eastlake a gentlemanly, thinking, assiduous, nay indefatigable and honourable man, a most respectable artist, and confessedly the best read one, with the best artistic library in England: the very faults which Timon alludes to are highly creditable to him as a secretary. What, in the name of human reason, can he do but accumulate facts, on fresco, for instance, however the whole may become a conglomerite? Fresco never yet was practised by man with one single ray of light from true theory—the rule of practice; on the contrary, all, all has been chance and caprice, equally as regards the lime and the pigment—the beauty and the permanence. Hitherto we have progressed little; and assuredly the so-called frescos of the late exhibition give us infant hope alone, and that, as a consequence, the base on which the whole were raised was bad—the laths and rough-cast rotten and ill-applied, merely made, in fact, like the razors of Pindar's Jew, to "sell, not to shave," to fill the pockets of the colourman alone, as shopkeepers, not one of whom either knew the nature or properties of cements, a web the more than of

"All the poor compounds which they sell;"

this was covered by plaster nearly worthless, and no blame, good Timon, to the Commissioners either, for they had read and listened, inquired, and of good men and true, men of worth and genius like Cornelius, and Morr, and Overbeck: but of what avail? Cornelius copied the one of two lines of ancient practice—the long keeping of lime: Cornelius had used it again and again, and therefore warranted it, precisely as the old woman warranted her magpie, to live an hundred years; but Cornelius has not yet lived half the hundred to see the effect! Eastlake, after unwearied and incessant research, recommended the practice of Pallomino—frequent washings—to which he added some keeping. So much for unenlightened practice, and that from a climate infinitely different from ours; and on such a compound—one might almost have said compost—artists new to the practice, ignorant of the theory, biassed perhaps also by the rude aspirations of

[1] The palpable defect of having no scientific as well as artistic aid; on the valuable secretary is therefore thrown the judgment of matters requiring other qualifications, and leaving him open either to publish error, directly or indirectly, through sheer theoretic—where he would need—"practical" advice.

such persons as have written on the subject,[2] although proclaiming themselves in every page ignorant of the first elements of science,—such men, I say, under such circumstances, painted for exhibition instead of for school. We cannot wonder, then, at the miserable daubs we saw. The best were highly laboured—far too highly laboured fresco—glazed, shall I say? no, blackened by ten times too much tempera finishing for the then approaching exhibition of Bartholomew fair. Alas, what havoc and ruin a sponge and rain-water would achieve on the field of King John's shield, the gorgeous purple of his robes, or the sweet face of Sir Thomas More's daughter in his prison-house,—or aglios less laboured, and dei gratia less savoured recollections of Naples! and how long would the mechanical neatness of Maclise's Knight bear it?

And yet, will fresco be adopted on fixed principles, and with successful results, by the perseverance of Englishmen. Timon has only to forget all he has read, and use his brains: fresco, though assuredly adapted best to mighty halls and majestic domes, might be used in the nieches of a baby-house, and there the theory is simple. If a permanent stucco be the sine quâ non of fresco—and caustic lime be as necessary to the stucco—caustic lime is also the sine quâ non of fresco: nothing, I humbly conceive, can be more palpable; therefore the pigments must be adapted to the lime, not the lime, by deterioration, to them; and it matters not what the nature of it, whether by marble dust or whiting, or carbonic acid[3] from the atmosphere, or from some extra superfine carbonates made by wire-gauze chemistry at peculiar temperatures, in artificially ventilated vessels of thermometric constitution; in plain English, be the so-called amelioration what it may, it is but the same dead hit at theoretic Salmagundyism!

Now to incaustic, well enough in its way, but not well enough for us: neither adapted to our smoky atmosphere nor coal-fire warmth,—nor, if Armitage's Fates be a specimen, or the Indian-redism of the Royal Exchange be a proof, worthy of our wasting much space in what Cornelius, *in his politeness*, declared a "*very fine situation*," although, when he said so, Benjamin Hawes' chimney vomited, like a second Vesuvius, clouds of alkaline vapour, sulphur, and cockney smoke! Distemper, or tempera, and oil, are of more worth: in either, or both, shall the talent of this day go down to posterity without a blush from Timon's cheek.

To the first two, for I am not among the persons who at all identify them, I will merely say, permanence depends wholly and solely on *the individual permanence of each pigment* in use—nothing must be left to, or expected from, the vehicle, be it gum, white of egg, saccharine mucilage, or gelatinous matter from isinglass or size,—but *cohesion, bearing-out*, and *freedom from crack*. In oil the case is reversed,—everything depends on *the vehicle*, of which I give you this proof: lead which is inherently chargeable is, for oil painting, fully equal to, if not surpassing, ultramarine. I do not despise a colour because it is individually permanent,—it is always valuable to have such for oil as well as water; but it is not, as generally and foolishly imagined, a sine quâ non: every experienced man, among artists as well as connoiseurs, knows that, in practical effect, *ultramarine* can and does change; the oil rises and forms a skin—this skin becomes yellow, and hence the frequently green tone of ultramarine skies; whereas fine flake white, or, what is infinitely better, either sulphate or muriate of lead, in a vehicle which *will not rise*—or which *prevents the rise of oil*—becomes permanent in defiance of ages; hence, many fine old pictures painted with inferior pigments to any now used by the common house painter.

Theoretic writers like Merimee, whose oil copal quackery to "*brighten colours without drying them more quickly*," amply proves he knew nothing of the true principles of permanence—for a recent picture is garish enough, and oil copal increases that disposition to skin which ought to be restrained—these writers, I say, vend a mass of twaddle also respecting testing colours by sulphuretted hydrogen, which is little better than nonsense: strip the oldest and best picture in existence of protecting varnish, and this gas will blacken it in twenty seconds,—what value, then, has it as a test of practical worth among pigments? As a vital caution, then, send M'Gellup and boiled oil and gumption with physic to the dogs, as ignes fatui of the art. Paint with fine poppy oil, or, for larger pictures, linseed oil bleached by light, but never rendered more drying by oxides,[4] for there half the secret lies; nut oil, for instance, which is deceptive and *useless here*, except for grinding colours in, rises as soon, and yellows as much, as the commonest linseed. It is, moreover, a *bad dryer*[5] in this region, and all similar ones, still it would be the best of the three for Italy, South America, or the East Indies; and the picture drying without skin, dries without yellowing, and ultimately without horn; it only then requires three or four months to season and harden, when, after being washed with soft water with a slight dash of gall, a coat of good old mastic varnish will carry it down the stream of time.

Mastic I prefer, because it can be rubbed off by the finger and a little resin powder, and replenished or renewed as often as you please without injuring the picture; whereas all varnishes requiring *solvents* require such agency as acts on the glazing; hence no man who values his painting trusts it to those empirics who call themselves picture cleaners.

I must defer to a future period the subject of the Altramentum of Apelles,—the various impostures now happily dying a natural death, under the spurious soubriquets of glass media, silica media, &c. &c. and the errors of Reynolds; until which, with a smile as well as a tilt for the patriot Timon,

I am, yours,

WILHELM DE WINTERTON.

September 15th, 1844.

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2 One Weld Taylor published on fresco, and tells you, for instance, hydrate of lime, that which we make in and by slaking, is a salt indigenous to limestone! That vermilion, which is black sulphuret of mercury "reddened by heat," has a tendency to "blacken by heat," &c. &c.!!

3 M. Vicat and other sheer theorists speak of this carbonic acid as the source of age and hardness in cements, whereas it is very obviously the source of pulverulence and decay.

4 Such a dryer has been given to the secretary for publication, and at no trifling sacrifice, by one of my personal friends.

5 Dr. Andrew Ure, in his great book, the Dictionary of Arts, Manufactures, and Mines, tells us it is one of the most siccative or drying oils, when every artist knows it is the worst; and that East Indian gum is the best for blending with colours, when every colourman knows its solution "rapidly becomes ropy," and the cakes made of it are leather brick-bats: so much for book-makers!

ST. MARGARET'S CHURCH, WESTMINSTER.

SIR—In your last month's number, I read an article on Saint Margaret's Church, near to Westminster Abbey, which induced me to visit the "venerable temple founded by Saint Edward," fully expecting to find that "rebuilt by Edward IV."

I agree with Mr. Bardwell, that an "accumulation of buildings" is advantageous to Gothic Architecture, and that the position of Saint Margaret's Church would not injure the effect of the Abbey Church; and I would be the last person to advocate the removal of an architectural *gem*. The Cathedral at York is not injured by its Chapter-house, nearly in the position of St. Margaret's Church, to the north-east of that noble structure, (and I may apply this remark to most of our Cathedrals and Abbeys,) nor were any of the buildings, erected by, and for the several uses of those who worshipped in them, constructed otherwise than in perfect harmony with, and so as to give the best effect to the exaltations of the temple of the Creator, above the abodes of his creatures.

Were St. *Margaret's* Church worth preserving, I would not care for the *Abbey* Church, as by its removal, the *desecrations* of the splendid north transept *would be exposed*, which were *perpetrated* when the western towers were built by the *rebuilder* of this "venerable temple" of the Edwards; why it has not externally one ancient feature!—its bare unbuttressed walls, its uncusped elliptic windows, and *modern builders'* square coped parapets; and then its tower—see the octagon buttresses with *square sunk panelling*, square headed belfry windows, with those winged heads in spandrels, grinning or crying *for shame of their position*—the plain ten of diamonds parapet, and corner pinnacles, which would e'en make Mr. Compo stare. Away with this abortion, this vile deformity, *enclose its sacred site*, and *thus*, let us hallow the bones of our forefathers.

I would rebuild on another site a Church as unlike this as possible, for I verily imagine that this was the very church recommended to the modern Compo's as of moderate dimensions, and being within sight of the Church Commissioners' Office, was by them considered a standard or test by which the merits of modern Gothic designs should be tried: hence the Metropolitan Gothic Churches of the last 20 years. I would recommend the inhabitants of Westminster to ask the opinion of the Camden or the Oxford Architectural Societies on the merits of this Church, as they are certainly the best judges of the day, though far from infallible; as an antiquary and lover of the true principles of architectural composition,

I remain your friend and old subscriber,

DIONYSIUS.

Walworth Road, Sept. 2, 1844.

THE SAFETY BEACON ON THE GOODWIN SANDS.

The following extract from a private letter in the *Times*, dated Deal, Sept. 17, written by a gentleman who was an eye-witness to the late operations on the Goodwins, and who has taken a deep interest in the success of the safety beacon, may be interesting to our readers:—"Captain Bullock has just completed the replacement of his safety beacon on the Goodwin Sands, which was run down by a careless Dutchman some weeks ago. It now stands erect on those dangerous sands, the record of a simple design, which has led to attempts of a similar humane and praiseworthy character, but of a more elaborate and costly descriptson. It is affixed upon the same principle as the first, with an improvement in its base. This is now composed of iron instead of wood: and it consequently penetrates further into the sand than the former. From the stability of the materials of which it is composed there is no doubt, 'barring accidents' of a similar nature the last, it will last for years. A proof thus far has been obtained that beacons of refuge may now be placed upon any sand. The honour of having led the way to these useful undertakings (even after this simple contrivance shall have been eclipsed, by the substitution of beacons of a more durable description) is due to Captain Bullock. There is no doubt that the first beacon of refuge has been the happy means of saving both life and property, answering the double purpose of a warning and a refuge. It has cautioned the unwary of the proximity to danger, and has been a guide even to those who were aware of its erection in the constant communication between Dover and Ostend. During my visits to the Goodwins, while the beacon was in the course of re-erection, my attention was particularly drawn to the fact, that the foundation of the former beacon remained unmoved and unabsorbed. Day after day I walked upon the mass of chalk deposited by Captain Bullock, now four years ago. In consequence of this circumstance I perceive that Captain Bullock has resorted to his former plan by throwing upon the same foundation between 50 and 60 tons of concrete blocks, chalk, and shingle, all of which have stood unchanged during the continuance of the late calm weather. The tide, so strong as it passes the shallow, has had no visible effect upon the mass, around which the sand had accumulated nearly two feet in height, and it now remains as the result of a most interesting and successful experiment. The present gale (while I am writing) from the southward will prove whether it will eventually stand against the boiling surf, by which it will be surrounded and assailed. I have myself very little fear for the heavy concrete blocks which constitute the base of the cone; but I think it very likely that the upper portions of the undefended and loose shingle may be disarranged, and the cone somewhat flattened down. It is, however, but an experiment, and the problem will probably be demonstrated that human skill and ingenuity cannot overcome the formidable Goodwins with small means, and that man cannot successfully wage 'a little war' with such a foe. However, I must say, from all I have heard, that the Lords of the Admiralty have behaved in the most kind and handsome manner to Capt. Bullock, in enabling him to possess thus far every facility for carrying out his humane and highly praiseworthy undertaking."

FIRE-PROOF WAREHOUSES AT LIVERPOOL.

THE noble pile of warehouses now being erected for Mr. Brancker, is unquestionably the largest yet erected in Liverpool, occupies the three fronts of Great Howard Street, Dublin Street, and Dixon Street, and covers 4,433 square yards of land, being only 107 yards less than an acre. It is divided into eleven warehouses, of something less than 400 square yards each, not including the walls. The external walls are 3½ bricks thick, and the division walls are 3 bricks. When completed, the warehouses will be 65 feet high, and will have six stories of rooms, besides the basement or cellar story. Every window throughout the pile is to be glazed with large sheets of plate glass, and each is protected by a strong wrought-iron shutter, secured to an iron frame. The floors are formed by iron girders or beams, resting on columns of great strength, and are all secured together by wrought iron coupling bars. The bearing beams rest on large blocks, made of Welsh fire-clay, and brick arches of 9 inches thick are to be thrown from beam to beam, the lateral thrust of the arches being counteracted by wrought iron tie rods, strongly secured to the beams, which are placed horizontally every 6 feet on the average. These connecting rods are 1¼ inches square, and are tested to resist a tension of 35 tons each. Every bearing beam is also tested by a lever press, at the building, to bear on its centre a pressure of 38 tons, which is equivalent to a weight of four tons on each square yard. The floors of the whole structure are to be laid with Welsh fire tiles, bedded in Terras mortar—there being an intervening strata of sand to prevent the fracture of the arches should heavy goods be thrown down upon them. The entrance doors are made double—that is, of two separate plates rivetted together, having a cavity of an inch between them, with six small air holes, so that if either side of the door became heated, the other side would be comparatively cool. The various rooms have also iron double doors of communication, each door being placed on the internal face of the wall, so as to leave a space of two feet between them. The staircases are enclosed from the rooms by walls of two bricks thick. These staircases are 18 feet long, by 7 feet 6 inches broad, and all the steps are of Yorkshire stone. Each staircase is to be provided with an upright main, of 6 inches diameter, which is to be supplied with water from the mains about to be laid down by the Sewerage Commissioners, and which, from the pressure of the Low-hill reservoir, will always be full of water. On each landing there is to be a brass stop-cock screwed, to fit either the hose kept on the premises (60 feet long being appropriated to each room), or it will fit the hose of the Commissioners and Fire Police, so that in case of fire there will be an abundant supply of water on each landing, and instantly available. Small apertures are provided through which the branch can be inserted, and as each room will be perfectly air-tight, it will be impossible, if a fire occurs, for it to break out into flame. The staircases are so admirably constructed, that if every room in the building was on fire, men may be placed in perfect security on each landing, and pour a continuous stream of water into every room. All the entrance doors are recessed back from the fronts of the building, and there are no projecting cat-heads or pent-houses beyond the line of the edifice. The roofs are all to be formed of wrought iron trusses, covered with Welsh slates; and parapet walls are to be built between each warehouse for additional security. Great attention seems to be paid to the drainage, there being three large dry wells of 5 feet diameter and 20 feet deep, and barrel sewers are being carried from all parts of the cellars into these wells. The whole of these magnificent buildings have been designed, and are being erected, by Messrs. Samuel and James Holme.—*Liverpool Journal.*

MILLSTONES.

M. Guevin Bouchon and Company sent to the Exposition of France several millstones. Among them was one of Train's aëriferous millstones, the arrangement of which allows the circulation of cold air under the millstones, in order to prevent the heating, which so often does injury to the grist. These millstones are generally 1·3 metre (4 ft. 3 in.) in diameter, and are

Fig. 1.

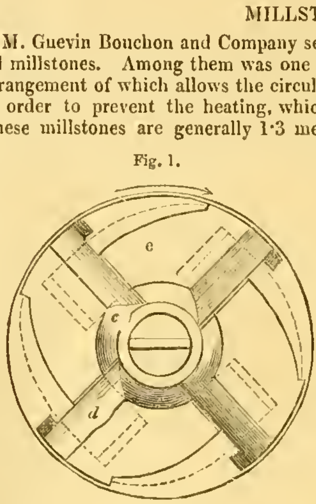
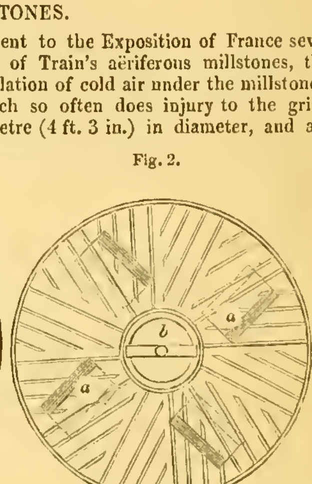


Fig. 2.



thus formed. Four orifices, *a a*, starting from near the centre of the millstone to within 5½ inches of the periphery, and pierced sloping, are made through the whole thickness of the stone. The mill is provided in the centre with a cast iron eye or box, *b*, in the form of a cone reversed, and on its external part a wrought iron circle, *c*, covering by about 8 inches the upper surface of the millstone. Iron plates, *d*, are strongly rivetted on to the iron eye and circle, some inclined 45° over the orifices, others forming quadrants or curbs, *e*, perpendicular to the great circle, and serving to lead the air, which is thus forced to pass into the orifices, *a*. By these means a current of air is produced by the rotation of the millstone.

ROUEN.—A correspondent of the Athenæum observes, "a respect for the monuments of antiquity, which so especially characterise this place, is felt; and at the present time, the buildings at the east end of the Palais de Justice, having been pulled down, are to be replaced by a wing corresponding with that at the west side of the building, now in course of erection; and it was only last week that the Préfet paid a visit to the crypt beneath the church of St. Gervais (the oldest Christian erection in France), with the view of examining into the practicability of removing the white-wash with which some portion of the walls are covered, on which, by-the-bye, traces of painting are still visible. A church, also, on a magnificent scale is now nearly finished on the top of the hill next to Mount St. Catherine, through which latter mountain the railway tunnel is now in progress of formation. Besides this, a Museum of departmental antiquities has been recently established, and is already infinitely superior to anything of the kind we have in England. It now occupies two sides of a quadrangle, in the middle of which are placed stone coffins, and other objects too large for the interior of the Museum, which is lighted by a series of stained glass windows of great beauty, rescued from one of the old Abbeys. Of the contents of this Museum, it will scarcely be necessary to speak at length, as it is what it purports to be,—a collection of archæological antiquities of this part of France from the earliest periods: statues, coins, charters, armour and arms, implements of all kinds, glass and crockery ware of all ages, reliquaries, carvings, models, ancient paintings, &c., arranged with a taste worthy to be taken as a pattern for a similar collection in our own National Museum."

REPORT ON THE ATMOSPHERIC RAILWAY.

To the Committee of Management of the Cromford and High Peak Railway.

Gentlemen—Agreeably to the instructions which I received at the meeting, held on the 7th of March last, I proceeded shortly afterwards, accompanied by Mr. Brittlebank, to Dublin, to examine the Amospheric Railway between Kingstown and Dalkey, and to ascertain whether or not the principle might be applied with advantage to our inclined planes. In our investigation we received every attention from the gentlemen connected with the undertaking, and were not only allowed to examine every part of it minutely, but were also furnished with every information derived from their own experience.

For the information of those gentlemen who may not be conversant with the principle of the invention, I will explain its peculiarities in contrast with those of other railways, as carried out, and in daily operation at Kingstown. On ordinary railways, the train or load is moved along by means of an engine, attached thereto, and moving with it; on the contrary, on the Atmospheric principle, the load is moved by means of a *stationary* engine, at a considerable distance from, and totally unconnected with it; differing, however, not only from railways where the locomotive engine is used, but also from those on which the stationary engine is the propelling power; inasmuch, as the rope is entirely dispensed with, and its place supplied by the pressure of the Atmosphere. This therefore, forms the peculiar feature of the system, and constitutes the difference between it and all other modes of propulsion on railways.

The means by which the principle is put in practice, are simply these:—

Between the rails, and along the entire length of an ordinary single line of railway, a pipe is laid of, say, fifteen inches diameter. This is connected at one end by a steam engine, the power of which, is applied to a large air pump, which being set to work, pumps out or exhausts the air from the interior of the pipe. Within this pipe is a piston, or plug, which works freely along its entire length; but, nevertheless, so tight that but little air can pass from one side to the other. This being so far understood, it is clear, that by pumping out the air from the *front* side of the piston, the pressure of the atmosphere on the *back* of, or behind it, will force it forward with a velocity dependant, 1st, on the degree of rarifaction of the air in front of the piston; 2nd, on the weight of the load to be drawn; and 3rd, on the inclination of the railway. The great difficulty however, and that which yet remains to be explained, is, how to communicate the power which is *inside* the pipe, to the load which is *outside*. To accomplish this, there is a longitudinal opening or slot on the upper side of the pipe, which is continued throughout its entire length. In this opening there is a bar of iron, which is attached *below* to the piston within the pipe; and, *above*, to the leading carriage of the train, or rather one used exclusively for that purpose, to which the train is attached; so that if the former moves along the latter must move with it. It is evident, however, that during the time the engine is at work, exhausting the air from the pipe, the opening or slot of that portion of it, which is between the engine and the piston, must be closed perfectly, or as nearly as possible, air tight, otherwise a vacuum could not be formed. This is effected by means of a leather valve, hinged on one side of the opening, over which it falls, and extending its entire length, perfectly covers and closes the whole of it. This valve is covered with iron plates both on its upper and under sides, for the purpose of strengthening it, and is rendered more perfectly air tight by means of a composition of wax and tallow, into which the outer edge falls when closed. A heater attached to the carriage completes the process by melting the composition as it runs along its surface, and effectually seals it in readiness for re-exhaustion.

There are other valves, but of a different description, which close *across* the pipe, and by means of which, it is separated into divisions; one of these is placed at that end of the pipe which is opposite to the engine, so that when closed, the pumping can commence, and a vacuum be formed at any time, so as to be in constant readiness. When the train is about starting, and the air pump has produced a sufficient vacuum, as indicated by the barometer, the travelling carriage, with the train attached, is moved by hand until the piston enters the open end of the pipe, within a short distance of which the *closed* separating valve is placed. This valve, immediately on the entrance of the piston, falls down, by means of a self-acting apparatus, and the pressure of the atmosphere is instantly transferred from it to the piston, and motion forthwith commences.

During the passage of the train, the longitudinal leather valve has to be raised or opened, to allow the bar before spoken of, as connecting the piston *within* the pipe to the train on the *outside*, to pass; this is done by means of a roller attached to the piston frame, within the pipe, which is placed a little in advance of the bar, but behind the piston; and which, as it passes along, raises the valve just sufficient to allow the bar to pass, which being done, the valve falls into its place again, and is immediately pressed down by another roller which follows for that purpose; the heater follows and seals the composition. and the whole is then ready for the next train.

The Atmospheric Railway, at Kingstown, is $1\frac{3}{4}$ miles in length, and in that distance, rises by variable gradients 91 feet, which is equal to 1 in 115, or about 52 feet per mile. It has a main or pipe of 15 inches diameter, and is exhausted by an air pump of 67 inches diameter, and $5\frac{1}{2}$ feet stroke; worked by a steam engine of 100 horse power, making about 20 strokes, and discharging upwards of 5000 cubic feet of air per minute. The degree of exhaustion varies with the load; but for ordinary passenger trains, it ranges on the barometer from 12 to 16 inches of mercury, which is equivalent to a pressure of from 6 to 8 pounds per square inch. The trains weigh from 15 to 20 tons, and the time occupied in working the engine for each, is about 6 minutes; that is, $2\frac{1}{2}$ minutes in exhausting the main, and $3\frac{1}{2}$ in working the train up the $1\frac{3}{4}$ miles. Hence the mean rate of travelling is about 30 miles an hour, but the greatest speed occurs about the middle of the journey, at which point the train moves at a rate of 40 miles an hour. The railway does not appear to be by any means adapted for high velocities, there being curves upon it which have a radius of not more than 500 feet; but this I believe was unavoidable, the railway having to follow the line of an old tram road, which had been used for the conveyance of stone from the quarries at Dalkey; as a mere experiment, however it is valuable, inasmuch as it proves that curves of so short a radius may be traversed at a speed of from 30 to 40 miles an hour without danger.

Without entering into the subject of the Atmospheric Railway, beyond the legitimate object which we have in view, I may here remark that the application of the principle to a long, single line of railway, with an extensive, irregular, and miscellaneous traffic, would appear to me, in the present state of our knowledge of its capabilities, an experiment of doubtful success; confined however, to such lines as would not require that trains should be travelling in opposite directions at the same time, and to situations where good locomotive gradients, could not at a reasonable expense be obtained; the invention offers advantages which are not found in, nor could be accomplished so well, so safely, or so economically by any other with which we are at present acquainted. But, before making any further remarks on this part of the subject, I will proceed in considering it with reference to its application to our Inclined Planes.

In order to shorten and simplify the enquiry, I purposely omitted entering upon anything which might be considered as common to both systems, and confined myself to those points only, in which they might be expected to differ. Limiting my investigation therefore exclusively to the mode of applying the power; I directed my attention, first, to its mechanical practicability; secondly, to the comparitive loss of power; thirdly, to the working expenses, wear and tear, &c.; fourthly, to the requisite permanent outlay; and lastly, to its comparative advantages and disadvantages.

As regards the first subject of enquiry, namely, its mechanical practicability; I found that the working parts of such as are most subject to wear, were by no means of a complicated character, nor such as would require either elaborate workmanship, or other than the most common materials in their construction; consequently, neither from their form or material, are they such as, under ordinary circumstances, would easily be deranged, or soon worn out, or require other than common workmen and labourers for their repair, renewal, or management.

Exclusive of minute details, the only parts subject to wear are the piston, and the valve which covers the pipe; the latter being merely a strip of leather between iron plates, protected from the influence of the weather by the composition of wax and tallow, and merely raised a little out of its place once for each train, can scarcely be said to be subject to wear of any kind. The same may almost be said of the piston, which is simple and strong, and requires no further attention than the application of a little grease occasionally, and the renewal once a week, or so, of the leather packing, which can be done by an ordinary workman, or even an intelligent labourer. On the whole, therefore, there is nothing whatever in the system which would require a superior description of men to those which we now employ, nor any thing which they could not comprehend and manage as well as their present employment.

The second object of my enquiry, and one which I considered of great importance, was to ascertain the precise lose of power, from leakage. I was the more anxious for satisfactory information on this head, because the substitution of a rope of air, for one of hemp or iron, has been much dwelt upon, and the difference of their weight and friction considered as an addition to the nett available power: but however plausible this may appear, it is possible that a loss of power may arise to as great an extent from pumping out the superfluous air from a pipe, as in moving a heavy chain or rope; and if it should be found that the loss from leakage in the one case is equal to the loss from friction in the other, it would be evident that in this respect no advantage would be gained by one as compared with the other. The loss from leakage on the atmospheric system (supposing the permanent joints to be perfectly tight) can only arise, first, from the longitudinal valve; second, from the travelling piston; and third, from the air pump piston.

The loss from the latter, whatever its amount, which however cannot be great, is permanent and irremediable. That arising from the travelling piston, is also, to a certain extent, permanent, but less in proportion as the velocity increases and the degree of exhaustion is diminished, while that from the longitudinal valve, which I consider the source of by far the greatest part, is proportioned to its length, and the degree of exhaustion of the main, diminishing of course as the piston approaches the engine: the loss, however, from this cause depends much on the attention paid to the state of the valve and the sealing composition. On our inclined planes, the loss of power, which arises from the weight and friction of the chain and other causes, amounts to about thirty per cent.; and, judging from information which I obtained at Kingstown, that arising from leakage on the atmospheric system is as nearly the same as possible. This estimate of the loss is confirmed by some experiments made by Mr. Stephenson, the particulars of which were given me by the engineer of the railway, in one of which the loss from leakage was 33 per cent., and in the other 25 per cent. Hence, I was induced to conclude that the loss of power, whether caused by friction in the one case, or by leakage in the other, is as nearly as possible the same in both.

We are now come to the third subject of enquiry, namely, the working expenses, wear and tear, &c. On our inclined planes, we have seven miles of chain in work, weighing 70 tons, which last on an average, four years, and cost about £18 per ton; 70 tons at £18 per ton, amounts to £1260,

	£	s.	d.
which divided by 4 gives an annual expense for chains, of	315	0	0
We have also about 1500 pullies, or rollers, which weigh ¾ cwt. each, cost £10 per ton, and last about seven years. Hence 1500 rollers at ¾ cwt. each, weigh 56 tons, which at £10 per ton, amounts to £560, and divided by 7, gives an annual expense of	80	0	0
Axles, wood bearings, &c.	10	0	0
Sundries, such as large wheels, chain wheel, segments, preventers, tackling chains, shackles, coal, tools, damage, &c.,	100	0	0
Wages, estimated at	100	0	0
	£605	0	0

In ascertaining the working expenses of the Atmospheric Railway, I was assured by the gentleman who superintends it, that the amount was so trifling that it might almost be left entirely out of the calculation; indeed from the remarks already made with regard to the wear and tear it will be inferred that it cannot be large. The patentees allow in their £50 annually per mile, for the renewal of the travelling apparatus. If, therefore, we take this sum and £20 additional for piston leathers, grease, and sundries, we shall probably have the annual cost sufficiently near for our purpose. £75 per annum therefore on 3½ miles, will amount to £262 10*s*., which, exclusive of the interest on the permanent outlay, shews an annual saving on the Atmospheric system of upwards of one half.

I have purposely left out of the calculation everything relating to wages; because, not only the same description, but also the same number of men would be employed in one case as the other. Proceeding with our enquiry, our next object is to ascertain the amount of permanent outlay which would be required in changing from one system to the other. Our inclined planes are nine in number, and together are 3½ miles in length. Their inclinations vary from 1 in 6 to 1 in 16; hence, the Atmospheric mains necessary to enable us to draw the same weights, as we now do, must in one case be 27 inches, and in the other 17 inches diameter. The air pumps being proportionate to the power of the engines, would for the greatest be 44 inches, and for the least (leaving out the small engine at Whaley), 32 inches diameter. The estimates of the patentees shew that a main of 15 inches diameter, laid down and ready for use, would cost £3,350 per mile, and with the air pump £3,600. But much of the cost depends on the weight of material; and, as ours would require to be at least one half heavier, in consequence of their increased size, we could not safely estimate the cost at less than £5,000 per mile, which for 3½ miles would amount to £17,500. The interest on this sum at 5 per cent., would be £875 per annum, and added to the working expenses, wear and tear, &c. amounting to £262, would give the annual cost of the new system *to us*, at £1137 instead of £600 as on the present plan.

It is clear therefore that whatever might ultimately be *gained*, nothing could be *saved* by the change; while for any *uncertain* advantage which might be expected to result from it, we should have a *certain* increased expenditure to the extent of at least £500 a year.

It now only remains that we should compare the advantages and disadvantages of the two systems; and, with this view we have to enquire, in what other respect the introduction of the atmospheric principle would be beneficial.

The only object of importance which we should gain by the change, would be *safety*; and although I am well aware of the value of perfect security, in working inclined planes, I am nevertheless of opinion, that for a mere merchandise traffic, the outlay of eighteen or twenty thousand pounds is considerably more than the object is worth; besides, so far as relates to the safety of goods, we are now nearly as free from accidents, and damage arising therefrom, as we should be under any system.

If to this we add that under the atmospheric system we should be subject to inconveniences which we do not now experience; it will tend further to shew, that for a merchandise traffic, we are best as we are. The inconveniencies alluded to would arise in this way; whenever a train of four or more waggons arrive at our inclined planes, they are, if loaded, drawn up in pairs, and as soon as one pair has reached the top, the other is immediately hung on at the bottom and drawn up without any further loss of time; but on the atmospheric system, the train would be obliged to wait until the engine had exhausted the main, unless it had been prepared in readiness; and, when the first waggon had been drawn up, the next would not only have to wait until the main had been re-exhausted, but also as much longer as would be required for the descent of the travelling apparatus; making together, not less than six minutes delay between each pair of waggons, in addition to the time occupied in their ascent. The same kind of delay would occur to the descending waggons, with this additional disadvantage, that in order to raise the travelling apparatus between the descent of each pair of waggons, the engine must be kept in constant work; the same for downward as for upward traffic; causing thereby, a considerable extra expense for coal and other requisites.

There are a few other inconveniences which would result from the change, but those which I have already pointed out, being of the greatest importance, and also quite sufficient to shew that the application of the principle to our inclined planes, is by no means desirable, it is needless now to mention them.

From the preceding remarks it will, I think, appear evident, that the application of the atmospheric principle to our railway in its present state, so far from being any advantage, would, in fact, subject us not only to serious inconvenience, but to considerable additional expense, and that too, (so far as relates to our present traffic,) without any compensating benefit. It, however, by no means follows, that the principle cannot, under any circumstances, be applied with advantage; on the contrary, I am of opinion that it is peculiarly applicable to the circumstances of our railway, if properly carried out.

I am, Gentlemen,
Your very obedient Servant,
John Leonard.

Railway Office, Cromford,
July 1st. 1844.

METHODS OF PAINTING ADAPTED TO MURAL DECORATION.

By C. L. Eastlake, Esq., Secretary to the Royal Commission on the Fine Arts.

Four modes of painting adapted for walls have been employed in ancient and modern times: Tempera, Encaustic, Fresco, and Oil-painting. The three first were known to the ancients; the fourth method, invented by the moderns and originally applied to moveable works, has been also employed in mural decoration.

Tempera is so commonly practised that it can hardly be necessary to enter into a minute description of its process. It has, however, an interest from its antiquity, and from its having been more generally in use in Italy than any other method, immediately before the introduction of oil-painting. This circumstance and certain difficulties in its practice appear, in some cases, to have led to a union of the two methods. Tempera is applicable to the surface of smooth dry stucco or to any similar levigated ground which has either been incorporated or covered with a due proportion of size or glue. It does not, like fresco, necessarily require to be executed at once, and admits of the use of all colours which are not prejudicial to each other. White lead is however excluded, because being unprotected in tempera from the action of certain gases, it soon loses its brightness. The white used is principally *gesso marcio*,[1] to which white earths are sometimes added. The binding vehicle may be formed of animal glutens, such as size, yolk of egg,[2] &c., or of viscous fluids and gums procured from the vegetable world, such as the milky juice of certain trees and plants, solutions of gum arabic, gum tragacanth, &c.[3]

The practice of tempera-painting may be said to be carried to perfection in modern scene-painting, in which imitation is chiefly confined to large effects. But in this application of the art the difficulty of blending tints to the extent required in figure-painting, so as to equal the completeness and finish of oil-painting, is not encountered. The thinness of the vehicle and the almost immediate change of the tints in passing from the wet to the dry state renders a certain abruptness of execution unavoidable. This peculiarity is compatible with great truth of imitation when the work is seen at a sufficient distance, and the crispness of execution which is the result, is, with the moderns, the characteristic of tempera.

The early Italian masters, when they painted altar-pieces in this method on cloth, endeavoured to attain the requisite finish by continually damping the back of the painting.[4] This enabled them to complete a given portion while in the wet state, and to give it any degree of softness that was desired. But this was only applicable to pictures executed on a thin and porous substance; tempera pictures on wood or on walls, in which finish is aimed at, cannot be so treated, without some modification of the vehicle or by continually moistening the surface in front. Some of the early Florentines and painters of the neighbouring schools adopted a more laborious method, but less satisfactory in its result.[5] They attained the completeness they sought by minute hatchings. A tempera picture in the National Gallery, attributed to Perugino, is a specimen of this laboured process.

The varieties of practice in the early examples of tempera, are also partly to be attributed to the varieties of the vehicle. The Greek illuminations in MSS. immediately preceding the 13th century, are generally painted in tempera with a very thick vehicle, and this system was adopted by the Italians, even for paintings of a much larger size, up to the time of Giotto. He appears to have been the first to introduce a thinner medium. In his works, while the tints are blended, the minute handling, which is almost unavoidable with the older practice, is not apparent. The thinner vehicle was composed of yolk of egg diluted with water, and combined with the milky juice of

1 Plaster of Paris stirred with much water till it loses the power of 'setting.' In the early Florentine descriptions of the process of tempera, white lead is mentioned; this is a proof that paintings so executed must have been subsequently varnished, and accordingly the early Italian works in tempera are always found to have been so treated. See "Cennini, Trattato," &c., p. 70.

2 The Italian writers restrict the term tempera to the vehicle of yolk of egg more or less diluted. The modern practice is to add, by degrees, a small wine-glass of white vinegar to a yolk well beaten.

3 See "Armenini de Veri Precetti della Pittura." Ravenna, 1587, l. 2, c. 8; and "Vasari," Introduzione, c. 20-25.

4 See "Armenini," ib. "Vasari," ib. c. 25.

5 "Armenini," ib.

shoots of the fig-tree.[6] It may seem extraordinary, that this last material should have been detected by chemical analysis in an early Florentine picture; the result was however verified by the analysis of the milky juice of the fig-tree while fresh.[7] A painting executed with this vehicle is not very easily affected by water or by oil; a varnish produces no other change than that of giving additional depth and lustre to the tints, and the colours do not dry so rapidly as in the ordinary practice of tempera. The fact that the more tenacious vehicle, with all its inconvenience, was revived or adhered to without change by other painters much later than Giotto, is not an uncommon instance in the history of art of attachment to habits, however defective, which time may have recommended.[8]

The Italian artists of the 16th century had generally abandoned the practice of tempera as an independent art,[9] and the examples of it are rare, especially when applied to the decoration of walls. An instance occurs at Trascorre, near Bergamo, in the private chapel of the Suardi family. The artist was Lorenzo Lotto.

It appears from various passages in the lives of the Flemish painters,[10] that tempera-painting was commonly practised among them. On all occasions of great public festivals, this rapid art was put in requisition,[11] and the tapestries which were executed in such abundance in Artois and Brabant, and which were wrought from cartoons coloured in tempera, had also greatly the effect of encouraging its practice. The schools of tempera-painting were to the Flemish artists what the *Feria* or market of Seville was to Murillo and his contemporaries.[12] For (though the latter uniformly painted in oil) such demands had the effect of promoting facility of execution and a large style of imitation, the influence of which may be traced in the more complete works of the respective schools, different as their tendency was in other respects. The rage for temporary decorations in the cities of Flanders, to do honour to distinguished individuals, had the additional effect of promoting a taste for allegory. The most extravagant combinations and allusions were excused in ephemeral productions; till by degrees the public were accustomed to such inventions; and the greatest artists—aware of the value of such materials as conducing to picturesque effect, ventured to introduce them in more permanent works, and recommended them by their talents.

The vehicles employed in tempera were sufficient to bind it when the colours were used in moderate thickness, but the danger of cracking prevented the application in much body. When therefore pictures in tempera appear to be executed with unusual substance, it may be suspected that other ingredients were added so as to give it sufficient tenacity, by which means it held a middle place between water-colour and oil-painting; the rapid drying which precluded the possibility of giving the work the requisite softness and completeness was at the same time prevented. The colours prepared for painting in this method may be mixed either with water or oil.

There is every appearance in some unfinished pictures of the Venetian and other schools of the north of Italy that the tempera adopted by them was of this description, and it is also apparent, from such pictures, that the method was sometimes employed as a preparation for oil-painting. Various modes of this kind may be considered and described in an inquiry into the early process of oil-painting; but lest too much importance should be attached to such preparations in tempera, it may be remembered that the practice of Rubens, Vandyke, and Rembrandt, supposes no such system.

The tempera-painting of the ancients, (although from passages in their writers evidently a distinct art from encaustic,) appears to have been protected by a coat of wax, and thus may not be easily distinguished, in actual remains, from encaustic painting. But it is probable that in every case where a finished tempera painting was thus varnished, the surface was first covered with some glutinous application before the liquid wax was added. Without this precaution, the mutual relation or *keeping* of the tints would be in danger of being altered. Other modes of protecting tempera, so as to render it washable, have been discovered by modern chemists. The description of an important invention of this kind is the subject of the next paper.

The ancient Egyptian paintings were executed on a stucco consolidated with an animal gluten, probably the serous portion of blood. On this was a thin coat of wax, and on this again the paintings were executed with the same vehicle of serum.[13] The stucco of the Greeks was sometimes consolidated with thick milk,[14] their tempera vehicle appears to have been gum tragacanth (Sarcocolla),[15] size, yolk and white of egg, &c.

In encaustic painting, wax was an ingredient from first to last. The precise process of this art among the ancients has been the subject of much controversy, but the actual remains of antique painting at Pompeii and Herculaneum,[16] as well as numerous allusions in the writings of the ancients, prove that it was common among the Greeks and Romans. It was also occasionally employed during the middle ages, and it is even asserted that it is still practised, however rudely, by Greek painters of the present day.[17]

The inquiries and experiments hitherto undertaken, seem to prove that two methods are practicable. In one, the wax is dissolved by a lixivium, and is then worked with water. In the other, it is mixed with a resin dissolved in spirit. In the first process a final coat of wax is essential to protect the painting. In the other method this varnish may or may not be used.

In the ancient encaustic, whatever were the ingredients, heat, (as the term encaustic implies,) was employed either during or after the process of painting. In the attempted revival of this art, in the last century, the application of heat was also considered indispensable. The method practised was to apply a *cauterium*—a portable furnace, hot iron, or any similar instrument, so as gently to melt the coating of wax spread over the finished painting. The heat was sufficient at the same time to affect the wax incorporated with the colours, and thus a union was produced throughout the mass. If afterwards rubbed with a cloth the surface acquired a slight polish.[18]

In the other process which, in its improved state, is more modern, heat is considered unnecessary, and the art is therefore properly called wax-painting, not encaustic-painting. The application of heat might still serve to consolidate and give transparency to an external coat of pure wax, but the presence of resinous substances in the vehicle, and with the colours, is supposed to render such application superfluous as regards the consolidation of the painting itself.

The solution of wax by means of alkaline lixivia was probably not unknown to the ancients.[19] This was the method of Bachelier,[20] Walter,[21] Requeno,[22] and others, but the specimens executed according to their system have not been considered successful as regards durability.[23] The following communication from Mr. King, of Bristol, may be considered an improvement on the process in question.

" The conversion of wax into a substance soluble in water is effected by the vegetable alkali, known by the name of potash, being combined with tartaric acid. This is the *Sale di Tartaro* of the Italians, and is sold by all chemists and druggists in this country, under the proper name, Tartrate of Potash, and more commonly salt of tartar or soluble tartar. When the acid predominates it is called supertartrate of potash or cream of tartar. This is the best substance to be employed in my process, and in the following manner:—An indefinite quantity, say half a pound, of this salt being placed upon an iron shovel and exposed to the action of fire becomes a black substance resembling coal, a sort of slag. It is to be thrown while hot into a vessel holding about six quarts of pure water, that is, filtered rain water or distilled water. Shortly after it is quenched, it is to be ascertained that the fluid is saturated with the alkali by its taste, or better, by its effect upon the colour of test paper.

" No quantity of water can hold more alkali in solution than that which is sufficient to saturate the water at the same temperature. The undissolved portion is separated by filtering, and the residue will serve to saturate another quantity of water. By filtering, the saturated fluid is sufficiently freed from the dark colour which was caused by the burnt alkali. This saturated fluid is called a lixivium, and in it the purified wax is to be boiled until it is converted into soluble soap, and wholly dissolved so as not to separate from the fluid when cooled. According to the proportion of the quantity of wax to that of the water the fluid will appear like milk when the proportion of wax is small, like cream or butter when it is greater; and even of the consistence of soft cheese when the wax is in excess. The consistence of cream is best suited for grinding the medium with more or less finely pulverized dry pigment body colours, such as ochres, raw or burnt terra sienna, raw and burnt umber. Cobalt, smalt, light red, red and white and black chalk, stone coal or anthracite, &c., answer best for dead colouring, and become brighter in the subsequent fusion and fixing by the use of the cauterium.

" Metallic colours, which are artificial oxides of metals, like vermilion or cinnabar, which is a sulphuret of mercury, red and white lead, chrome yellow, and others, are differently affected in the burning in, and the changes which they undergo are to be ascertained by previous trials. The latter class of pigments are more adapted to the finishing of pictures. Pigments of a vegetable nature, such as lakes, madders, &c., are altogether to be avoided or very sparingly used, and not at all in masses. The connexion of the medium (soluble wax), by grinding it with every pigment, is best performed in stone or earthenware (Wedgwood's) mortars and with pestles of the same materials, and the colours thus prepared are to be kept for immediate use in glasses or common gallipots. Instead of a wooden palette, a plate-glass or stone slab is required for large masses, and a spatula of hard wood or horn.

6 See "Cennini," ib.; "Vasari," ib., c. 20; "Borghini, Il Riposo," l. 2, &c.

7 See "Die Farben, Beitrag zur Vervollkomnung der Technik in mehreren Zweigen der Malerei, von Dr. Jacob Roux; Heidelberg, 1828; Zweites Heft.," pp. 63, 68.

8 The Italian tempera vehicle, in which gums are the chief ingredients, is prepared as follows: take one ounce of gum tragacanth, half an ounce of gum arabic, one ounce of parchment shavings, (of white goat-skin,) half an ounce of isinglass, boil in two quarts of water till the fluid is reduced to half its bulk. Before it is quite cold, add half a pint of spirits of wine, stirring well.

9 "Armenini," ib.

10 "Descamps, la Vie des Peintres Flamands, &c.," Paris, 1753. Compare "Armenini," ib., and "Borghini," ib.

11 See "Cornelii C. Spectaculorum in susceptione Philippi Hisp. Prin. Divi Caroli v. Cæs. f. an. 1549 Antverpiæ editorum apparatus," Ant. 1550. On this occasion 233 painters were employed, and the total number of workmen amounted to 1726. Compare Robertson, "History of the Reign of Emperor Charles V.," book 9.

12 "Cean Bermudez sobre el estilo y gusto en la Pintura de la Escuela Sevillana. Cadiz, 1806." p. 35.

13 See "Chemische Untersuchung Alt-Ægyptischer und Alt-Romischer Farben, &c., von Professor Geiger, mit Zusätzen und Bemerkungen über die Maler-Technik der Alten von Professor Roux." Karlsruhe, 1826, p. 22. Compare Pliny, l. 28, c. 8.

14 Pliny, l. 36, c. 55; l. 35, c. 36.

15 Ib, l. 35, c. 6; see also John, "Die Malerei der Alten," Berlin, 1836, p. 156.

16 "Geiger u. Roux," ib. p. 53.

17 Eméric David, "Discours Historiques sur la Peintre Moderne," Paris, 1812, p. 186.

18 Compare Vitruvius, l. 7, c. 9.

19 Compare "Columella de Re Rusticâ," l. 12, c. 50.

20 See Diderot, "l'Histoire et le Secret de la Peinture en Cire."

21 F. A. Walter, "Alte Malerkunst," Berlin, 1821.

22 Requeno, "Saggi sul Ristabilimento dell' antica arte de' Greci," &c.; Parma, 1787, p. 234.

23 Durosiez, (Manuel du Peintre à la Cire, Paris, 1844, p. 18,) assumes, that the presence of alkalies, such as ammonia and salt of tartar, in the substance of paintings must be especially injurious.

"The surface to be painted on must be a solid dry coat of stucco grounded with a mixture of such colours as will give a suitable tone of colour and depth. The first coat or ground is to be fixed by the *cauterium* with a moderate degree of fusion. The subject may be sketched on this ground with chalk or charcoal; and precise outlines, especially of minute forms, can be traced or sketched in with a metallic point or etching needle. The *cauterium* or salamander is not to be used again until the whole surface is covered and the effect advanced to a certain degree. It is clear that the manipulation of these materials, differing greatly, from painting in oil, will succeed more readily in the hands of an artist who has had some practice in fresco or in distemper; and as the surface is in most cases perpendicular some care is required to prevent the colour from running down.

"When the inustion by the *cauterium* is finished, and the whole surface of the picture cooled, it may be polished by friction with cloth or hard cushions, covered with some more or less rough texture, or with some of the implements used in polishing wood."[24]

Those who recommend in preference the solution of wax in spirit, and the addition of resins, do not profess to have discovered the precise process of the Greeks, but they have not failed to remark that the ancient writers speak of resins as entering into the ingredients of painting.[25]

The credit of having suggested the present systems of wax-painting, which are adopted with various modifications at Paris and Munich, is generally attributed to Montabert, who, in the eighth volume of his comprehensive "Traité complet de la Peinture,"[26] extols this art above that of oil painting. In consequence of the difficulty of reviving the study of Fresco painting in France, the attention of many artists and chemists has been turned to the employment of wax painting, and various churches and public buildings in Paris have been already decorated in this mode. In Munich, also, considerable works are in progress, executed in a method analogous to that of Montabert.

The advantage of wax as a vehicle is its durability. A wall painted white, partly with wax and partly with oil, exhibits the same tint for some days, but by degrees the oil colour darkens, and after some months the two portions are quite distinct; that which was painted in wax retaining all its brilliancy.

To this advantage is opposed, besides the difficulty of manipulation, the dull effect of dark shadows in pictures executed in wax. This is owing to the semi-opaque nature of the material, and is unavoidable as long as the absence of gloss on the surface is considered indispensable; but the colours become much more vivid after the surface is polished, and the admixture of resins tends to give clearness to the deeper shades.

Some of the French artists have gone farther; they have added a portion of oil to the cero-resinous medium, and by this means attain any degree of richness they please.[27] In this last system the *mat* quality, or absence of gloss, is in a great measure abandoned, and the method is only to be considered a means of lessening the quantity of oil, and consequently of avoiding the danger of a horny and darkened surface.

Some German artists, again, have considered it essential that the resinous ingredient should predominate, and have recommended only a thirtieth part of wax, the rest consisting entirely of liquid resin[28] (balsam).

Wax painting, properly so called, from its not admitting of much force (while its lights are assumed to be unchangeably bright), would suggest a particular style and choice of subjects; and as all colours (according to the French chemists) may be employed in it, it is considered to be particularly fitted for poetical subjects adapted to the lighter kinds of decoration. It is for such purposes that it has been chiefly employed in Munich.

The following is a description of the methods in general use at Paris and at Munich.

A wall which is to be painted in wax (and the same principle is applicable to all mural pictures) should not be quite perpendicular, but should incline inwards, with reference to the room, in its upper part. By this means the work is better seen, and dust is less apt to collect on it. The surface should be levigated; it is then to be thoroughly dried by heat, and lastly to be saturated with the following mixture: 10 parts of white wax, 2 parts of resin, and 40 parts of spirit of turpentine. This liquid is made to penetrate the wall or stucco by means of heat,[29] and the application is repeated till the surface ceases to absorb. Holes or irregularities are to be stopped with a mastic composed of wax, resin, and whiting. Over this preparation a coat or two of wax colour is to be spread as a ground for the painting.

The wax used in painting should be bleached and perfectly free from extraneous matter.[30] The resin recommended by Montabert is that called elemi; this combined with wax and an essential oil is the vehicle in which the colours are ground, and which serves to work them. The proportions are, 1 part of resin, and 4 parts of wax, dissolved over a water-bath in 16 parts of essence of spike-lavender.[31] The colours are ground in this gluten, diluted as may be required during the operation of grinding by the addition of the essence. They are then preserved in glass or earthenware vessels, and if they get hard (which can only happen after a considerable time) they may be dissolved with the essence or ground again and are always fit for use. Instead of elemi, copal may be used by those who prefer hard resin.[32]

The solution of wax alone is effected by the same essence, and this preparation is available when the artist wishes to increase the proportion of wax. The paste may be thinned with water by grinding it thoroughly with a muller, and gradually adding water to the amount of four times the weight of wax. This is called the milk of wax, and serves as a varnish for pictures executed in the above mode.[33] The solution of elemi or other resins in the essence, without wax, may also be employed when the resinous ingredient is required in greater abundance. To these materials may be added the essential oil of wax (procured from wax by distillation) which evaporates more slowly than that of lavender, and may sometimes be of use in the practice of this art.[34]

A process introduced in Munich by Professor Fernbach is not yet made known, but it is supposed to consist merely in the addition of liquid resin (balsam) to the wax, instead of artificial solutions of hard resinous substances.[35]

The methods more commonly practised in Germany differ but little from the system of Montabert. The following descriptions have been obligingly furnished by the artists:—

"For large paintings it is desirable that the ground should be somewhat rough. In Munich it is prepared as follows. A mortar composed of three parts of sand and one of lime is spread on the wall. When this is done the whole surface, while moist, is rubbed with a linen cloth; the result is a granulated ground, like rough paper. For small works, ornaments, &c., the ground requires to be smooth, and in such cases finely pounded white marble should be mixed with the lime instead of sand; the mortar so composed being then carefully spread and made even.

"The encaustic vehicle is prepared as follows:—To one pound of rectified spirit of turpentine add half a pound of Damara resin and a quarter of a pound of wax. The resin should be pounded to powder, and the wax cut up in small pieces. Both are then to be put into an earthenware or copper vessel, and the spirit of turpentine poured on them. Place the vessel on a moderate charcoal fire, so that the solution may take place slowly. When the ingredients are dissolved the vehicle is ready for use, and should be kept in glass bottle well stopped to prevent the volatile oil from escaping. Should the mixture become too thick in time, spirit of turpentine may be added. The colours are ground in such a quantity of this vehicle as is necessary to saturate them. If during the grinding the pigment tends to *set* (dry) spirit of turpentine should be added. For extensive paintings the colours are kept in glass vessels. For smaller works they may be tied up in bladders like colours for oil painting. The same colours which are employed in oil may also be used in encaustic painting.

"It is essential that the ground on which the painting is to be executed should be quite dry. Then the whole surface to be painted is to be washed over with milk. When this is dry a ground of encaustic colour is to be spread on the wall, the artist selecting any tone he pleases. This being done the surface is suffered to dry well, which will require some days, as it is important that the colour should be in no danger of being dissolved by subsequent operations. The artist can then begin to paint.

"In executing ornaments on a coloured ground, the ground must be composed of two or three coats (not too thick), each of which should be allowed to dry separately. The time required for drying varies according to the state of the weather. As soon as the pigment used for the ground is no longer easily dissolved,—a degree of hardness which it often attains in the course of a day, the painter may begin to work.

"When the painting, whether consisting of ornaments or other subjects, is finished and sufficiently dry, the whole is to be thinly passed over with the encaustic vehicle applied with a large brush, and after a day or two this varnish is to be heated with a charcoal fire, to such a degree, however, as not to injure the colours. The result is an equal but moderate shine over the whole surface."

Another process, practised at Munich in 1843, may complete this list of recipes:—

To a pound of turpentine (resin), evaporated to dryness by heat, add half a pound of powdered Damara resin, and a quarter of a pound of bleached wax, cut into small pieces. To be heated as before; and, when used, to be diluted, when necessary, with spirit of turpentine.

A mode of cleaning wax paintings is described, together with the materials now used by the French artists, in Durosiez's pamphlet, before quoted.

The following description of the nature and advantages of wax, as adapted

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24 Extract of a letter from Mr. John King, chemist, 26, Mall, Clifton, Bristol. Aug. 21, 1842.

25 A writer of the second century, Julius Pollux, enumerates among the materials of painters, wax, colours, and 'pharmaca.' Various Greek epigrams mention frankincense (Libanas, Libanoton) as entering into the composition of paintings. Other examples are quoted by Soehnée, "Recherches nouvelles sur les Procédés de Peintre des anciens," Paris, 1822, p. 36, and by Eméric David, ib. p. 171. Compare Knirim, "Die Harzmalerei der Alten," Leipzig, 1839.

26 Paris, 1829.

27 The method of Taubenheim is analogous.—See Fratrel "La Cire alliée avec l'Huile," &c. Manheim, 1770. The later practice of Joshua Reynolds was probably suggested by the researches prosecuted on the Continent at the corresponding period, respecting wax-painting.

28 See Knirim, ib. p. 182.

29 See the Second Report, p. 50.

30 The 'punic wax' of the ancients was nothing more than bleached wax. Pliny, l. 21, c. 14, and Dioscorides, l. 2, c. 105. Compare Requeno, ib. v. 2, p. 86. Bleached wax is easily procured, but the white wax sold for ordinary purposes is mixed with spermaceti.

31 'Essence d'aspic.'—It is prepared from the wild lavender (Lavandula major or latifolia). It evaporate more slowly than spirit of turpentine.

32 Durosiez, ib., p. 16.

33 Ure, "Dictionary of Arts," &c., article Varnish, describes the preparation of milk of wax by means of spirits of wine.

34 See Durosiez, ib.

35 Balsams, as is well-known, are native compounds of resins with essential oils.

for general painting, was submitted to some German chemists by Dr. Roux,[36] and received, among other statements by him, their written sanction :—

"Wax is, in chemical language a combination of cerine and myricine. It is a peculiar organic substance, resembling fat, but yet distinct from it. Wax is unaltered by exposure to air. It neither becomes harder or softer, and therefore does not contract like the unctuous oils. Exposed to light, it becomes whiter. Grund, in his history of ancient painting, relates that he saw in an Italian church two large wax candles, which had been presented in the year 1445, and which he at first took for snow-white marble pillars. On breaking the surface, he found them equally white internally.[37]

"Colours mixed with wax are entirely saturated by it. Wax and colours form together a more solid, less fusible substance than wax alone. The pigments remain closely united with the wax. No skin appears on the surface of the picture, even when the wax has been mixed in abundance with the colours. An under-painting executed with wax colours, has much more brightness than one executed in oil. A second painting on such a preparation appears bright and clear; on which account a painting in which wax has been used as the vehicle is always brilliant. When an oil painting at twilight begins to become indistinct to the eye, a wax painting next it is still clearly visible.

Wax is dissolved in volatile oil, which is also used with the colours. This volatile oil evaporates in a short time, and assists the drying of the colours.

"Paintings executed with wax colours cannot crack, (?) for the under painting dries quickly from the ground. The ductility and tenacity of the wax prevent its cracking. This method of painting has also the advantage, that the dissolving power of the volatile oil which is used in the after-painting and finishing produces a union of the upper and under layers, by which means the whole coloured substance becomes intimately united."

The statement that wax has no tendency to crack is true as regards the substance itself; but a painting thickly executed in wax, and varnished soon after its completion, would very probably crack. The Germans evade this difficulty, and consider resinous varnishes unnecessary to wax painting. The French artists do not exclude a final varnish. If such an addition be desirable, it is of more than ordinary importance to select a resinous solution that has little tendency to crack. The Damara varnish of Lucanas, and the excellent varnish of Soehnée (which seems to be analogous to Field's lac-varnish[38]), have this reputation. The latter has also the agreeable quality of being perfectly dry to the touch within a few hours after its application, and of remaining so. It never becomes discoloured. A coat of white paint, having half its surface varnished with this liquid, and the other half with mastic varnish exhibits a great difference of tint in a short time; the portion varnished with the Soehnée varnish retaining its first appearance unaltered. Its defect is its want of sufficient body; there seems also to be a difficulty in removing it from the surface even of an oil picture. The Damara varnish has the same qualities of not changing colour, and never cracking; it has more body than Soehnée's preparation, but is certainly not so clear. The modes of preparing and removing it are described by Lucanus.[39]

Of the remaining modes of painting on walls, viz., Fresco and Oil Painting, the papers already published on the former may be sufficient to give an insight into its practice. The problems yet to be solved are, the speedier preparation of a lime adapted for fresco painting,[40] and the preparation of durable colours of the more florid kind, such as lake and crimson.

Sir Humphry Davy, in his analysis of some of the colours of the ancients, found some vitrified substances, and accordingly expressed his conviction that glass frits would be the most durable of coloured materials, if they could be so prepared as to meet the wants of the artist. Dr. Roux is of the same opinion, and suggests that "as a white frit possessed of sufficient opacity is not to be obtained, the oxide of zinc might represent it among the vitrified colours. It is equally unchangeable."[41] To these opinions is to be opposed a practical authority of great weight,[42] who remarks that these colours, when ground to the degree of fineness necessary to render them applicable to painting, become liable to all the chemical changes and affinities of the substances which compose them.

The adaptation of oil painting to walls has generally found less favour with painters than any other method, from the numerous examples of a blackened surface which works so executed present. The process may be less objected to since it has been so ably employed in the Ecole des Beaux Arts at Paris.

A mode of preparing the wall so as to effectually exclude damp was described in a former paper.[43] The preparations used by Sebastian del Piombo, and recommended by Vasari,[44] might be preferable, as they contained little or no oil.

In this mode of painting, as hitherto practised, all absorption from the ground is cut off by the application of the first coat or hydrofuge preparation; it is, therefore, essential that the quantity of oil should be diminished in the under painting. For this purpose the half tempera method, which, it appears, was sometimes employed by the northern Italian schools as a preparation for oil painting, would be well adapted. But the application of a composition impenetrable to damp is not incompatible with an absorbent ground for the painting itself. Such a ground could be made to bind firmly to the hydrofuge by various means; indeed the same mode which the Italians adopted for panels would quite answer this end. These various methods are, however, so intimately connected with the general question respecting the early practice of Oil-painting, that, to avoid repetition, they may be reserved till that inquiry can receive due attention.

A method invented by M. Hussenot, called "Peinture à l'Huile en Feuilles," consists in the preparation of very thin sheets of oil pigment (for example white lead), which may be rolled like cloth. They may be made of any size, or may be fitted together so as to exhibit no joining. A sheet of paint, so prepared, is fastened in a temporary manner on a panel, or on cloth attached to a stretching-frame, and the artist completes his picture. When dry it is rolled up, carried to the place for which it is destined, and permanently fixed to the wall, being then made to adhere throughout its whole surface, probably by the application of a coat of white lead, to the wall. The objection to this mode (to say nothing of the oil ground) for important paintings, is the extreme danger of accident in the rolling and unrolling. For ordinary purposes it offers great facilities, since the application of decorations in oil on the walls of rooms or on shop fronts can be accomplished in a few hours, the work having been prepared without inconvenience in the study of the artist.[45]

[36] Ib. Zweites Heft, p. 49.

[37] The author elsewhere observes that the wax of southern climates is much whiter and harder than that which is produced in the north.

[38] "Field's Chromatography," p. 209. See also "Transactions of the Society of Arts," vol. 45. This varnish was not unknown to the Italians; see the list of recipes at the end of Orlandi's "Abecedario;" "Vernice di bellissimo lustro," &c.

[39] "Vollstandige Anleitung zur Erhaltung &c. der Gemalde, zur Bereitung der Firnisse, &c., von Dr. Fr. G. H. Lucanus." Halberstadt, 1842, p. 34-65.

[40] A method communicated by Mr. Dinsdale is now under the consideration of chemical professors.

[41] Ib. Zweites Heft, p. 51. [42] Field, ib. p. 45. [43] Second Report, p. 52.

[44] Introduzione, c. 22. Compare Bossi, "Sul Cenacolo di Leonardo da Vinci."

[45] See "Peinture à l'Huile en Feuilles, inventée par M. Hussenot, par A. de la Fizelière." Paris, 1843. See also "Rapport de l'Academie Royale de Metz sur les Procédés de Peinture inventés par M. Hussenot." Metz, 23rd November, 1842.

COMMISSION ON THE FINE ARTS.—CHOICE OF SUBJECTS.

Considerable surprise has been felt at the award of prize works in the recent cartoon exhibition, and also at the selection of subjects for the decoration of the House of Lords. On the former we shall not now so strongly dwell; but we cannot pass over the latter, because, to our minds, it is fraught with mischief, not only in its present influence but in its whole bearings, it suggests the fear of sad want of judgment in the individual instance, and the probable want of it on all the future proceedings. We are the more prompted to take up the question as we have before us the controversy between Mr. Hallam and Lord Mahon, appended to the Commissioners' Report. For the decoration of the House of Lords have been chosen three allegorical subjects, we do not complain of them because they are allegorical, and three historical events. The principle which has guided the Commissioners in the individual selections we cannot understand, clearly the House of Lords cannot be devoted to the sovereign solely, any more than it could be to the House of Commons, it must be treated either as the assembly hall of the whole legislature, or as that of the House of Lords only, and in either case the present arrangement is by no means fitting. It might, however, be decorated with the representations of great constitutional events, but even that is not the case now. We have Religion, Justice, and Chivalry, the latter a very queer constitutional element, and the Baptism of Ethelbert, Prince Henry acknowledging the authority of Chief Justice Gascoigne, and Edward the Black Prince receiving the garter from Edward III., neither of which latter have any constitutional importance, or bearing upon the functions of the House, while there would have been no difficulty in finding subjects more fitting in a moral and artistical point of view. A Council of ancient English Princes and Chieftains, the germ of the Parliamentary system; King Alfred submitting his laws to the Witenagemot; the Witenagemot recognizing the Accession of King Edward the Confessor; Henry the First restoring the Laws of Edward the Confessor; Henry the Third presiding in his Parliament; Trial of David, Prince of Wales, before the Parliament, 1283; Edward the Third, 1363, consenting to the Statute (36 Edw. III. c. 15) that pleas shall be pleaded in the English tongue; Edward the Third investing Edward the Black Prince as Duke of Cornwall in full Parliament, 1337. Either of these, we conceive, would be much more fitting for the decoration of a House of Lords, though many other subjects may be found, state trials, &c. and many important historical events must be excluded, as invidious to some branch of the legislature, and others because they are too modern. Certainly no worse choice could be made than that which has been announced, and if such unmeaning decoration is to degrade the House of Lords the sooner the paper hanger is called in the better, though there is one consolation that a future age might have more discrimination, remove the proposed fadaises, and put up more significant works. What great idea can indeed be communicated to the spectator by Chivalry and Chief Justice Gascoigne, and what great idea can inspire the artist? Are we reminded of the temple of legislation belonging to a great nation, and of the glorious constitution, which twenty centuries of liberty have fostered to its present growth? Shall we see anything but gawd and glitter and prettiness, things perhaps not works of art, certainly not works of mind?

When we come to look at the correspondence of Mr. Hallam and Lord Mahon, we must confess we distrust the Commission, so far as its historical aspirations are concerned. Mr. Hallam, indeed, is willing to avow that our national history can and must afford abundant materials for the artist; but he, of all men, is unable to appreciate its bearings. The author of our constitutional history confounds the history of the people with that of the island, and talks of Caractacus and Boadicea as if they had anything to do with English liberty or English government; and in another place he tells us that "the whole building is strictly denominated Her Majesty's Palace," which is certainly nothing more than a piece of lawyer's special pleadership. Still, while he appears to insinuate that English history may fairly be thrown overboard, and Greek and Roman history and mythology be introduced, he in reality gives abundant evidence to show how well and appropriately the Palace of the Parliament may be treated.

"In our halls of Parliament, or as we approach them, let us behold the images of famous men; of Sovereigns, by whom the two Houses of Peers and Commons have been in successive ages called together; of statesmen and orators to whom they owed the greatest part of their lustre, and whose memory, now hallowed by time, we cherish with a more unanimous respect than contemporary passions always afford."

"It is by no means my opinion that English history is to supply nothing. We cannot but recollect that a living foreign painter of high reputation has, with a sort of preference, resorted to this source for his most celebrated pictures. It is impossible, that the large proportion of those which may hereafter adorn the walls of the new building, should not be of this description. The bias of public taste in England, tends so strongly towards what is called nature, and so little towards ideality in painting, or even in sculpture, and has evidently exercised so great an influence over our artists themselves, the motives for selecting our own history are so obvious, and to a considerable degree, as I would again repeat, so well grounded, that we can have no reason to apprehend a superabundant influx of more universal subjects."

"The arrangement adopted for the New Palace at Westminster, may lead, perhaps, to a reasonable distribution of the paintings which may be chosen for its decoration. In those apartments which are naturally associated with the business of the Legislature, such as St. Stephen's Hall, the Central Hall, and the various rooms belonging to the two Houses of Parliament, our English history, or, possibly, also, such allegory or mythic representation as bears upon legislation and policy, ought exclusively to find a place. There would be in this at once a commemoration of past times becoming the national sympathy, and a just observance of that propriety in all its accessory parts, which a splendid monument of architecture requires."

Mr. Hallam, while willing enough to let in any extraneous subjects, takes a technical objection to works founded on the pages of the historian, but wrought out by the artist's imagination, as for instance, the First Trial by Jury; but we think him right in laying down the canon that no event should be deemed historical which was, as it were, episodical, and which forms no link in the sequel of causation, affecting only a few persons, great as they might be by fame or rank, without influencing the main stream of public affairs. We do not coincide with Mr. Hallam that the most beautiful and interesting women in English history must be painted, if at all, on the scaffold: the story of Rowena; Kenswintha persuading Kenrid, King of Mercia, and Offa, King of Essex, to take the monastic habit; St. Hilda baptized by S. Paulinus; Queen Bertha persuading Ethelbert, King of Kent, to receive St. Augustine; Sexburga, Queen of Wessex, leading her troops to battle; Alfred the Great taught by his mother to read; Elfleda the Queen heading her troops against the Danes; not to mention later instances, contradict this idea, and give full scope to the artist. On the other hand, we agree with Mr. Hallam that it is desirable show pieces, coronations, processions, meeting of princes or generals, and all overcrowded or dressmakers' pictures should be discarded as much as possible. Battles, we think with him, we must have; but we should have liked to have seen a more marked notice of naval pieces, works which though neglected, deserve support from this nation of all others, and which are not destitute of artistic resource. We cannot but think on the review of Mr. Hallam's letter, taking the whole of it into consideration, that the good points can have had little influence on his colleagues, and that he himself must be regarded among the supporters of the present trumpery scheme, if not the suggester of it.

Mr. Gally Knight's plan we need not speak of, as it has no particularly meritorious features.

Lord Mahon gives proof of a much better spirit than Mr. Hallam, but is about as obtuse on the matter of history. He talks gravely about the English originally roaming as painted savages over their barren hills, and thus mars a fine allusion to the glorious advance of the empire to its present colossal might. Lord Mahon boldly asks, can the history of such a people be wanting in scenes of interest? and, though without much discrimination in his citations, he still shews enough to convince any one that ample material is to be found in our annals, appropriate, picturesque, interesting, and important.

"I cannot but observe that the two instances, Canada and India, which from amongst others, I have quoted as tokens of our greatness, might also perhaps, afford practical answers to the artistic objections urged by Mr. Hallam. He deprecates the painting of battle since 'the introduction of field artillery and scarlet uniforms;' but surely in Canada, the death-scene of Wolfe, when withdrawn from the field and mortally wounded, with, I think, only one officer by his side, the young general (he was but thirty-three), surveyed the distant conflict with a dying yet a steadfast gaze, is a subject worthy of employing, and I trust it may obtain, a far greater artist than West. Thus, also, when Mr. Hallam justly points out the scope to a painter, afforded by 'such subjects as exhibit the human form to a considerable degree uncovered,' he will, I am sure, acknowledge (for no man could more ably describe) that the long train of our Indian successes in the arts of war and peace, would supply the advantage he desires by the delineation of the graceful and well-formed but scarcely clad Hindoos.

"Mr. Hallam goes on to observe with great truth, that for any attractive series of historical pictures, it is essential to 'intermingle female beauty,' and this, in his opinion, a strict adherence to our authentic records will not adequately supply. 'In fact,' he adds, 'the most beautiful and interesting women in English history must be painted, if at all, upon the scaffold.' Here, again, I cannot have the honour and pleasure (for I feel it as both) to concur with him.—Are we to have any State Trials? If we have, could there be a nobler female figure for an artist than in the scene which another member of your Commission has well described:—

"'There on that awful day
Counsel of friends, all human help denied,
All but from her, who sits the pen to guide,
Like that sweet saint who sat by Russell's side
Under the judgment seat.'

"Thus, also, why need any by gone difference on a Royal line, now extinct, prevent us from delineating the young Countess of Nithisdale liberating her husband from the Tower in 1716 (as her own most beautiful letter describes it), or the young Flora MacDonald saving Charles Stuart from his pursuers in 1746? Again, how rich is Scottish history before the Union in deeds of female heroism! Remember, for example, the scene previous to the assassination of James the First, when Catherine Douglas thrust her arm, instead of bolt, into the staple of the door, and bid the conspirators without burst it open if they would after this announcement! But supposing that Mr. Hallam desires to confine us, in our argument, strictly to England, and to actions in which royal blood bears some part; although I see no reason for either limitation, yet even then I would venture to allege, amongst others, Boadicea; Queen Eleanor of Guyenne saving her husband's life by sucking the poison from his wound; Queen Margaret of Anjou holding forth her children, and confronting the robber in the forest (an instance allowed by Mr. Hallam as the exception to his rule); Anne Boleyn in her bridal array; Lady Jane Grey at her youthful studies; Mary Queen of Scotland, and heiress presumptive of England, on her landing from France; Queen Elizabeth at Tilbury Fort; Henrietta Maria in the Civil Wars; Miss Lane assisting Charles the Second in his concealments and disguises after the battle of Worcester; the flight of Queen Mary of Este, and her infant son in 1688; Queen Mary the Second receiving the news of the battle of Boyne; Queen Anne giving her assent to the Act of Union with Scotland: and last, not least, the first Council of Queen Victoria! It may be objected that, in some of these instances, as with Queen Elizabeth and Queen Anne, the 'female beauty' required by Mr. Hallam may not be found. But where a Queen is introduced, there need be no lack in paintings any more than in reality of blooming Ladies of the Bedchamber and Maids of Honour to attend her."

We again say that we admire Lord Mahon's spirit, though we cannot applaud his judgment, and we are pleased to see that whatever may be his errors they are not on the score of illiberality, nor participate in the too great tenderness of Royal Commissioners, in glossing over bold and striking scenes. He suggests even the Seizing of the Mace by Oliver Cromwell, and the Death Scene of Chatham; and concludes by expressing his sincere and earnest objection to Mr. Hallam's general idea of subjects independent of and unconnected with English history, and his decided opposition to it.

Mr. Hallam replied to this letter, and informs us that the Commission had resolved on the adoption of subjects of universal or national interest, a pretty specimen of which is afforded with regard to the six House of Lords' subjects, which most decidedly have neither universal nor national interest. We cannot see that Mr. Hallam has, in his second letter, taken up any stronger ground, though he again implies that the representation of historical subjects must give preponderance and predominance to all the absurdities and extravagances of modern dress.

In conclusion, we would say the English have a deep interest in historical subjects, and have had the opportunity of appreciating many. Improve this vantage ground and it must be for the benefit of art at large.

EXPOSITION DE L'INDUSTRIE FRANCAISE.

MINERALS—MINERAL SUBSTANCES OTHER THAN METALS.

(Continued from page 328.)

COMBUSTIBLE FOSSILS.—Coal has been employed for centuries at Newcastle and Liege, but in France its use is of much later date. In 1520, the Faculty of Medicine, being consulted with regard to the use which was then begun to be made of English coal in Paris, gave their opinion that with precautions to avoid the inconvenience of smoke, this fuel might be used without injury to the public health. Thirty years afterwards a proclamation was issued forbidding farriers, on the occasion of an epidemic malady, under pain of fine and imprisonment, from using coal in their shops. Prejudices however wore away, and Henry the Fourth exempted coal from the payment of the royalty of a tenth. Lewis 14, also encouraged it, and put a duty on the importation of foreign coal. At the time of the great revolution, however, the whole consumption of coal in France was not more than 450,000 tons, of which half was supplied by importation. The quantity of wood fuel consumed in France is calculated at 15,000,000 tons, (10 metrical quintals or a thousand kilograms being taken as a ton), and of coal 5,000,000; coal is however reckoned to have double the calorific power of wood, so that coal may be considered as supplying two-fifths, and wood three-fifths. The superficies from which the wood is obtained is 20,000,000 acres, or 30,000 square miles, being sixteen times the superficies of the coal deposits, which moreover are available for agriculture. The progress in the consumption of coal in France since 1815 has been as follows:

	French produce, tons.	Importation, tons.	Total consumption, tons.
1815	881,500	249,300	4,121,000
1825	1,491,300	508,600	1,904,300
1830	1,862,600	637,200	2,493,900
1835	2,506,400	793,100	3,278,200
1840	3,003,300	1,290,600	4,256,700
1841	3,410,100	1,619,100	4,979,800

Thus whilst since 1815 the production of coal in France has quadrupled, the importation of foreign coal has increased seven fold. France possesses 46 coal basins, and up to 1841, 392 coal mines had been granted, of which 256 were in work. The superficies of the sets was more than 1,000,000 acres (432,000 hectares), 670 pits had been sunk, and 365 levels run. The maximum depth which had been reached was in the mines of Anzin, 1571 feet (479 metres). The mines were worked by 146 horse machines, and 388 steam engines, of a total force of 9,667 h. p. More than 30,000 men were employed. The total value of the produce was £1,320,000, at a mean price of 97 centimes per metrical quintal. Of the 3,410,000 tons of ten metrical quintals, the Loire basin furnished a third, and the Valenciennes basin more than a quarter. Next came the basins of Creuzot and Blanzy (Saone and Loire), Alais (Gard), Aubin, (Aveyron), Epinac (Saone and Loire), &c. Of the 1,600,000 tons imported, 1,000,000 are from Belgium, 4,000,000 from England, and 200,000 from Prussia. The great difficulty in the way of the French coal owners, is the want of good communications with the markets.

The state of France stands thus. The Belgian coals at the door are brought into the North and to Paris by the lines of navigation, the English coals are in contact with canals and rivers which take them to the ocean, and so up the French rivers, without river dues. The French coals however can only reach the coast or the great centres of c s umption by means of a difficult and expensive navigation on rivers deficient in water, or by canals, burdened with heavy dues. The coal owners therefore loudly call for the improvement of the Loire, the Yonne and the Seine, and complain of the dues on the Burgundy canal, Lateral canal of the Loire, and the canals of Briare and Loing. The capital invested in collieries has increased much more than that in woods, because the demand for wood has been stationary, while many new sources of coal consumption have been opened, particularly the manufacture of iron by pit coal. As a proof of this the basins of St. Etienne and Revè de Gier are cited. Before the opening of the St. Etienne and Lyon Railway, a proposition was made to a leading capitalist in Paris, in 1831, to purchase the mines of the whole basin, for the purpose of forming a consolidated company, the purchase being estimated at £1,000,000, and this was thought too much. It is now worth £2,600,000. The basins of the Saone and Loire, the Gard, &c., have advanced much more in value.

Great improvements have taken place in the mode of working. Formerly in the mines of the centre and south thick seams were left with pillars of coal, taking up half the available coal. Better modes are now adopted, and in the St. Etienne and Revè de Gier basins the roofs are almost universally propped by rubbish from the mines or from the exterior. The effect of all these measures has been considerably to reduce the price of French coal.

The works of the Revè de Gier being threatened with inundation, no other means of avoiding this evil remained than by a plan of joint drainage, and in 1836 a law was passed for this purpose, and now an engine of 400 h. p., on the Cornish system is at work at Revè de Gier, and which i he mest powerful engine in France. The introduction of the Cornish engine may indeed be considered as being one of the important features in the progress of French coal mining. The first engine put up in France on this system was built in the old works at Chaillot, under the direction of Mr. Edwards, for the coal mines of Breulle, in the north. Some of late years have been set up at Blanzy (Saone and Loire), in the Creuzot, and in the north. The Anzin Company in the north carries on its works on a very large scale. It has as it were built the town of Denain, dug canals, made railways, and opened manufactories.

France besides coal possesses beds of lignite, the produce of which in 1841 was 180,000 tons, of which one-half from the superficial deposits of the Bouches du Rhône.

The quantity of peat turf extracted was 500,000 tons, employing a great number of men, chiefly in the departments of the Low Loire, Isere, Doubs, Straits of Calais, Somme, and Aisne. It is used in several important establishments, as sugar factories, distilleries, dyeworks, lighting steam engines, lime and plaster kilns, forges, &c.

BITUMEN.—The asphalte mine of the Val Travers was begun to be wrought in the reign of Lewis XIV., and of late years it has been resumed. The chief mines now are those of Seyssel and Lobsann, both of which sent to the Exposition. The workings of asphalte at Pyrimont, canton of Seyssel in the Ain, are of old date. Count de Sassenay had began their extension, but M. Coignet had done the most. Specimens were also exhibited from Bastonnes, and Lampersloch in the Puy de Dôme. Asphalte is being considerably used at Paris for foot pavement, in preference to granite, on account of its cheapness, Auvergne lava, moreover, not giving satisfaction.

A new application of bitumen was exhibited by Messrs. Chameroy and Co., being pipes of thin sheet iron screwed together in zink and covered with a thick coating of bituminous mastic. M. Legoux, of Bayeux, and Messrs. Lasserre also exhibited pipes and stoves, with bitumen melted in. Messrs. Dournay and Co. of Lobsann, make waterproof papers of bitumen.

METALS.

In the course of the last century great activity was shewn in this mining in France, and the deposits of St. Marie aux Mines, Giromagny and Plancher aux Mines, in the Vosges; of Poullaouen and Pontpéan in Brittany; of the mountains of l'Oisans in the Alps, and the numberous veins of Auvergne and the Cevennes, produced considerable supplies of copper, lead and silver ore. New works were, however, imprudently carried on, and no provision being made for drainage the mines have been successively abandoned. Those of Vialas and Villefort in the Lozère, of Poullaouen in Brittany, and Pont-Gibaud in the Puy de Dôme alone attest this former period of property. At the present time France derives most of its copper from England and Russia, lead from England and Spain, tin from England and India, and zinc from Silesia and Belgium. Iron is the only metal which is worked on a considerable scale in France.

IRON.—Iron works appear to be very ancient in France. Cæsar, in the account of the siege of Avaricum (Bourges), particularly mentions the skill with which the beseiged made subterraneous galleries to undermine the earthworks of the Romans, which facility he observes the inhabitants obtained from their practice in the iron mines. Strabo, in particular, mentions the existence of large iron works in Berry and Périgord. Under the old regime iron mining was restricted, but increased under the empire, and the French ironmasters had the exclusive monopoly of the supply. On the return of peace, however, Sweden and England came into the market again, but their produce was burthened with heavy protective duties. Of late years the manufacture has considerably advanced. The following is the produce of pig and bar iron, of late years, in tons 10 metrical quintals, or 1000 kilograms.

	Pig, tons.	Bar iron, tons.
1825	198,500	143,500
1830	266,300	148,400
1835	294,700	209,500
1840	347,700	237,300
1841	377,100	263,700

The production has thus doubled in fifteen years. M. Burat reckons the produce of iron as follows.

	Pig, tons.	Refined iron, tons.
England (1842) ..	1,210,000	
France (1841)	377,100	263,700
Russia (average 1835—1838)	189,000	102,700
Sweden (1839)	115,100	87,200
Prussia	111,600	75,400

The number of mines and iron works in France in 1841 was 2464. Their superficies is 250,000 acres, and they employ 12,000 men. They produce 2,300,000 tons of ore. This ore is reduced in 573 furnaces, of which 468 were in work in 1841. Of these 573 furnaces 519 are worked with charcoal or wood, 11 with charcoal and coal mixed, and 43 with coke only or mixed with coal. Of 377,100 tons of metal, 292,000 were produced by vegetable fuel, and 85,100 by mineral fuel. The production by coal in 1835 was only an eighth, it is now about a fourth.

The conversion of the pig into bar iron is carried on in various works. In 1841 the produce was 263,700 tons of bar iron. of this quantity 146,800 tons, or more than half was manufactured with coal, either by the Champagne process with the hammer, or by the English process with the roller.

Among the new processes which have been applied of late years in France, three deserve to be enumerated. These are the use of the hot blast; the substitution of dried or torrefied green wood for charcoal; and the application of gas in blast furnaces for refining pig iron and converting it into bar. It is known that the use of hot air was imported from England; it has not been generalized there; neither has it in France, it has however extended, and out of 573 blast furnaces, 121, or near a quarter now make use of it. In charcoal furnaces it effects a considerable saving of fuel; it gives more regularity to the process; but it sensibly modifies the quality of the iron by making it more fusible and taking away its tenacity, which seems to imply that it should be abandoned in such charcoal furnaces as are used for producing bar iron, and should be introduced on the contrary in such as are used for castings. It is also employed with success in blast furnaces, which are worked with green or torrefied wood, or with charcoal and coke mixed, because it remedies the irregularities arising from want of homogeneity in the combustibles employed. In coke furnaces, the hot blast seems generally to succeed, and is frequently adopted. From official returns it seems that of 468 blast furnaces worked with wood, 46 only, or one-tenth use the hot blast; of 54 with green or torrefied wood, 39 use it; and of 54 with coal, 36, or two-thirds use it.

The use of dried or torrefied green wood has also been introduced within the last ten years. Formerly wood was only used after it had been converted into charcoal, although this operation exhausted many of the combustible elements. Carbonization as practised in the French forests, was at least half the calurific value of wood. This loss is owing to two causes, the imperfection of the processes of carbonization used, and the composition of the wood itself which is such that it is impossible to extract the carbon contained without losing a notable quantity, which escapes with the steam arising from the water of combination. Several plans have been proposed at different times to ameliorate carbonization and augment the produce; but these processes, either could not be employed on a large scale in the woods, or when once applied without adequate inspection, no longer gave the habitual results. Attempts were then made to ascertain how far it was possible to use on the iron manufacture, instead of charcoal, wood in its natural state, or at least only subjected to such incomplete carbonization as would lose only a slight quantity of its calorific elements. Many experiments have been made in the last seven or eight years. Some have introduced the daily and habitual use of green wood; others have dried; others, and by far the larger number have used a process for preparing it in a close vessel by means of the heat lost from the mouth of the blast furnaces, so as to subject the wood to a less advanced carbonization than that performed in the forests, and producing a combustible intermediate between dried wood and charcoal. The use of green or torrefied wood has not extended so far as might have been wished. Only 51 furnaces make use of it, and even this number seems to diminish. Several reasons explain this result. The first is the irregularity produced in the proceedings of the furnaces; the green wood occasions coolings down, which prevent fusion from taking place in a regular manner, and torrefied wood always presenting a very variable degree of desiccation or carbonization produces a similar result. Another and more important cause is that if a true saving of fuel take place by this process, it does not always show itself in money results; for if the works be at any distance from the woods, then the cost of carriage of the green wood to the furnaces increases. In order for the process to spread, the works would have to be seated in the woods. Whilst the furnaces only consumed charcoal, the endeavour was to place them near mines rather than near forests, for the ore weighs more than the charcoal consumed, but wood weighing more than the ore, the neighbourhood of the forests must be sought, if torrefied wood is to be used with advantage. Besides a great number of furnaces are at the same time distant from both mines and forests, being forced to seek a site where water power was available for the blowing machines. An improvement which has been completely successful, the use of the heat of the furnace to heat a steam blowing machine, allows in new works a considerable saving of money to be effected by the use of torrefied wood. Water power for the blowing machines is in fact useless, and as far as the mines allow the works may be placed in the midst of the woods of which they are to consume the produce.

The third discovery was represented by iron sent by Messrs Trayler and Huillier, and Messrs. D'Andelarre and De Lisa. The term of gas iron was unknown in France three years ago, it is now used in trade, and applied to a class of iron superior to coal made iron, and almost equal for most purposes to charcoal iron. Gas iron is iron manufactured with the gases lost in the blast furnaces, or with those arising from the gasification of combustibles of small value or unfit in their natural state for working iron. This process originated in the works of Treveray (Meuse), belonging to Messrs. D'Andelarre and De Lisa, and is extremely important to works using vegetable fuel. Refining with charcoal has already become impossible in most of the French furnaces, on account of the competition of coal, and in a very short space of time it will be so with the rest. At present coal bar iron produced from charcoal pig is a little better than bar entirely manufactured in the English way, and fetches rather a better price; but once coal bar master of the field, the difference in quality will not compensate for the great difference in price, and the cheaper article will exclude the other. The gas process on the other hand, if generally adopted, will save the old charcoal works, though it also effects a great saving with regard to coal. An important saving in the gas process is the diminished loss in slag, which is reduced one-half in the puddling and balling furnaces. In the Treveray process the gases lost in the blast furnace, or the gases which have exhausted their physical and chemical influence on the bed of fusion, are collected and sent into the reverberating ovens. These gases before being so used in the subsequent processes are purified from the matters which they may contain, injurious to the iron. This is effected by very simple apparatus, and the pig iron is brought into contact only with a purified gas flame. The arrangement of the gas oven, with jets of hot air and hot gas intermixed, obtains a very high temperature, and perfect combustion, since the turning of a few cocks allows the fire to be regulated at will, not only with regard to the intensity of its temperature, but the chemical nature of its flame, so as to have a neutral, an oxidizing, or a red active flame. The inventors assert that the process is so advantageous as to admit of being applied in other works besides those of iron. Arrangements are made so as by very simple means to raise the temperature of the gas to a very great extent before being used. Where there is not a sufficient supply of gas from the works, coal dust is used, turf, anthracite, &c., to make up. The French contend that the process belongs entirely to them, and that a similar process used at Wasseralfingen, in Wurtemburg, has neither priority in time nor in merit. To France, which is badly off for coal, and is a great wood country, the gas process is of great importance, as so much iron is made by means of wood, of charcoal, and which latter in the competition with coal, has already received many improvements. The charcoal furnaces have been much enlarged, their blowing machinery better constructed, so that furnaces which produced only 400 or 500 tons of pig, now produce more than a thousand, and it is anticipated if the gas process be carried out that the bar iron may be produced with no more expenditure of fuel than is now required for the pig. By the double influence of torrefied wood and the gas process, the iron works dependant on the first have been armed with new resources. It is remarked as singular that while the price of charcoal has tripled in the last fifteen years, that of iron has been constantly falling, so that instead of bar iron being one-third dearer, it is one-third cheaper.

The iron-works of France may be divided into three principal classes; first, those which manufacture pig and bar iron by the exclusive use of mineral fuel; second, those which manufacture pig with charcoal and coal; and third, those which manufacture pig and bar with charcoal only. In this order it may be useful to give a sketch of the works in France which sent specimens to the Exposition.

The principal works using coal exclusively are those of Alais (Gard), Decazeville (Aveyron), the Loire (Loire), all in the south of France; that of the Creuzot in the centre; and in the north those of the north and Straits of Calais. These works are established on coal basins, but in general they have not enough ore near them, or at least they have not enough, or have to obtain them from a greater or less distance. They are worked on the English plan, or with only the slight difference that pig is sometimes reduced with charcoal. The coal works had much difficulty in establishing themselves, and languished for a good many years, and have only begun to prosper since the railway system has opened a new market for their produce. The works of Alais, founded in 1826, encountered great difficulties, and all operations completely stopped in 1834; but towards 1836 Messrs. Drouillard, Benoist & Co., having farmed this large establishment, brought their experience and capital to bear for its revivification. The works comprise four coke blast furnaces, a great forge, the hammers and rollers of which are worked by two engines, severally 30 and 80 h. p. The principal works executed here are in rails. The Decazeville establishment, also on a large scale, had similar difficulties to encounter. It comprises six contiguous blast furnaces, a large foundry, three refining furnaces, fifty puddling and reheating furnaces, hammers weighing four tons, and striking 60 blows per minute, puddling rollers and drawers, plate rollers, &c. The total steam power is reckoned 600 h. p. The produce is 12,000 tons of bar iron yearly, and it will soon be carried up to 15,000 or 18,000. More than 2000 work people are employed. It has supplied, among other lines, the Paris and Orleans, Paris and Rouen, and Paris and Belgian with rails. They are said to be remarkable among French rails for tenacity and hardness. The works on the Loire were established to work the beds of coal and iron there, but which were found not so extensive as had been hoped and distant deposits have been had recourse to. Great discouragement prevailed at first, but the construction of the St. Etienne and Lyon railway, the better preparation of coke, the improvements introduced, and the reduction in wages have enabled the companies to reach a high degree of prosperity. The £120 shares of the Company of Forges and Foundries of the Loire, whose chief works are at Terre Noire, have risen to £1600. The works of Berard les Saint Etienne (Loire), sent specimens to the Exposition, as did those of Montluçon (Allier), which make a good coke from the Commentry basin, and work the iron ore of Berry, obtained by canal. The Creuzot is one of the largest establishments. Its coal beds produced last year more than 1,000,000 hectolitres, and it has four blast furnaces, three worked with coke and one with wood, and another blast furnace in construction; forges producing 8,000 tons, instead of 5,000 in 1839, and which will produce double when the new works are completed; a factory comprising a large foundry, great forge, smithy, boiler works, fitting works; a building yard at Châlons, on the banks of the Saone, for building iron steamers and fitting engines. Denain is the largest work in the north. In 1830 it was still only a small village, it has now 5,000 or 6,000 people. In 1830 the first coke furnace was built, and 1837 the first blast furnace; they obtain their ore from the neighbourhood of Boulogne and Avesnes. The forges in the north are four, Raismes, Trith St. Leger on the Scheld, Denain, and Anzin. This last has been bought by the Society of Commerce of Brussels, who are greatly extending it. Several othe rforges are in progress. Most of these works are for Belgian pig iron, of which the importation is greatly increasing every year. The Marquise works, in the Straits of Calais, use ore from the neighbourhood of Boulogne.

The works of the second class are numerous, of 263.000 tons of bar iron in 1841, 127,000 were made by the mixed process. The chief metallurgical groups where this system is adopted are the group of the north-east, comprising tha Ardennes, Moselle, Low Rhine, and Meuse; the group of Champagne and Burgundy, comprising the Nievre, Saone and Loire, the Cher, and the Allier. Fourchambaut, in the Nievre, is the most important of all. It has 12 blast furnaces, and produces 16,000 tons of pig, 10,000 of bar, besides 300 or 400 tons of forged wood iron from the forges of Gressouvre, Trezy, and Tournay, in the Bher, belonging to these works. This work seems to be one of the most distinguished for the quality of its produce, Messrs. Rowcliffe and Co., of Rouen, make use of this iron. The works of Abainville, Meuse, belong to Messrs. Capitain and Co., and comprise three blast furnaces worked with charcoal, and five sets of rollers. Other considerable works are those of Messrs. Bonguéret, Courreux, Landel, and Co., of Chatillon on Seine, Messrs. Grenouillet, Luzarches, and Desoages, of Vierzons, and M. Demimuid, of the Meuse. The works of Sionne, Vosges, belong to M. Bourgeois, and comprise a blast furnace, four refining furnaces, three puddling furnaces, two cementing furnaces, and a roller. They sent to the Exposition some shafts five or six yards long, of which one weighed near a ton. Messrs. Festugieres, Brothers, of Eyzies, were the first to introduce, on a large scale, the use of coal furnaces into the department of the Dordogne. The forge. of St. Maur, in the Seine, near Paris, belongs to Messrs. Doë and Co., and works up old iron from the pigs of the Haute Maine. The Grenelle work, in the same district, carries on the same business. The forges of Athes, in the Seine and Oise, belong to M. Baudry, and produce iron principally for coach smiths, also good steel.

The last class of works is that in which improvement is slowest, and comprises chiefly the works in the eastern group, in the High Saone, Doubs, Jura, High Rhine, Meurthe, and Vosges; in the north-west group from the Eure to the Ille and Vilaine; and the groups of the Indre, Perigord, and the Isere. The works of Framont, Vosges, existed in the thirteenth century, and now comprise two blast furnaces, six refining furnaces and their hammers, a roller, &c. They produce annually 600 tons of castings and 900 of bar and sheet iron, and make railway axles. The works of Allevard, in the Isere, comprise two blast furnaces, a forge and four slitting mills worked by water power. The works of Ruffec, in the Cnarente, belong to M. Marsat, and consist of three blast furnaces, six refining furnaces, and two foundries. The forge of Lagreneric, belonging to M. Beorbazan, has for the last forty years supplied the iron for the great manufactory of arms at Tulle, principally employed for gun barrels.

There is, moreover a fourth class of works, consisting of those which make bar iron direct from the ore by the charcoal process, without passing through the state of pig. This, called the Catalan method, is peculiar to Corsica and the departments near the Pyrenees. Two works in the Arriege sent to the Exposition. They manufacture steel also.

Iron Castings.

In England more than half the pig iron is used for castings. In France, also, the use of cast iron is extending for architectural and ornamental purposes. Of the 377,000 tons of pig produced in France in 1841 more than 95,900 tons were castings, thus obtained—

From charcoal	61,600
From wood and charcoal . . .	10,400
From coal and coke	7,400
From coke	16,500

This quantity was produced by 162 blast furnaces worked with vegetable fuel, and from 28 with mineral fuel. To this total must be added the foreign imports, which bring it up tn 122,800 tons of pig used, reduced on casting to 117,700 tons. It is remarked that while some French castings are very good, the English have the superiority, particularly in large castings, because their produce is more equable and regular. Upwards of 18,000 tons of English pig, principally used for castings, were imported into France in 1812, and chiefly worked up at Paris, and the coast towns Havre, Rouen, Nantes, &c. The Franche Comté pig is esteemed the best in France, and is often mixed with English pig for castings with good effect. After these comes the pig of Perigord and the Nivernais, In the Meuse, Low Rhine, and Vosges most of the common castings are executed, and the gas and water main pipes for Paris are principally cast there. The higher class of foundry business is carried on in the large towns, among which Paris and the Seine take the lead, although in 1824 there were only 4 iron foundries there, the number now being from 35 to 40, producing a quarter of the superior casting of France, valued at £240,000. Next come the Lower Seine, Charente, High Rhine, Nievre, Gard, &c. A great many specimens of superior casting were sent to the Exposition. The chief foundry in France is that of Garchizy, known as the Fourchambaut works, under the direction of M. Emile Martin. It can cast 400 or 500 tons of second casting in a month, and has supplied hydraulic presses for the ports; the machinery for the Decareville works; the arches of the Pont du Carrousel; the work of Chartres Cathedral; the iron piers of the bridge of St. André de Cubzac, one of the largest works of the kind ever undertaken; and extensive orders for the French railways. M. Emile Martin is now bringing out a cast iron bridge for the Lyon railway at La Mulatière, and others for the Avignon and Marseilles Railway over the Rhone and Durance. M. Emile Martin has also a great locomotive factory, and is desirous that all railway works should be executed from uniform models, as in the artillery. Not far from Garchizy is the Torteron furnace, belonging to the Forchambaut Company, which executes rough castings. Here the hot blast has been used with advantage with a mixture of coke and charcoal. This furnace produces 3,000 tons, used for castings, chiefly gas and water mains, railway chairs, shot and shells for the army and navy, &c. Solid balls are now made of grey pig, like the English, instead of white and brittle pig, which in battery in breach would break and recoil on the beseigers. The chairs supplied to the St. Etienne and Lyon Railway, to be placed on stone blocks, and under contract to restore all broken ones within two years have never yet required any to be replaced.

M. Calla sent to the Exposition some of the most finished work. The establishment as founded by his father, in 1806, was only a machine factory, but in 1818, on returning from a journey to England, an iron foundry was added to it, and it has since greatly increased. M. Calla was the first in France to manufacture cast iron ornaments on a large scale, and he has exerted himself to produce patterns in good taste, and to bring out clean and sharp castings. He has supplied the Palais Royal, the Tuilliries, the Pantheon, Church of the Madeleine, Notre Dame de Lorette, &c., with staircases, flower vases and receptacles, candelabras, balconies, railings, &c. M. Calla exhibited this year one of the compartments of the grand door of the church of St. Vincent de Paul, representing St. Simon and St. Jude in demi-relief, also a holy water vase for the same church, and some busts. M. Ducel, also of Paris, sent a number of models for buildings, churches, garden work, fountains, heating, lighting, &c. Some of his best productions were crucifixes, of various dimensions, a gothic door, a Descent from the Cross in low relief, a lion, &c. M. André of Val d'Osne, in the High Meuse, who supplies the capital largely, sent in a kind of artistic exhibition, including ornaments of all sorts, candelabra, a handsome holy water vase, statues of the Venus de Medicis, and the Young Faun, &c. This manufacturer was the first to introduce into the High Marne moulding in sand, instead of the former tedious and costly process of moulding in sand. He has two blast furnaces, each produces about 1500 tons per annum; one, that of Morley, manufacturing gas and water mains only; the other, the Val d'Osne, manufacturing ornamental work, and also large work for bridges and water works. M. André has had a great hand in reducing the prices of run cast works, as pipes, &c. Messrs. Vivaux. Brothers, of Dammarie, Meuse, produce cheap saucepans and culinary utensils, tinned by a convenient process invented by M. Budy, who uses an alloy harder, more adherent, and much whiter than pure tin. Whether the same as the English plan or different we cannot say. In Alsace and Lorraine cast iron saucepans are used without tinning. Cast iron saucepans are gradually superseding copper in France. In Germany, instead of tinning the inside, an enamel is used more solid than tin, a great many of these enamelled iron pots are used there. The process is kept secret, and only known from the imperfect description given by Harston. The pots are chiefly made in the Hartz, Saxony, and Silesia, and large profits are derived from their manufacture. In France, the foundaries in Alsace and Franche Comté manufactured enamelled pots; but, either on account of the enamel not being firm, or the price being high, the speculation has not succeeded very well. At Birmingham some attempts have been made to enamel cast iron, but without adequate success, the enamelled street name plates being we believe the chief application.

Rails.

The rail manufacture is mainly carried on by the coal furnaces, eleven large establishments only being recognized by the government as contractors in adjudicationss of rails. It is asserted now that France is fully able to supply the quantity required, and in consequence of the custom house union with Belgium being considered impossible, several of the Belgian capitalists have taken establishments on French side, four new forges having been set up in the department of the North for manufacturing iron with coke. These establishments are extending, one is being built in the coal fields of Commentry, another at Montluçon, and four blast furnaces either at the gates of Lyon or at Lavoulte on the Rhone. All these works are for manufacturing rails, and it is calculated they will supply 25,000 tons. The eleven old works, it is said in the official mining returns, can supply 75,000 tons of rails yearly, which we should doubt. After all a hundred thousand tons a year only just supply 2500 miles yearly, or one-fifth of the total length of railway authorized by the legislature.

Sheet Iron.

Sheet iron was little attended to in France thirty or forty years ago, about two-thirds being imported from abroad and now not a plate. In 1834 the produce was 12,000 tons, in 1841 it was 26,200 tons, valued at £640,000. This increase arises from the great demand for machinery, steam boilers, boats, buildings, &c. Formerly sheet iron was only made with charcoal, now it is often made with coke. The High Saone and the Vosges are the chief departments for this branch. M. Richard exhibited boiler plates made out of four blocks of iron united by the hammer and then rolled. M. Blanc, jun., of Versailles, exhibited pipes of sheet iron.

Drawn Tubing.

This manufacture, derived from England, is extending in France, and is chiefly carried on at La Briche, near St. Denis, and at Abainville, in the Meuse. La Briche was founded by M. Gaudillot for drawing and soldering tubing hot, he imported the process, and exhibited his first specimens in 1839. His tubes or pipes are all tested to 300 atmospheres, and are principally used for gas and hot water pipes. M. Gaudillot supplied last year 16,000 yards to M. Duvoir Leblan for heating the Luxembourg Palace, the Blind School, and other large establishments. He also makes large tubing for pumps, boiler pipes, waggon axles, columns, &c. He is trying, in consequence of the experiments in England, to get a demand for hollow axles for locomotives and railway carriages. M. Gaudillet asserts that he can produce 9 inch pipes, while in England none have been made beyond $4\frac{3}{8}$ in. outside diameter. The use of hollow iron for large gates is extending. He has supplied a good many at Paris within the last 15 years. M. de Viney exhibited tubing drawn cold, proved to a pressure of 10 atmospheres, and galvanized by Sorel's process.

PROFESSOR FARADAY ON HEAT.

A course of eight Lectures delivered at the Royal Institute.

Lecture VII., *June* 1, 1844.

(Specially reported for this Journal.)

When light falls on a polished opaque substance, it is reflected from it, or thrown off in an opposite direction, the angle of reflection being always equal to the angle at which it falls on the surface. If the body is transparent, the greater part of the light passes through it, and if the light falls angular on it, it is refracted, or bent from its course, and when the transparent substance is prism-shaped, the light is thrown completely in another direction. Such substances as ice and glass allow light to pass through, and refract it, but polished metals reflect, and do not allow it to pass. The same facts have been observed with respect to heat, and although it cannot be seen in its passage, its transfer can be proved. When the hand is held towards a fire, heat is felt, which is due to its being radiated, or thrown equally, as from a centre, in all directions. The effects of radiated heat may be watched by using a red-hot ball, which will be found to give off heat equally in all directions, and will readily light a piece of phosphorus placed at a great distance below it. A flat mirror, held in the path of the rays of heat, will reflect them, and the rays may thus be thrown on any required spot. If, instead of one mirror, 300 or 400 are employed, and so placed that the heat reflected from each should fall on the same spot, the effect of course is greatly augmented. A concave mirror may be considered as such an assemblage of myriads of flat mirrors, and its focus as the spot where their reflected heat is accumulated. With two parabolic reflectors, the effects of radiated and accumulated heat are very striking. A red-hot ball placed in the focus of one will fire combustibles held in the focus of the other, though they may be far apart, and ice produces in a similar manner, cooling effects.

The rays of heat and light are not hot, and it is an error in thought and word to call them so. The rays of heat are *heating* rays but not *hot* rays. This is beautifully illustrated by the experiments of Melloni, who found that various transparent substances allowed heat to pass through them in various proportions; that those bodies that allow it to pass freely through them do not become heated, and that those that stop the rays become heated exactly in that proportion. He placed a red-hot ball on a stand, and the two substances he wished to compare on opposite sides of it, and by a frame prevented any heat from passing excepting through the two bodies; beyond these he placed two pieces of metal with phosphorus on them, and by comparing the time it took to fire the phosphorus, he learnt the comparative freedom with which heat passed through the bodies experimented on. Through a piece of rock salt the heat passed with facility, but through glass it scarcely passed at all. Passing through the salt, it leaves it cold, but being stopped by the glass it makes it hot, thereby proving that when as rays it is not hot, but only when stopped, and then they lose their character as rays. In the same manner the rays from a luminous body are not light, until stopped by a solid body. If they were, the light from the sun should be seen passing through space to the planets or to the moon, but they give no light until stopped by them, and therefore are invisible.

When reflectors are used with the sun's rays, of course both the light and heat are reflected. Wood or paper held in the focus of a large reflector, are immediately fired by the sun's heat. The course of the rays travelling from the reflector to its focus is made beautifully evident by holding a smoking piece of paper underneath.

The rays of heat passed through a lense, are conveyed in a similar manner by refraction to a focus, but in this case the focus is on the opposite side to the source of heat. With the action of a burning glass every one is familiar, but it will now be seen that the property of refracting to a centre does not depend upon the nature of the body, but upon its transparency and shape; for ice, if melted in a hot tin mould until it is lense-shaped, acts equally well with glass. By it the sun's rays may be concentrated so as to burn paper and other combustibles, and yet the ice does not become melted. This could not be done with common heat, for instance, that from a fire, as ice will not allow its rays to pass, and stopping them, becomes melted. In Melloni's experiments on this subject he found that there were different kinds of rays of heat, just the same as there are different coloured rays of light, and that these rays were mixed in various proportions according to the source from whence they emanated. Thus some will pass through ice and salt, and not through glass. The rays of heat from the sun pass through almost every substance, whilst those from a common fire are stopped to a certain extent by almost every thing, and the substances themselves become heated. That no heat is produced until the rays are stopped is seen by passing the sun's rays concentrated by a lense through a glass tube filled with ether, when no effect is produced; but put into it something which will stop the rays, such as a piece of black paper, and the ether is seen to boil immediately. The great effects produced by concentrating the sun's rays from a few feet on to one spot, gives a great idea of the immense quantity of heat which is continually being poured on this earth, and of the fearful effects were this heat withheld but for one season. These rays are not obstructed by the glass of the window, but allow it to pass on to carpets, &c., and heat them, but were they the same rays as from a fire, the effect would be very different.

The reception and emission of heat, though depending principally on the nature of the body, is found to be very greatly influenced by the state and texture of the surface. Of two radiating bodies, for instance, tin canisters filled with hot water, one blackened or roughened on the surface will be found to get cold sooner than that which is left bright, one appearing like a good conductor, the other like a bad one, though the only difference is in the state of the surface; or the experiment may be varied by black-washing or white-washing only one side of the vessel; a thermometer will then indicate more heat being given off from that side than from the others. In the same way the reception of heat is affected by surface, those absorbing the best which radiate the best. The application of this principle to useful purposes is carried out to a great extent; for steam engines, and boilers, which are required to retain the heat, are kept bright, whilst those from which the heat is required to be delivered, as in warming buildings by hot water pipes, the surface is kept rough. In domestic economy the china teapot is now superseded by polished metal, which is found to keep the infusion hotter, and a difference even would be found whether a silver teapot were kept clean or dirty. Every substance is continually radiating heat to any other body near it which is colder than itself, and ice, even, will send out radiant heat to solid carbonic acid. The emissive power is not always in proportion to the amount of heat, for the flame of a candle, though consisting of particles far hotter than a red-hot iron ball, does not radiate nearly so much heat as the latter. The power of a bright reflective surface to protect from radiant heat is well shown by placing a slip of gold leaf on a sheet of paper, and holding over it a red-hot ball; the uncovered paper is scorched, whilst the thin metal, itself an excellent conductor, entirely protects the paper below.

It has, then, been shown that bodies differ in their power of transmitting heat, some, like rock salt, transmitting it readily, or being an easy *diathermal* body, whilst others, such as alum, transmit it but slightly, and that the rays of heat differ, depending upon the source from which they emanate, for the facility with which they penetrate transparent media; thereby confirming the probability of the analogy that Melloni has drawn between the various rays of light and those of heat.

REVIEWS.

Practical Tunnelling. By FREDERICK WALTER SIMMS, C.E. London: Troughton and Simms. 1844.

This is an excellent instance of what may be done for the interests of science by an engineer closely engaged in professional pursuits, by the proper adaptation of his exertions. Mr. Simms, as many other engineers have been, was employed in superintending a considerable tunnel, and by making careful and copious memoranda during the progress of the works he has been able to produce a volume of very great value. He might, like many others, have pleaded want of time to write a book, and so glossed over the want of industry or inclination, which are too often the real grounds of neglect when parties are entrusted with the conduct of extensive operations. Mr. Simms, however, fortunately for the profession, and we think we shall in time be able to say fortunately for himself, has made no such idle plea, but given convincing proofs of its futility. We hope, indeed, this example will not be without its fruit, but that many more, having much better opportunities, may be urged to take advantage of them. However well trained a man may be in a particular pursuit, however much experience he may have had, and however well he may think he is acquainted with his duties, he will always derive benefit from the careful perusal of the evidence of other men. Engineering after all, however large its operations, has to deal with innumerable and minute particles, with cubic feet of earth, with blocks of stone, with single pieces of brick, and economy of materials, is only attainable by careful calculation and comparison systematically carried out. In the same way, much economy of labour, economy of time, safety and certainty of execution, could be obtained, and no one of his own individual knowledge dare say that he has attained the maximum of these, or is justified towards his employers in neglecting the proper and obvious means of acquiring information. On the one hand, by obstinate and ignorant adherence to old routine, we find scores of thousands of the public money wasted on sewers; on the other, by the careful application of science we find as many thousands saved. Nothing is more easy than to say, make a tunnel of such a length, through such a hill, give it an elliptical, parabolic, or other arch; but where, perhaps, a hundred thousand pounds is to be expended, it becomes the peremptory duty of the engineer to ascertain that the form he proposes, the dimensions he has adopted, and the course he is about to pursue are such as to effect the end in view with the greatest regard to the interests of his employers; and thus we say, however clever he may be, he will do most satisfactorily to himself, and them, by availing himself not only of his own experience, but of all records of the experience of others. In the same way, too, that it is his duty to take advantage of others' labours, and as he profits by them, does it become his moral duty to repay the obligation by communicating also the results of his own experience. This the Institute of Civil Engineers strongly inculcates and highly encourages; but we regret that many of its members, old and young, do not practise it. There can, indeed, be little doubt that from the want of such information being afforded, many millions have been expended in the railway system alone, which could well have been avoided. We therefore strongly urge all parties to avail themselves of the opportunities within their reach for the illustration of engineering science.

Mr. Simms was employed first in constructing the Blechingley tunnel, on the South-Eastern Railway, and afterwards the Saltwood tunnel on the same line, works the joint cost of which was upwards of £200,000, and he has minutely described the whole progress of the works, with copious illustrations, and full details of every item of expense, so as to present a manual not merely useful, as he modestly represents, to the beginner, but, for the reasons we have already mentioned, to the engineer of extensive knowledge and experience.

In the first chapter Mr. Simms explains the geological character of the country through which both tunnels pass, and the several difficulties with which he had to contend. He shows by an abstract of the payments that the works of the Blechingley tunnel, which is 1324 yards in length, cost £95,236, or about £72 per lineal yard. This tunnel was entirely executed under the superintendence of Mr. Simms, without any contractor, the company doing the work themselves, including the making of the bricks. The other tunnel at Saltwood was executed by contractors; the first one failed,—the works were carried on at the commencement with considerable difficulty in consequence of the great body of water in the lower green sand, through which the tunnel passes. After great labour, a heading or adit was made quite through the hill, on a level with the bottom of the tunnel; this being accomplished, the subsequent works were carried on with comparative facility. The company then entered into contracts with responsible contractors for the execution of the works at the sum of £85,000, which, added to the previous expense, made a total cost of £112,542 for a tunnel 954 yards in length, being at the rate of £118 per lineal yard. The size of both tunnels was 24 ft. wide in the broadest part of the curve, 30 ft. including walls, and 25 ft. high in the clear, or 30 ft. including the invert and arch at top, or 21 ft. above the level of the rails; the thickness of the brickwork varied from 2½ bricks to 4 bricks in thickness, and the invert three bricks.

The second and third chapters explain the construction of the Observatory, the Transit Instrument, and the setting out the line; the fourth chapter the sinking of the trial shafts, by which it appears that one of them was sank 35½ yards, and that the estimated cost of the shaft, 6 feet in the clear with a 9-inch rim, was £3 8*s.* per yard down, the price of 18*s.* per yard down being allowed for the sinking, and £16 per rod for the brickwork, but in consequence of the large quantity of water constantly coming into the shaft, the expense was increased £50 for the lower 5 yards. The cost of sinking a similar shaft for the Saltwood Tunnel, 25 yards, was £77 14*s.*, or £3 2*s.* per yard down. Mr. Simms carefully details the whole of the process in sinking the shafts, illustrated with engravings, and also points out how the various difficulties arising from water and sand were overcome. The next chapter proceeds in like manner to show the cost and the progress of the works connected with the working shafts, they were 9 feet in the clear with a 9-inch rim of brickwork, the cost of these by Mr. Simms' calculation appears to be about £6 per yard down for the Blechingley shafts in the weald clay, and £4 15*s.* for the Saltwood shafts in the lower green sand. Afterwards the erection of the horse-gins and plant connected therewith is detailed, which brings us to the seventh and eighth chapters, on driving the heading. Here we have some valuable statistical tables on the work done by horses in drawing water up the shafts by horse-gins; the following are the mean results of the weight of water raised one foot high in a minute.

Horses working three hours per diem, mean of 112 results, = 32,943 lb.
Horses working four hours per diem, mean of 4 results, = 37,151 lb.
Horses working four-and-half hours per diem, mean of 12 results, = 27,056 lb.
Horses working six hours per diem, mean of 212 results, = 24,360 lb.
Horses working eight hours per diem, mean of 4 results, = 23,412 lb.

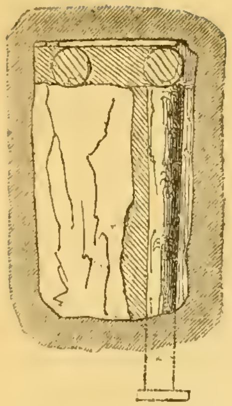
In the determination of the value of horse power from the above results, the three and six-hour experiments alone should be adopted. The other results were more or less objectionable, from a variety of causes over which there could be no controul; and are therefore of less practical value.

By working at the maximum, lifting 36,000 lb. to 48,000 lb. per day, the horses sank under the excessive fatigue, and 11 of them died. The horses were of good quality and cost from £20 to £40 each. The expense of horse labour, including boy to drive was about 2¾*d.* per ton lifted 100 feet high.

The four chapters 9, 10, 11, and 12 bring us fairly into the construction of the tunnel itself, here we must let Mr. Simms give the explanation himself.

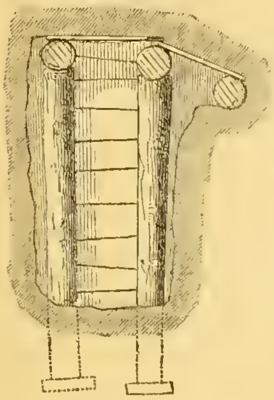
The excavations for the tunnels at Blechingley and Saltwood were carried on in a similar manner. One description of the general process will therefore suffice; with such occasional particulars of any peculiarity in the circumstances of either, as may have arisen in the course of those works.

The work was commenced by removing some of the polings, or deal ends, from behind the two top settings of the square timbering of the shafts; and driving a narrow heading, about twelve feet long, at the top, and in the middle of the intended tunnel. Where the ground is good, and will stand without much timbering, the top heading (as it is usually called) may have rather large dimensions; but must be limited in this respect where the ground is loose or treacherous. The headings at Blechingley and Saltwood were sufficiently high for a man to stand upright in, and about three feet in width. In some of the headings at the former tunnel no poling boards were required in so small an excavation, but at the latter place they were in all cases necessary. No regular system of framing was used, but pieces of poling boards were put up and secured in the best and most convenient manner, wherever the earth showed symptoms of falling in, but so arranged (where it was possible) as to form part of the subsequent roof of the excavation. The top of this heading was so much above the intended soffit of the arch of the tunnel, as to admit the proposed thickness of the brickwork, and that of the crown bars, packing and poling boards, together with the allowance of several inches for the settlement of the timber which is certain to take place when more of the excavation is made, and before the brickwork can be inserted to take the weight, and relieve the bars of their burthen. This allowance should never be omitted, for when such settlement takes place, and no room has been previously left for its occurrence, a part or the whole of the crown bars in sinking occupy the position of the intended brickwork; and therefore, in order to insert a tunnel of the required dimensions, the bars and poling boards must be raised to their proper level: which is only to be done piecemeal, by removing the earth over each bar, and then raising them one at a time: this involves considerable labour and care, and no trifling expense.



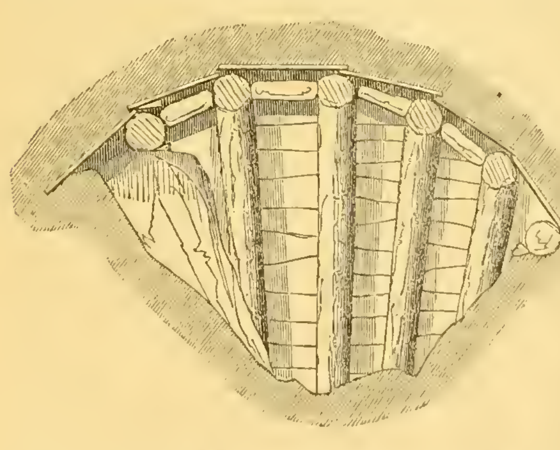
When the heading is driven, it is widened at the top along one side, to form, as it were, a shelf, upon which a crown bar may be laid lengthways. When this is done, the centre crown bar is placed along the top heading, and supported against the roof, by an upright prop at the remote end, and by resting it on the square timbering of the shaft at the near end; poling boards are then arranged above the two bars to carry the earth. This is shown in the annexed section of the top heading. A similar excavation or shelf is next made on the other side of the centre crown bar, and a third bar placed thereon, and poling boards inserted above, as in the first instance; a narrow slip of ground is next removed from under the remote ends of the two side crown bars, to the bottom of the heading; and rough props inserted to support them in the same manner that the centre crown bar is supported; their other ends being in like manner supported by the square timbers of the shaft. The earth may next be removed from under the two side bars, which leaves the heading much wider than before.

Sometimes when the top heading is wide enough, two crown bars are inserted and poled above, and the insertion of the side bars (by excavating a shelf to the right and left, as before described,) is then proceeded with, in the manner shown in the annexed engraving. The bars are kept at the proper distance apart, by inserting five or six struts between every two bars, as shown in the next engraving. The temporary props, at the remote end of the bars, rest upon flat foot-blocks, to prevent the superincumbent weight pressing them down. The foot-blocks are either placed at the bottom of the heading, or the ground is dug up to admit of their base standing upon the intended level of the under-side of the top sill. In either case, they are placed far enough outwards to admit thereafter of the sill being placed in front of them.—The dotted portion of the props and foot-blocks, in the above cuts, shows the end of the props so placed below the bottom or floor of the heading; however, it is not always that the ground will allow of this being done in the first instance. The perpendicular face of the work is secured from falling in, by the insertion of poling-boards across it, at the back of the props, as shown in the last figure.



In the manner above described, bar after bar is inserted to the right and left of the top heading; propped and strutted from the ground and from each other; and the poling-boards inserted both in the roof and against the face of the excavation, the bars being so arranged as to follow nearly the intended figure of the tunnel: or rather, such an arrangement is preserved as will be best suited for the subsequent insertion of the brickwork,—as will be hereafter explained.

The annexed engraving shews a section of the work in this stage of progress, which is technically called "getting in the top."



It has been stated above, that the near end of the crown-bars is at first temporarily supported or propped from the square timbers in the shafts; it must however be observed, that, by so doing, a great weight is thrown upon the square timbers in addition to that of the brickwork of the shaft, which is all that it is designed to carry, and in which it is materially assisted by the hanging-rods, or shaft-sills described in the preceding chapters; and, for this reason, the square timbers should be as speedily as possible relieved from the weight of the bars, and whatever pressure of earth they may be sustaining:—this is finally done, when the the top sill next the shaft is inserted in its place, by propping every bar therefrom. When the ground is good, there is no danger in temporarily supporting the near ends of the crown bars from the square timbers; but where it is soft, or yielding, it is unsafe thus to load them; for under such circumstances, the ground, instead of steadying the square timbers, is liable to give under the pressure; and when once the square timbers get out of the perpendicular they would require no great additional weight to force them in, and the yielding or soft ground which would thus lead to the accident, would follow from behind the shaft, and in all probability bring the shaft down with it. * * *

The cost to the Contractors for excavating the side lengths at Blechingley would, upon an average, be as follows:

			£	s.	d.
Miners . .	96·2 days .	at 6s. .	28	17	2
Labourers, . .	95·0 .	at 3s. 6d. .	16	12	6
Horses . .	28·9 .	at 7s. .	10	2	4
Candles . .	4 dozen .	at 6s. 6d. .	1	6	0
Gunpowder . .	1¼ cwt .	at 46s. .	2	17	6
Tools, and sharpening picks, wedges, &c., .		. . . .	1	5	0
Contractors' Superintendence, .	22 days .	at 7s. .	7	14	0
Clearing up the work when completed, .		per length	0	5	0
		Total .	£68	19	6

Thus the cost to the Contractor averaged £68 19s. 6d. per length of 12 feet.

In making the engagement with the gangers, or subcontractors, a price per lineal yard, for the side and shaft lengths taken together, was agreed upon, which price was £15, or £60 for each side length; they to find all manual and horse labour, candles, gunpowder, working tools, &c. Now it was well known that at such a price no profit could be derived from the side lengths; as the working expenses would, upon an average, exceed such price, which was proved by the result, as shewn above; but taken together with the shaft lengths, which, at the same time that they were longer than the side lengths, required *much less time and labour to construct*, they yielded a fair amount of profit. When the particulars of the shaft lengths have been given, this subject will be recurred to, for comparison between the actual average cost, and the price paid to the contractors.

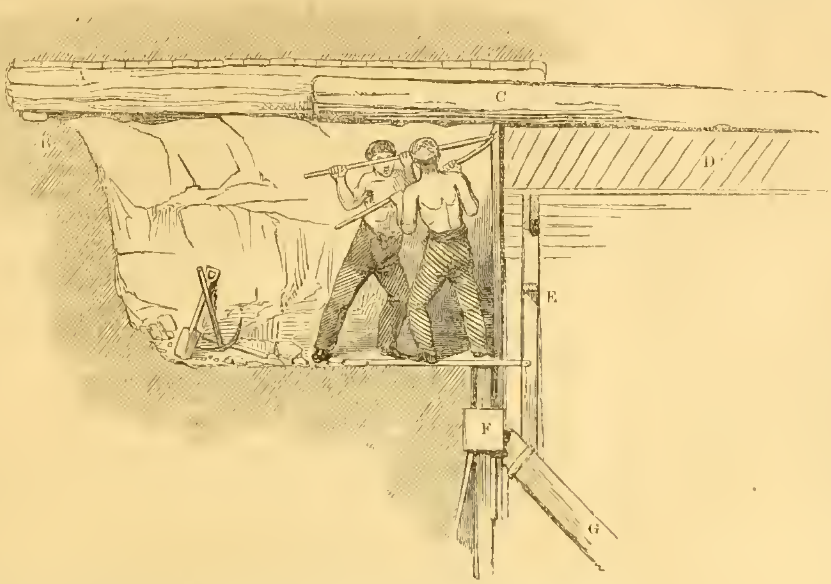
When the *leading* lengths were in progress, the miners obtained a bonus, in a charge to the bricklayers of £3 per length for lowering their materials, as bricks, cement, &c., to the underground works; which was done by loading the descending skip, at the time that the earth from the excavation was being raised in the other. This yielded a profit of about £2—the third pound being paid for extra labour in loading bricks, &c., and the loss of time occasioned to the miners' own work. But during the construction of the *side* and *shaft* lengths no such profit could be obtained, because the excavation was at a total stand, whilst the bricklayers were at work in each of these three lengths; whereas, during the progress of the *leading* work, the bricklayers would be proceeding at one end, from the shaft, whilst the miners would be progressing at the other, and vice versa, whereby the earth excavated by the latter could be raised to the surface at the same time, and by the same power, that the materials of the former were lowered. * * *

The *side* lengths at Blechingley and Saltwood were twelve feet long, and so situated as to leave between them, upon an average, fourteen feet for the shaft length; the three lengths making together thirty-eight feet of tunnel under every shaft, from which to carry on the work in both directions. When this portion of the work is done, the difficulties of the tunnel may be said to be over; as the subsequent proceedings are comparatively straightforward and safe: at all events, there can be but few natural difficulties that cannot be foreseen, and consequently their effects provided for, or guarded against; unless by injudicious proceedings, or absolute carelessness, difficulties and dangers arise which otherwise would not have existed.

Previously to commencing the leading lengths, it is requisite to construct a platform over the invert of the lengths already completed, as shown in the drawing: and which platform must be continued each way, as the work advances. It is made of planks, laid on sleepers or transverse timbers, placed across the invert, so as to leave a free channel for the water to pass along the invert, to be drained off through the heading; or, in cases where the water is not abundant, it may hence be conducted to a proper receptacle or sumph, convenient for the workmen to use it in mixing their cement or mortar; for where there is no water in the tunnel, the conveyance of that material to the shafts for the bricklayers' use forms a considerable item of expenditure. This was partly the case at Blechingley; the water, which was in abundance at first, diminished in quantity as the work advanced, and towards the last, (except at the west end) the land springs appeared to have been drained nearly dry.

The process of driving a leading length is nearly the same as that described for a side length; with this difference, that the bars in that case have to be propped and supported, at both their ends, whereas, in the leading work, they only require such assistance at their remote end, or against the face of the excavation; the near or back end of each bar, being left to rest behind, or upon the brickwork of the arch already turned.

The work is commenced by getting in the top, in the manner described as for the side length. A top heading is driven in the middle line of the tunnel, for the insertion of the crown bars, and is then widened out to the right and left, and the bars inserted one by one down to the level of the top sill, It will be remembered, that the crown bars for the leading lengths were described as left above the brickwork of the side length, to be drawn out (of their cells) to form the roof of the leading work, length after length; by which means, the same bars travel along the roof to the next junction, unless by accident any of them get broken, or stick fast in some part of their journey; whereupon they are generally built in, and left. It is, however, not the safest of practice to draw the crown bars from the side lengths at all, but to build them in, and leave them, unless the ground is very good, when their removal would be attended with perfect safety. They were mostly left in at Blechingley; as their value was of trifling importance, compared with any risk to the security of the work that carried the shafts, through disturbing the earth thereabouts; for, although the space from whence each bar is drawn is, professedly, rammed solid with earth, by a man standing at the end where it is drawn, using a long-handled punner,—yet, however well and carefully this may be done, it would, in most cases, be better that the bars were built in, than that the surrounding earth should be in any degree disturbed: and, too often, if the men are not watched, they will omit the ramming altogether, as their neglect cannot be detected afterwards.



The annexed engraving represents the process of drawing the crown bars, whether from over the side or any subsequent leading length. The top heading is shown as having been already driven, and one bar A drawn forwards, and its advanced end resting upon the shelf of earth B, preparatory to its being propped; the ground is also shown as ready for another bar, C, which the men are drawing from over the brickwork of the last turned length, D; the leading centre rib, E, is shown in section under the brickwork, also an end view F, of the top sill, and the upper end of its raking prop G.

The drawing of the bars can mostly be accomplished with crow bars, used as levers, as shown in the annexed engraving, which brings them forward by little and little, till the larger portion of them is advanced, and then they come out easily enough; but if, during their confinement above the brickwork, any particular settlement has taken place, the bars will frequently be jammed in extremely tight; the only way then to release them is by the use of one or more screw jacks placed horizontally against the arch, and lashing chains passed over these and also round the projecting ends of the bars, when upon working the screws, the bars are released. If however, the resistance is to great to be overcome in this manner, the bars are left and built in; for where a settlement has been so great as to cause such an effect, it would probably be unwise to draw the bars at all, were it even possible to do so, lest a movement be given to the earth that would be liable to produce results far more costly than the value of a few bars.

When the bars are drawn, great care should be taken, as before stated, that the space from whence they are removed is packed and rammed solid with earth; for the danger of leaving an empty space above the arch is too obvious to need any remarks. It is also of importance that attention be paid to the amount of sinking that takes place in the top of each length whilst standing in timber, in order that the leading ends of the bars for the succeeding lengths may be raised sufficiently high above their required level to allow for their sinking, before the arch is turned.

Our readers will see by this rather lengthened extract the very business-like manner with which our author proceeds with his work. Mr. Simms next gives some particulars of the actual cost of labour, calculated from the number of men employed and checked by the contract price paid for the work, by which it appears that the cost of excavating the *leading* lengths of the Blechingley tunnel, each 4 yards, was £42 17*s.*; this amount includes £3 for powder and candles and £1 5*s.* for tools, &c. The average price to the contractors (gangsmen) was about £11 per lineal yard, and for the Saltwood tunnel, each length of 4 yards, the estimated cost of the excavating was £28, or £7 per lineal yard.

The 13th chapter is devoted to the tunnel entrances, the shaft towers, and other finishing works. The 14th explains the construction of centres, and of Frazer's patent centres; and the 15th contains some useful information connected with tunnelling.

We have thus gone through this practical work, and before we conclude we must observe, that besides the numerous wood engravings with which it is illustrated, there are 12 copper-plate engravings by Lowry, accurately delineating the progress of the works in the construction of the tunnel. To Engineers generally do we recommend this volume most strongly; and to *all* Resident Engineers do we say "Go, and do thou likewise."

The Metropolitan Buildings Act. 7 & 8 *Vict. c.* 84. *With Notes and Cases.* By George Tattersall, Surveyor, and Messrs. Chambers, Barristers-at-Law. London: Lumley.

The New Buildings Act will of course be in the hands of every professional man, and, in order to afford a convenient and comprehensive manual, the authors of the book before us have republished the act, with the necessary notes, an abstract and analysis of the act, a glossary of the terms employed, and a list of district surveyors. We notice, however, one very great defect in a work of this nature, the want of an index.

Ansted's Geology. Vols. 1 and 2. London: Van Voorst.

We have received this work, completed in two volumes, but we feel we could not do justice to it were we to attempt this month to go through it. The first number gave us too favourable an impression of the work to allow us to pass it cursorily by.

Illustrations of Baptismal Fonts. London: Van Voorst.

This valuable work is now completed, and as we are anxious to consider the introductory essay, we shall postpone until next month the remarks which we are desirous to make with regard to it.

EPITAPH ON A DECEASED ACADEMICIAN.

A Portrait.

Here lies of men the most malignant;
The very earth feels quite indignant,
At covering such a shrivelled mass
Of envy, malice, spite and brass:
He envied rank, he hated beauty,
And spat at genius as a duty;
And when he tottered to his midnight bed,
He lifted up his trembling hands and said—
Oh God! I thank thee, that once more
I've passed another day, as spitish as before;
Grant me but life to see to-morrow!
How I will mortify disease and sorrow,
How I will slime my species with my spittle,
To show mankind I hate them—'cause I'm little.
The morning broke in innocence and light,
He ope'd his eyes with their accustomed spite
And chuckled at the thought of all he'd wound ere night.
In vain! Death seized him with a hurried grasp,
For e'en Death feared the withered asp.

B. R. Haydon.

September, 1844.

FIRST IMPRESSIONS OF A VISIT TO WESTMINSTER HALL.

Without having at all canvassed the opinions of others in regard to this Exhibition, I give it as my own that if the public went to it with expectations in any way excited by what has been said and written about fresco-painting during the last two years, they must be not a little disappointed and dissatisfied. The chiaro-scuro cartoons exhibited last year were looked upon only as preparatory studies—productions in an incipient stage of their progress, remaining to be awakened into life and transfigurated into the beauty and poetry of art by the fascination of colour; and, no doubt, most persons conceived that fresco would of course manifest a decided superiority to all other modes of painting, and would accordingly captivate the eye in an unusual degree by its *primâ facie* appearance. The present exhibition, on the contrary, shows us fresco-painting itself—at least what it is, and what it is likely to be in the hands of those who have sent their samples of it to Westminster Hall.

I am aware that very great allowance is to be made for the peculiar circumstances of the case; I was prepared to find defects arising from inexperience in the requisite manipulation and technical process, but not to the extent here observable, and unaccompanied by the evidence of any of those other qualities which are indispensable in the higher branches of art—the historic and the poetic, since without them what is intended to be grand is almost sure to sink into bombastic bathos. Considered with regard to execution merely, these performances exhibit great crudeness and extravagant tawdriness of colouring, yet feebleness and flatness as to general effect, and not only incorrect but feeble drawing. Considered again, with regard to the more intellectual qualities of the art—conception, composition, expression, sentiment, they are equally deficient, some of them even absolutely null, as if, not being stipulated for in their 'bond,' they might be omitted with impunity. Some of the subjects are most miserably namby pamby and mawkish stuff, with just about as much mind or soul displayed in them as in those of the 'Boydell' period, and in the book-plates of forty years ago.

It will probably be said that I judge far too harshly of works that are avowedly first attempts and studies in a branch of the art requiring unusual dexterity of pencil; still it is more surprising than satisfactory to find that so many who, it may be presumed, are tolerable judges of painting should have fallen so much below the mark, or having done so, should have sent their abortions, with all their imperfections on their heads, as likely recommendatory specimens of their handiwork, on such an occasion. It seems, however, that I do not see the full extent of the silly presumption and imbecillity of all the aspirants to fresco-painting employment, since the catalogue informs us that "The Commissioners have exercised their judgment in altogether excluding some of the works submitted to them;" which, if we may judge from many of those they have admitted, must have been vile indeed.

I do not say, that after such a beginning as we here behold, I ought actually to despair of fresco-painting making any progress in this country; but I must say that I do not here perceive anything like that promise which the immediate occasion requires. All things must have their beginning, and in the course of time we may have a school of *frescanti*; but I should be truly sorry to see Mr. Barry's edifice made, in the interim, a school for embryo artists to practise in, trying their 'prentice hands upon its walls, and covering them with such daubing as we behold in this exhibition.

On no account ought the Palace of Westminster to be treated as a *corpus vile*, or pauper patient, on whom it is allowable to make experiments, no matter how hazardous, for the benefit of science. I know not how far Mr. Barry himself may relish the idea of his building being turned over to tyro fresco-painters, in order to receive from their hands the finishing touches of embellishment: or whether, if not exactly satisfied with any of the specimens here assembled, he is nevertheless gifted with such consolatory prophetic ken as to be able to discern in them talent, both of mind and hand, that will be sufficiently matured for the occasion when the time shall have arrived for commencing actual operations. I only know that was I in his place I should look forward to the latter event with considerable alarm—even with dismay, and be able to take comfort only in despair, in the assurance derived from it that unless very far more satisfactory evidence of talent for fresco can be produced beforehand, the idea of adopting such embellishment will be postponed *sine die*. At present there is hardly one thing which would induce me to invest its author with decorating a few square yards of wall, except in some dark corner or imperfectly lighted passage, where his work would be befriended by shadow and gloom.

At all events, therefore, it is to be hoped that, unless very great advance in all the pre-requisites for fresco-painting shows itself in the interim, the Commission of Fine Arts will experimentalize very cautiously, and lock the doors of all the principal galleries and apartments against the painters, allowing them to operate at first only on those parts of the interior where failure would be attended with comparatively little mischief. And on such an important occasion mere decent mediocrity must be positive failure; medium there is none between the dignified and the paltry; and a very long stride in art must be taken by almost every one of the present exhibitors of fresco specimens, ere they can attain the former, and qualify themselves for suitably decorating the new Palace of Westminster. It would be almost a profanation of the term "Art," to apply it to very many of the things sent thither to obtain the suffrages of the public. Not a few of them seem to belong to the now obsolete school of sign-painting, and in regard to subjects, too, many of them are as inappropriate as can well be imagined; for instance, No. 10, "Beatrice Cenci meditating the murder of her Father." Her ill-favoured expression shows indeed that she is meditating no good—at least, that her meditations are not of the most pleasant kind; but no one could possibly guess at the subject of them without the Catalogue to inform him, and when so informed, he is not better satisfied with the work itself than before. By way of strong contrast to the preceding, as one of the curiosities of the exhibition, may be pointed out No. 44, which shows us one whose meditations are evidently of a more jovial complexion—of a kind, indeed, likely to scandalize Father Mathew, he being a jolly old toper regaling himself with a jug of brown ale! The judgment exercised by the Commissioners must surely have been in the same very good-natured condition as this merry old blade himself, when they allowed such a subject to pass muster. After this we should not have been very much startled had we found the *moral* of "Sairey Gamp" as a candidate for the honour of figuring in fresco. I can account for the admission of such an alehouse subject only by supposing that it was thought likely to act favourably as a foil to most of the others, rendering their historic dignity and poetic mysticism all the more impressive by comparison with it. Still it was rather dangerous to do what looks like throwing ridicule upon the whole affair.

As to the taste shown in the ornamental borderings to some of the frescos, I can safely aver that I have frequently seen very much better in patterns of paper-hangings for rooms. Some of them are vulgarly tawdry, others mean, insignificant, and ineffective.

Taking it altogether, I am opinion that its very unsatisfactoriness may be in some degree beneficial, as it must open the eyes of the Commissioners, of artists themselves, and of the public, to the real state of matters, and convince them that, unless very much better earnest of talent for fresco and historic painting can be obtained, it would be little less than madness to think of it for the embellishment—*alias* degrading—so noble an architectural pile as, when completed, will be the Palace of Westminster. Should, by-and-bye, any of the Commissioners themselves feel perfect confidence as to ultimate success, it is to be hoped that they will impart some degree of it to the public by affording some of the artists most likely to be engaged in the scheme of decorating that national edifice the opportunity of proving their qualifications for the important task, by confiding to their pencil the walls of even a single room in their own mansions. Such course would, at all events, show their sincerity and their patriotism.

Z.

DOCKRAY'S SELF-ACTING RAILWAY SIGNAL.

SIR—Upon perusing the 5th volume of your Journal, I observed at page 115, a description accompanied by a sketch of the above invention, in which there appears an inconsistency; to point this out it may be necessary, (to save the trouble of reference), to explain the principle upon which it acts; its first impulse is from the weight of a passing train depressing a pin, communicating by a bell crank a connecting rod to a lever which raises a piston in a cylinder, which piston upon falling by its own gravity, expels the air from beneath it by degrees, according to some regulated time. To the piston rod is attached wheel work, which causes a band to rotate on a dial, showing to an after train how many minutes the other has preceded it—this arrangement would be excellent but for one circumstance, viz., that when a train has passed and pressed down the pin, the connecting rod before mentioned has moved to its place, there is a catch which holds it in that position, and the lever which has raised the piston is therefore prevented from allowing it to fall, thereby causing the stoppage of the whole apparatus.

If these remarks are not too late, by inserting them you will oblige,

Your constant subscriber,

Bow Street, Covent Garden. J. JONES, Jun.

IRON HOOPING FOR BOND.

Sir—As iron hooping is much used now instead of bond timber, I venture to point out to the consideration of the building profession an objection to it which seems to have been overlooked. I allude to the chemical action which is nearly certain to take place when iron is buried in cement; the bad effects of this I have seen in numerous instances, and I particularly remember one in the Rotunda of the Bank of England, where a large piece of stone was forced from its position by the operation of the action alluded to. Apart from this, proper attention is not paid to the protection of the hooping from atmospheric effects, as I have frequently noticed the ends of the hooping left projecting at the extremities of new built walls to the extent of three or four feet, and this for weeks together, the consequence has been that the hooping so left exposed has been covered with rust, and rendered unfit to be inserted in the walls intended to be built, and tied *by this very hooping* to the newly built walls already erected.

I am induced to request your insertion of this, in hopes that some of your readers may point out a substitute for the iron hooping, which would be less liable to the operation of the chemical action.

Your's, &c.

Thos. J. Pring.

Bouverie Street, Fleet Street,
September 4, 1844.

A FEW MORE HINTS ON DECORATIVE ARCHITECTURE.

The sticklers for architectural "unities," are somewhat like their brother sticklers for dramatic proprieties. The latter-named gentlemen contend immensely for unity of time, place, and action, each of them being absurdly unnatural, but totally neglect that one little thing needful, the unity of nature. They will not allow a change of scene, a lapse of years; a difference between a bed-chamber and a banqueting hall; but have no objection to a bravo talking like a hero; or a waiting-maid like a countess. And the prior named sticklers are enormously severe upon intercolumniation (regulated by theoretical proportion, and not the strength of the material!) and such like points, but totally overlook minor discrepancies, which to *uneducated* people really do appear important. Look for instance at an assembly-room, a town-hall, or a court of justice.

Columns ornament the walls; frescos decorate the panels; elaborate cornices surround the windows and doors; the ceiling is enriched with panels, roses, wreaths, and all the pride and glory of Bielefeld's papier-maché; but alas for the architectural "unities," the bewildered spectator casts his eyes, dazzled by the magnificence of the scene, down upon the ground, and behold, a vacant dreary area of Norway pine or Baltic timber, unadorned save by the straight lines of the joints, that run on in endless and tiresome perspective. An idea rushes through his brains of Beau Brummel in a bad hat, or George the Fourth in Bluchers, and he precipitately retires, a wiser but a sadder man.

In a private residence, the same incongruity prevails, architectural taste and elegance are lavished indiscriminately upon the walls and ceilings, but the "poor floor that we tread upon," has got its nakedness disguised by a Turkey or Kidderminster carpet, the beautiful texture of which becomes disgusting from the hideous discord of the colours, and the insipid absurdity of the pattern. Now as every person, however reckless, must more or less look before they leap, and even before they step; and as people in general do not walk with their eyes in a heaven-ward position, it is pretty certain that the floor has greater claims upon the attention of the architect than the ceiling or even the walls.

In churches, thank God, a better taste begins to show itself, and that portion of the floor, not disfigured by pews, is well ornamented in the ancient style by deviced tiles; except in halls and corridors, however, this method is not applicable for general purposes, and a substitute must be sought elsewhere.

In the late Government exhibition in St. James' Street, of decorative works, there was a model exhibited which seemed in a great measure to supply the wants—it was a combination of wooden tiles or blocks, of the richest colours, and admitting of course of every possible variety of form and pattern. It is the patent of a Mr. Austin, C.E., and on a late visit to the Royal Exchange, we were told it is to be laid down in the library of that building. If it should be found to possess durability, it will certainly be a valuable acquisition to architectural resources.

Something must be done; a Napoleon of Kidderminster, or a Turkey Newton must arise, or else (would indeed it were so) the profession must leave off twaddling about unity of style, and classic severity; Christian art and masonic rules; German Æstheticism and English Puginism; and turn their attention to those *unconsidered trifles* which, whatever they may think, are worthy of their sapient consideration.

A. H. Patterson.

Westminster, Sept. 3, 1844.

THE ORDNANCE ESTIMATE OF THE EXPENSE OF SURVEYS.

We have thought it our duty to give the following document, for the information and consideration of our professional readers. We are not amongst those who would bolster up monopolies, or attempt to make a vested interest of public rights, and we therefore feel the less diffidence in denouncing this measure. It must be evident to every one that the estimate in question is entirely fallacious, and does not represent the real cost to the public of such surveys. Take, for instance, the case of officers of the Ordnance alone. We have here no allowance for their education, sick or non-effective pay, or retiring pensions: we have no account of the pay, lodging, clothing, allowances and pensions of the subordinates employed. Every one will therefore see that, as a mere matter of figures, the estimate is a delusion; we have, moreover, strong reasons for believing that, even as the figures stand, they do not make due provision for the duties to be performed. It will be seen that the estimate for surveying, at the highest rate, is only about a penny or twopence a house, figures which carry their own refutations with them. Were this estimate, however, a true one, the grand objection against the whole plan remains untouched. It proposes a dangerous and mischievous interference, not merely with existing private enterprise, but with the future interests of the public. We sincerely deplore, as all must, the neglect of the necessary surveys at present, and the ignorance too often to be witnessed in local surveyors. But how are we to have this remedied, if professional men do not have the means of improvement allowed to them, and if they do not receive the reward of proficiency. All these plans for putting local surveys into the hands of the Ordnance officers, amount to neither more nor less than this,—defrauding the localities of competent resident officials, and it is on this ground we take our stand, as thereby not only would no economy be effected, but continual and sure losses be inflicted on the public.

With regard to the officers of that eminent service, the Ordnance Department, we cannot but think that, to call on them for such reports and such services, is to place them in an invidious position with regard to their civilian brethren. While we should be among the first to deprecate the interferance of professional civilians with the officers of the Ordnance, so do we feel regret when we see duties so unpleasant imposed on the officers of Government. We now proceed to give Captain Tucker's Report to the Ordnance Department.

Report.

In obedience to your order of the 22nd February, 1844, I have the honour to submit the following estimates for the Health of Towns Commission, plans on the scale of five feet to one mile, showing countour altitudes, or altitudes marked at equal vertical distances, in the streets of towns, contour lines without the towns, sufficient to be serviceable for the sewerage and drainage of them, and including the expense of ascertaining sewers, water-pipes, and gas-pipes, arranged under the folowing heads:—

1st. Of towns of which the survey is completed.
2nd. Of towns of which the survey is in progress.
3rd. Of towns of which the survey has not been commenced.

No. I. *Towns Surveyed.*—In the estimate under this head the expense of the surveying and levelling already done is not included, as I have considered them to have been performed for the Ordnance Survey, therefore I have only charged the additional expense of marking contour altitudes *in* the streets, and contour lines *outside* the towns, ascertaining sewers, water-pipes, and gas-pipes.

The cost of making copies of the plans is inserted, to which the additional cost is added to show the cost of copies of the plans with the additional information for sanatory purposes.

No. 2.—*Towns in progress for the Ordnance Survey of England.*—The estimate for levelling and marking contours *in* the streets is for the levelling which will be necessary for the improvement of the sewerage and drainage of towns, supposing it to be done for that purpose.

The cost of copies of the plans is the same as for Class No. I.

No. 3. *Towns of which the Survey is not commenced.*—The surveying, plotting, and drawing are charged, showing the cost of levelling, contouring, ascertaining sewers, water-pipes, and gas-pipes, as in No. 2.

The expense of fixing points is not included in the estimate.

The expense of surveying varies in proportion to the size or population and the compactness of the town.

The area or extent of the close or compact part of a large town being greater in proportion to the whole area or extent of the town, than the compact part of a small town bears to its whole area or extent, the cost of surveying will be greater in proportion to its area than the cost of a small town therefore I have estimated the cost of preparing plans of towns having a population of 10,000, 20,000, 50,000, 100,000, 300,000.

The levelling and marking contour altitudes in the streets embraces the showing the water-shedding line, and the lines of natural drainage, as accurately as the sinuosities of the streets will allow of their being traced, and the levelling is supposed to be arranged for that *particular* object, as contour lines cannot be laid out within the towns; showing also a sufficient number of contour altitudes to connect altitudes marked along the line of drainage with equal altitudes marked along the water shedding lines.

The expenses of levelling and contouring are estimated for towns situated on gentle slopes. For abrupt slopes the expense of levelling will be nearly one-third greater, but the contour altitudes in the streets will be at greater vertical distances and fewer contour lines will be laid out.

I have considered the towns of 10,000 and 20,000 inhabitants, to consist of long branching streets with few cross streets, and requiring less levelling than towns that are compact with numerous cross streets.

The expense of contouring or marking the contour lines outside the town is calculated on the supposition that one-third of the whole area, usually included on the Ordnance plans, will admit of their being laid out, and the expense shown in the estimate is the average expense per acre for the whole area of the plan.

The levelling performed at Windsor cost 6*d*·5. per acre, including the levelling for four lines of sections in addition to that which would have been sufficient for sewerage and marking the contours.

The contouring cost 2·75 per acre.

The contours above the datum mark at the bridge are laid out at four feet vertical distance from each other.

Those below the datum point at two feet vertical distance apart.

The expense of contouring was much increased by the necessity for laying out and surveying the lines before the plan was drawn, in order to complete them before Her Majesty's return to the the Castle, which caused an increase of 0*d*·75 to the expense.

The cost of contouring Windsor exceeds the expense per acre. shown in the estimate for towns, arising from the large extent of country in proportion to the area covered by the town, the contoured area being three-fifths of the area of the plan; whereas in the estimate for plans of towns the space or extent of ground on which it will be possible to lay out contour lines is supposed to be one-third only of the area of the plan.

The cost of ascertaining the sewers, water-pipes, and gas-pipes of Windsor, and the Castle, and putting them on the plan, amounted to 1*d*·3 per acre for the space occupied by the town.

The sewers, water-pipes, and gas-pipes of Manchester have not been ascertained.

The cost of obtaining them for the town of Oldham amounted to 1*d*·1 per acre.

The sewers and water-pipes, but not the gas-pipes, have been ascertained for Bury at the expense of 0*d*·28 per acre.

The plans of Oldham and Bury are not sufficiently advanced for the insertion of the sewers, therefore the expense of putting them on the plan is not known.

The expense of ascertaining the sewerage, water, and gas-pipes, varies according to the facilities given by the local authorities in appointing persons to show their position and the quantity of the sewerage; some places being very deficient, and few or none possess plans.

There is not a plan of the sewers of Oldham, and only one man 80 years of age, could be found who knew the situation of a principal sewer.

I have not included contingent expenses, as office rent, conveying parties or stores, as, should the Commissioners wish to undertake the surveys of towns, these expenses will depend on the strength of the party or parties employed, each of which, I think, should consist of 16 to 20 *surveyors*, to be divided into two parties, when the towns nearest to each other are small, or to be employed as one party if a town be large, that the survey may be promptly executed.

Estimate of the Cost per Acre of Five Feet Plans of Towns.

Population of the Towns.	First Class. Copies of Plans of Towns, of which the Surveying and Levelling are completed.						Second Class. Copies of Plans of Towns, of which the Levelling is not commenced.						Third Class. Plans of Towns, of which the Survey is not commenced.						
	Cost of a Copy of the Ordnance Plan, per Acre.	Additional Expenses per Acre for			Total additional Expenses.	Total Cost of the Copy, per Acre.	Cost of a Copy of the Ordnance Plan, per Acre.	Expense per Acre for			Total Cost for Levelling Contours, Sewers, &c.	Total Cost of the Copy, per Acre.	Surveying.	Expense per Acre for				Total Cost of Plans per Acre.	Total Cost of Plans per Acre, including the Fixation and Calculation of Points.
		Contour Altitudes in the Towns.	Contour Lines without the Towns.	Sewers, Water, and Gas Pipes.				Levelling and Contour Altitudes in the Towns.	Contour Lines without the Towns.	Sewers, Water, and Gas Pipes.				Plotting and Drawing.	Levelling and Contour Altitudes in the Towns.	Contour Lines without the Towns.	Sewers, Water, and Gas Pipes.		
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*s. d.*	*s. d.*
10,000	8	1·5	1	1·5	4	12	8	4	1	1·5	6·5	14·5	12	21	4	1	1·5	3 3·5	3 8
20,000	9	1·5	1	1·5	4	13	9	4	1	1·5	6·5	15·5	15	22	4	1	1·5	3 7·5	4 0
50,000	11	2·0	1	2·0	5	16	11	5	1	2·0	8·0	19·0	21	25	5	1	2·0	4 6	4 10½
100,000	12	2·0	1	2·0	5	17	12	5	1	2·0	8·0	20·0	28	29	5	1	2·0	5 5	5 9
300,000	14	2·5	1	2·5	6	20	14	6	1	2·5	9·5	23·5	49	32	6	1	2·5	7 6·5	7 11

METHODS OF TRACTION ON RAILWAYS.

Atmospheric Pressure, Tension of a Rope, Locomotive Engines.

There are three general methods of traction practised on railroads where steam is the motive power.

First, by means of a rope passing over and wound up by a drum, which revolves by the action of the engine.

Secondly, by means of a tube extending the whole length of the railway, and containing a solid piston, which is forced along by the air being pumped out of the tube by an engine stationed at one end of it.

Thirdly, by means of a locomotive engine which turns the wheels on which it rests, and by the friction of these with the rails, carries the attached train forward.

In each of these methods of transferring the power of the engine, a part of the power is lost in the transference.

I. In traction by a rope some part of the power will be absorbed by the friction of the rope with the road, or with the friction wheels on which it is laid. Also, the parts of the rope between each two friction wheels will hang down in a curve; force will be expended in raising and straightening these segments of the rope before the train can be put in motion. Moreover, if the rope possess elasticity, the engine must first stretch the rope to a certain extent before it can act on the train. It must be considered also that the engine starts not only the train itself, but also with equal rapidity a heavy rope equal in length to twice the distance between the two railway stations.

These causes would operate were the trains to move on rails perfectly even, but in practice obstacles occur at the joints of the rails and elsewhere which communicate shocks to the train in motion. Hence will arise another abstraction of power; for at each shock the train will be slightly retarded, and then again accelerated, and consequently a vibrating motion will be given to the curvilinear segments of rope between the friction wheels. The vibrations arising from this and similar causes will be very observable in the line of rails parallel to that on which the train is in motion. The maintenance of these vibrations is a fruitless expenditure of power.

An exact illustration exists in the endless bands used for communicating motion in steam-weaving and steam-printing, and even in common knife-grinders' machines; the most casual observer must have noticed the rapid vibrations of the bands in these cases. The motion of the tow-ropes of river barges affords another example of these vibrations. From this cause also among others, steam-tugs tow vessels more efficiently when closely and rigidly lashed to their sides than when connected by a long rope; and a garden roller is moved over a rough gravel path more easily by pulling the handle than by pulling a long rope fastened to the handle. This last illustration suggests an experiment worth making, and easily made, by which the subject would be elucidated far more clearly than by written explanation.

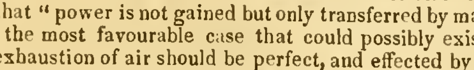
The alternate retardation and acceleration of the train will have another effect which is due to the elasticity and weight of the rope, namely, that at each retardation the tension of the rope will be slightly increased, and at each acceleration diminished; the consequent stretching and unstretching is maintained by force, which contributes nothing to the motion of the train.

II. In considering the application of steam power by atmospheric pressure, it will be necessary to remove a very common error which supposes that power is in some way gained by the intervention of the air. Now to refute this notion it seems sufficient to state the general theorem that "power is not gained but only transferred by machinery;" or taking the most favourable case that could possibly exist, namely, that the exhaustion of air should be perfect, and effected by apparatus perfectly air-tight, and without friction, it may be seen that whatever pressure exists on that end of the locomotive piston open to the air can only arise from, and will be exactly equivalent to, the power exerted in removing a corresponding pressure from the other end of the piston, so that even in this hypothetical case, power would not be gained but merely transferred.

But it will be shown that in practice the amount of power actually transferred is much less than that expended. The causes of the loss are many; among them are the friction and leakage of the locomotive piston in traversing the whole length of the tube, and the friction and leakage of the air-pumps. But these are trivial compared with the enormous waste owing to leakage in the fissure extending along the top of the tube; and this cause will operate after every precaution has been employed. The apparatus also for closing this fissure will require and abstract additional power, which contributes nothing to the motion of the train.

There is another cause of power being lost which, as I have never seen it noticed, I shall discuss at some length, namely, that arising from the elasticity of the air and analogous to the effect already alluded to, of the elasticity of a rope, where that means of traction is employed.

Suppose first for sake of explanation that the power of the engine is transferred to the train by compressing instead of rarefying the air. Taking the simplest case, let A, *a*, be two pistons moving air-tight in



a horizontal tube. If the piston A were advanced to B, the effect would not be that *a* would advance an equal distance to *b*, it would not move so far, and part of the force used in advancing A to B would be absorbed in condensing the air between the two pistons into a smaller space.

Similarly suppose that A receded to C, *a* would not therefore recede an equal distance to c; part of the force used in moving A would be absorbed in rarefying the air between the two pistons. Now this is precisely the case of the Atmospheric Railway.

Or the matter may be simplified thus—drawing an analogy between the traction by a rope and that by atmospheric pressure, we may state that in the one case the power is transferred by a rope of comparatively inelastic material, iron wire or hemp, and in the latter case by a rope of the most elastic substance—air.

Papin, the inventor of the well known machine, called "Papin's Digester," proposed to pump water out of a mine by aid of a stream moving a water-wheel, two miles distant; his plan was to use the water-wheel to work two pistons moving air-tight in a tube which was continued from the stream to the mouth of the mine, where two similar pistons were placed. He imagined that the air would communicate the reciprocating motion of the first pair of pistons to the second, though they were two miles apart. Owing however to the elasticity of the air, he found that no effect could be produced without giving the first pair of pistons an extent of motion altogether preposterous.

Sir Walter Scott had a scheme at Abbotsford for superseding bell-wires by air-tubes, at the ends of which next the bells, solid pistons were placed which were to set the bells in motion; at the other ends similar pistons could be worked by hand. The apparatus proved altogether ineffectual.

To determine more precisely the nature of the waste of force in atmospheric railways from the cause under consideration, we will imagine an atmospheric pressure of (suppose) 10 lb. to the square inch on the locomotive piston necessary to overcome the inertia of the train, and set it in motion with the requisite velocity. "The elastic force of air at a constant temperature varies inversely as the space it occupies;" or, in other words, the pressure lessens in proportion as the air is rarefied, and increases in proportion as the air is condensed. Now to produce a pressure of 10 lb. to the square inch on one end of the moving piston, we must (taking the ordinary atmospheric pressure at 15 lb.) diminish the elastic pressure in the tube of rarefied air till it amount to only 5 lb. on the square inch: that is, the air in a tube some three miles long, must be rarefied 5-15ths or one-third its original density before the train can be put in motion. And the force requisite for this purpose contributes nothing, be it remembered, to the *subsequent motion* of the train, since to maintain its motion the pumps must continue to be worked exactly as if this preliminary exhaustion had not been effected, for otherwise the advance of the piston would soon condense the air again.

We must now recur to the experiments illustrated by the preceding diagram. In these experiments we have tacitly assumed the existence of friction or some other resistence to the motion of the piston *a*. Did no such cause operate, the piston A would not by its advance or retreat condense or rarefy the air between it and *a*; the pressure of air on both sides of *a* would ultimately be balanced—that is, the air between the pistons would become of equal density with the external air; consequently the extent of motion of both pistons would be the same when not resisted by friction or otherwise.

When however resistances exist, the motion of the first piston is greater than that of the second. It must not however be hastily concluded that the loss of power, because called into existence by the friction, is therefore *equal* to it. If such were the case, we should in the preceding paragraph have been allowing for the friction twice over. This, however, is not the case, for if the loss of power now under consideration were equal to the friction, its amount would clearly be determined by the friction only, whereas that amount depends also on the length of the tube. And from principles already laid down it will be readily seen that, *cæteris paribus*, the loss of power will only be half so much in a tube a mile long, as in one twice the length. For instance, suppose a force of 5 lb. to the inch were required to overcome the resistance of the piston, the pressure in the tube of rarefied air must be made $= 15-5$, that is 10 lb.; consequently the air must be rarefied to 10-15ths its original density. Now for this purpose twice as much air must be pumped out of an air-tube two miles long, as out of one, half the length.

It may be considered also that we have over-estimated the loss of power in stating that "the preliminary exhaustion contributes nothing to the subsequent motion of the train." It may be argued that the amount of pressure necessary to merely put the train in motion is much less than that necessary to maintain its full velocity. In practice, however, the train is never started till a great proportion of the exhaustion has been effected, and before the train has performed but a very small part of its journey the maximum exhaustion is effected. Moreover, up to that point the waste of power will continue to operate—though of course not in so great a degree as when the train is at rest, and diminishing as the velocity increases—for this reason, that until the full speed is attained, the vacuum increases in degree and is therefore carried on with greater rapidity than corresponds to the mere progression of the train.

We must explain what is meant by "rapidity of exhaustion corresponding to the velocity of the train." When the rarefaction has reached that degree which is to be maintained without increase or diminution throughout the journey, the train will also reach its full speed. It will follow, therefore, that while the degree of rarefaction remains unaltered, for every foot which the motive piston advances along the air-tube a quantity of air equal to that contained in one foot of the air-tube will be pumped out by the engine. If this exact correspondence in the rate of pumping the air and of the motion of the train were not maintained the degree of rarefaction would not remain unvaried. If the air were pumped out more slowly than the motion of the propelling piston required, the air would tend to condense, and *vice versâ*. Of course in this explanation the supposition of leakage is excluded.

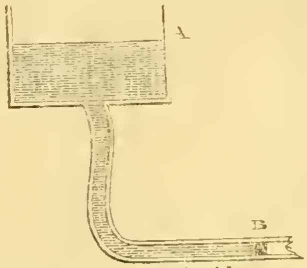
The elasticity of the air affords a reservoir of force which towards the end of the journey would keep the train in motion for some little time after the air-pumps ceased to be worked. This circumstance might be considered another offset against our estimate, but that the train is never in practice allowed to come to rest gradually but is stopped by the external force of breaks. On the whole, therefore, the amount of loss must be considered to be almost exactly that above estimated. The motive piston successively occupies every part of the air-tube, consequently, supposing no leakage, the air-pumps must before the journey can be completed, pump out a volume of air equal to the solid content of the tube. Now we have shewn that where the pressure is ten pounds to the inch, the extraction of two-thirds of this bulk of air contributes nothing to the motion of the train. We may therefore state, without appreciable error, that with the abov degree of pressure the preliminary exhaustion wastes two-thirds of the power of the engine.

The immediate corollary to this statement is that the train is propelled most economically with a low degree of exhaustion of the air-tube. Supposing the pressure on the propeller to be only one pound instead of ten to the square inch, the waste would be but one-tenth of that estimated above—that is to say, one-fifteenth instead of two-thirds of the power of the engine.

It must be carefully noted that the friction of the propelling piston is not an *immediate* but an *ultimate* cause of loss of power. For any given diameter of the piston, the necessary degree of exhaustion increases as the resistance to the piston, from friction and other causes, increases. In other words—the amount of this waste is in mathematical language a function of two variables—that is, varies as the resistance to the piston and length of the tube conjointly.

So much for the waste of power from preliminary exhaustion. Before discussing the next cause of loss of power, we may consider parenthetically another method of propelling railway trains, which, as it has never, I believe, been carried into practice, is only introduced for the purpose of explanation and comparison with existing methods.

III. This third method of traction was based on two hydrostatic principles—that the pressure of water is directly proportional to its depth—and that the pressure is communicated equally in every direction. Hence if a cistern A containing water communicate by a tube of any form whatever with a piston B fixed in the tube, the pressure on B will not depend on the quantity of water in the cistern and tube, but solely on the perpendicular altitude of the surface of the water in A above B. In the case of the railway, the piston B was attached to the train, and was to traverse a horizontal pipe laid along the whole length of the rails.



The above law of liquid pressure is however laid down on the supposition that the fluid is at rest—when the fluid is *flowing*, the pressure is by no means so great, and diminishes as the velocity increases, a great proportion of the force being absorbed by the mutual action of the fluid molecules and their friction with the surface of the tube.

Hence we come to another important truth, namely, that the laws of fluid pressure are by no means the same for fluids at rest and fluids in motion. This truth applies as well to the atmospheric as hydraulic railway. In the former, a large portion of the atmospheric pressure would be absorbed, and the labour of pumping increased, by the friction of the air with the inner surface of the tube; and this loss will not appear inconsiderable when we recall some familiar instances of this kind of action. A trumpet is sounded, that is, the whole mass of metal composing it is thrown into a state of rapid vibration by the friction of air. The friction of air in the nozzle forms the greatest resistance to the working of the common bellows. A peg top when spun is brought to rest principally by the action of air—not by resistance of the air in the ordinary acceptation of the phrase (for that would require projecting surfaces), but by the friction of it. A peg top in vacuo has been known to continue spinning an hour and a half. If an inflated bladder have the mouth stopped, and only a small hole pricked in the side, it will take considerable force to drive out the air; the resistance is the friction of the air with the sides of the hole. It is unpracticable to light two distinct towns with gas from one gasometer, the gas being obstructed in flowing by its friction with the internal surface of the supply-pipe.

Excepting this friction of the tubes, the comparison between the hydraulic and atmospheric railways seems greatly in favour of the former. Water being incompressible (nearly so, at least,) the loss corresponding to that from "preliminary exhaustion" is avoided in the hydraulic scheme; owing to water being much less subtle than air, the waste from leakage would also be much less. The hydraulic system affords also the convenience of a reservoir of power, for the power stored in the cistern may be employed at any distance of time after the cistern has been filled.

The last effect of transferring pressure by the intervention of air which we have to consider, may, like the preceding, be explained by analogy. In considering the rope traction it was shewn that obstacles on the rails would cause a constant stretching and unstretching of the rope, which would give rise to a waste of power. The reader will, on reflection, easily perceive that the same waste occurs in atmospheric traction, only proportionably increased, on account of the exceedingly greater elasticity of the materials by which communication of power is effected.

IV. In the fourth mode of traction, that by locomotive engines, the causes of loss of power differ altogether from the preceding—they arise from the power being employed in moving not only the train, but also the enormous additional weight of the engine and tender, which frequently amounts to fifteen tons, also from the occasional slipping of the wheels on the rails.

These, then, are the sources of loss of force in the three methods of railway conveyance. In making, however, an election between the three, many other questions besides that of loss of power would have to be taken into account,—such as the danger of breaking the rope, where that kind of traction was used; and, on the other hand, the fact that locomotive engines, by the very nature of their action, become inoperative on rails not nearly horizontal. With respect, however, to the mere question of waste of power, there will be no difficulty in determining, from the above considerations, the particular mode of traction in which the loss immeasurably preponderates.

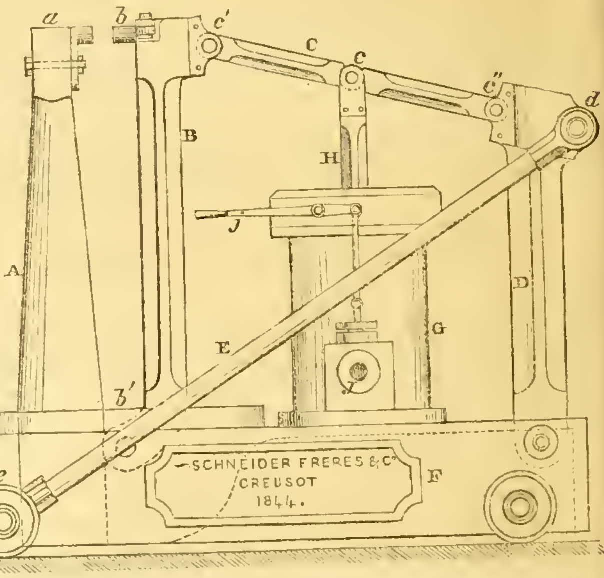
H. C.

STEAM RIVETTING MACHINE.

In our last volume, page 216, we gave an engraving of Mr. Fairbairn's rivetting machine, we now present our readers with a modification of the same machine by Messrs. Schneider Brothers, and Coe, of Creusot, France. The drawings, with the accompanying referenc , will sufficiently explain the nature of the machine. Fig. 1 is a side

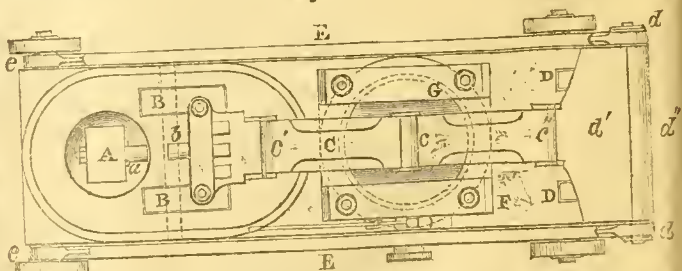
Fig. 2.

Fig. 1.



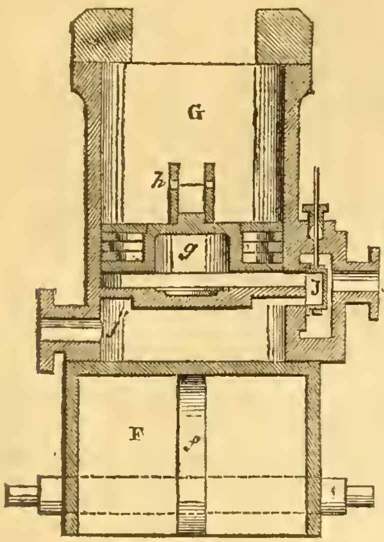
view; fig. 2, front view of the top of stem; fig. 3, a plan of the machine; fig. 4, section through the steam cylinder; figs. 5 and 6, plan and side view of the piston; similar letters in each figure refer to similar parts.

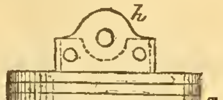
Fig. 3.



A, the stem, with the counter die, *a*, firmly fixed in the base of the machine; B, B, two standards moving on joints at *b*, and on the top is the die, b'; C, jointed bar moving on a knee joint at c, and hinge joints at c' and c''; D D, upright standards fixed with bolts at the base *d*, and on the top at d', to side rods or stays, E E; F, cast iron base with a projecting bracket, *f*, on the underside, and a projection on the

Fig. 4. Fig. 6.





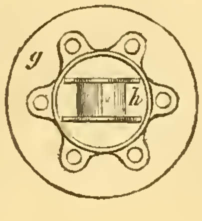


Fig. 5.

top, f', with a wrought iron hoop to securely hold the base of the stem, A; G, open top steam cylinder; *g*, piston; H, piston rod with a moveable joint at *h* on the piston and at the top, *c*; J, valve with steam and eduction ports; *j*, steam pipe; j', eduction port, and j'', handle for a man to regulate the admission of the steam.

The article to be rivetted is suspended between the die, *b*, and counter-die, *a*, and in the position the engine in fig. 1, appears the steam has been admitted under the piston and raised it to the top of the cylinder, and pressed the jointed bar, C, into a straight line, and forced the die, *b*, upon the rivet. When the steam is cut off, and the underside of the piston opened to the eduction passage, the weight of the machinery, together with the weight of the piston, causes it to descend, and with it the rod, H, and the jointed bar, C, which then takes an angular form like the knee when bent, and draws back the standards, B B, and with them the die, *b*; when the steam is again admitted the piston is again raised to the position as shown, and presses upon the rivet as before.

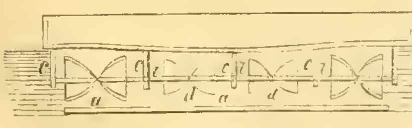
REGISTER OF NEW PATENTS.

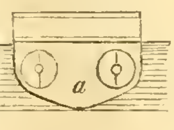
(Under this head we propose giving abstracts of the specifications of all the most important patents as they are enrolled. If any additional information be required as to any patent, the same may be obtained by applying to Mr. LAXTON at the Office of this JOURNAL.)

STEAM BOAT PROPELLERS.

Henry Davies, of Norbury, Staffordshire, Engineer, for "*certain Improvements in the construction of vessels for conveying goods or passengers on water, also certain improved arrangements of machinery for communicating motion to such vessels.*"—Granted Jan. 25; Enrolled July 25, 1844.

Fig. 1. Fig. 2.





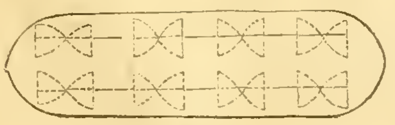
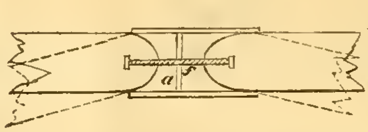
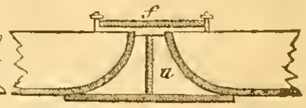


Fig. 8.

The first part of this invention consists in constructing that part of vessels which is immersed in water with a tube or channel, for the purpose of allowing a current of water to pass through the hull of the vessel from head to stern. Secondly, in the application of rotary curved plates or propellers within such channel, and lastly, in a peculiar mode of connecting one vesssel to another, so as to form a train of vessels.

Fig. 4. Fig. 5.





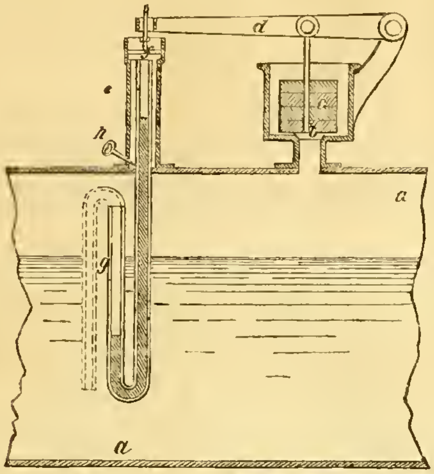
In constructing vessels according to this invention, Mr. D. prefers that they should be made of plate iron, rivetted in the same manner as in the ordinary way of constructing vessels, with this difference that the bottom or keel of the vessel should be level, and the sides of the vessel parallel to each other, as shown in the end view fig. 2, and plan view fig.3 . The deck of the vessel should be slightly curved from the ends and sides of the vessel, as shown at fig. 1, which is a longitudinal section; *a a* is the channel formed in the hull of the vessel; *b* is a shaft, (there being two of them as will be seen by the end view and plan,) supported by standards *c c c*, and coupled together by universal joints to allow of a lateral movement if required, and upon each of these shafts there are 4 propellers, which constitute or form two half circles or revolutions of a double threaded screw of considerable pitch; the above forming the principal features of the improvements in the construction of vessels. With regard to propelling such vessels, which constitute the second part of these improvements, the specification proceeds as follows:—Supposing that a vessel constructed as above to be propelled or towed along the canal, river, or other water, by means of a horse or other power, a partial vacuum will take place in the water towards the stern of the vessel, and a pressure of water will take place against the fore part of the vessel, which combined effect will cause a current of water to pass through the water-way or channel *a*, in an opposite direction to the motion of the vessel, to fill up the vacuum caused by the motion of the vessel, and would have the effect of turning or giving a rotary motion to the shafts, but in consequence of the water way being contracted in the middle of the vessel by lowering the deck for the purpose of giving buoyancy to the vessel, the velocity of the current will at such part be greatly increased, and in order to counteract this difference in the motion of the water in passing through the channel or water way the inventor constructs the propellers of a different pitch, those at the ends of the vessel being given as 5 ft. pitch and 3 ft. 6 in. diameter, whilst the two propellers marked *d d* being stated at 2 ft. 8 in, diameter and 6 ft. 6 in. pitch.

The last improvements, in connecting vessels together so as to form a train of vessels, fig. 4 being a plan, and fig. 5 a sectional elevation; *a a* is a rectangular box or trough of plate iron with a division in the middle, this box being of such dimensions as to receive the prow of one vessel and the stern of another, and allow of the vessels moving out ot the straight line, or turning in the trough, when required, as shown by dotted lines, the two vessels being held together by means of a rope, *f*. The object of connecting a series of vessels, as above described, being to prevent them producing separate displacement in the water, the whole being as it were one vessel and forming one displacement.

SAFETY VALVES.

Thomas Liddle, of Newcastle-upon-Tyne, engineer, for "*Improvements in apparatus for preventing explosions in steam boilers.*"—Granted Feb. 21; Enrolled August 21, 1844.

There are two modes described in the specification of preventing explosions in steam boilers; the first is the application of a float for aiding or assisting in raising the safety valve. The second is the application of a syphon containing mercury, which by the pressure of steam within the boiler is caused to exert a power on the lever of the safety valve, in addition to the pressure of steam upon such safety valve. The apparatus first described consists of a float suspended from a rod, which passes through a stuffing-box attached to the top of the boiler, and also through the end of a lever of the first order, the end of this rod being provided with a nut or other projection. At the opposite end of the lever is suspended a rod, to which is attached the safety valve, and below the valve and inside the boiler is attached the weight, but the weight may, if required be outside the boiler; the object of this arrangement being that when the water in the boiler gets lower than a certain point, and the pressure of steam in the boiler is not sufficient to open the valve, the nut upon the end of the rod, which is attached to the float, which float has descended as the water evaporated, comes in contact with the end of the lever, and thereby raises the valve and allows the steam to escape. There is another modification of this apparatus, which in effect is precisely similar to the foregoing.



The second part of the invention will be clearly understood by the annexed diagram and following description; that is to say, *a a* shows a section of portion of a boiler, *b*; the safety valve attached by a rod to the lever *d*, and *e* the weights; *e* is a cylinder attached to the top of the boiler, having a piston *f*, fitting within it; this piston has a rod which passes through the end of the lever *d*, with a collar upon it; *g* is a syphon passing from near the top of the cylinder below the surface of the water in the boiler, this syphon contains a column of mercury equal to the required pressure of steam, the action therefore is as follows, as the pressure of steam in the boiler is increased, should the valve stick in its seat or from any other cause not be raised, the mercury contained in the syphon will be forced into the cylinder *e*, and a pressure of steam will then be exerted upon the piston *f*, and the same will be forced against the end of the lever *d*, so that a pressure of steam may by this means be applied to the end of the lever *d*, as well as to the safety valve, which cannot very well fail to raise it; *h* is a screw plug for letting the mercury flow from the cylinder *e*, back again into the syphon; the dotted lines show that the syphon may be bent so as to come below the surface of the water, which may be employed for raising the piston instead of mercury as will be understood, for which the inventor claims, first the application of a hollow metal or other proper float in such manner as to act on the safety valve, and aid in opening the same, when the water in the boiler falls too low; and secondly, in the application of a syphon pipe with a column of mercury, as before described, to act on the safety valve, and cause it to open the same, when the pressure becomes too great in the boiler.

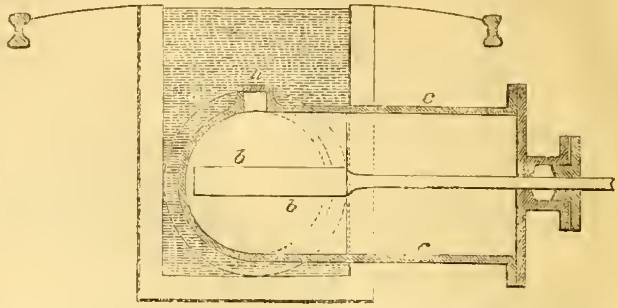
ATMOSPHERIC RAILWAY.

John Aitken, of Surrey Square, in the county of Surrey, gentleman, for "*Improvements in atmospheric railways.*"—Granted February 24; Enrolled August 24, 1844.

In the construction of atmospheric railways the air from the traction pipe (as is well known) is removed by means of air pumps, and some difficulty has been experienced in getting out the air so as to obtain a good vacuum, in consequence of the air at each succeeding stroke of the pumps getting more and more rarefied. Now the object of this invention is in the first place to obtain the required vacuum by causing the traction pipes to be filled with water, and then allowing the same to escape through the eduction pipes from "32 to 33 feet" long, by which means a better vacuum can be obtained in the traction pipes than by the aid of air pumps. The object of the second part of this invention is to obtain a more perfect air tight covering for the longitudinal valve of the traction pipe, by covering such valve, and also the pipe with water for the purpose of retaining the vacuum obtained therein.

In carrying out these improvements the traction pipe is to have a longitudinal opening, which is to be covered with a valve of leather or other suitable material previously prepared, to resist the action of water in the same manner as the leather employed in pump buckets, and the same may be strengthened by transverse plates of iron, and attached by one of its edges to the top of the traction pipe, or the same may be wholly lifted up, as is now practised; the invention having no reference to the peculiar mode of applying the valve, the principal feature being in the application of water for the purpose of forming a vacuum and keeping the longitudinal valve air tight, which is effected as follows. Fig. 1, shows a transverse section of the traction pipe, which is laid in a trough formed between the rails, the whole length of the line, and sufficiently deep to cover the longitudinal valve *a*, which is some inches below the surface of the water; *b b*, shows one of the transverse slides or stops, which is received within a rectangular box or trunk *c c*, and in order to form a vacuum within the traction pipe, the same is to be filled with water which is allowed to flow out through any convenient number of eduction pipes, which operation may be performed at any period previously to the train

Fig. 1.



arriving, so as to allow sufficient time for the water to run out of the pipe, which after the train has arrived is to be pumped back again to refill the pipe. It will appear evident that as the longitudinal valve is raised, the water contained in the cistern or trough will flow into the pipe, and exert a pressure together with that of the atmosphere, on the back of the piston, and assist in impelling it forward, and after the piston has passed each of the transverse sliding stops *b b*, that length of pipe may again be filled with water, ready for another similar operation. In cases where the railway is to be constructed on ascending or descending planes, the inventor proposes to employ a greater number of sliding stops, and to lift the water by means of pumps into the trough at the highest point, or at various points, so as to keep the longitudinal valve always covered, for which he claims the mode of constructing atmospheric railways whereby water is used for obtaining the necessary vacuum in the traction pipes, and also for keeping the longitudinal valve air tight, as described.

IMPROVEMENTS IN STEAM ENGINES.

John Stevelly, of Belfast, in the county of Antrim, professor of natural philosophy, for "*Improvements in steam engines.*—Granted March 2; Enrolled Sept. 2, 1844.

This invention for certain improvements in steam engines, which improvements are arranged under nine different heads, consists first in the peculiar arrangement of a *complicated* condenser, the object of which is intended more particularly as a medium whereby a great amount of heat may be obtained or collected from the steam to be applied to various useful purposes such as heating the rooms of cotton and flax mills, and supplying hot water to the various branches of such manufacture, than any benefit to the actual working of the engine itself; on the upper part of the condenser, which consists of a vessel somewhat less in capacity than the cylinder, there is arranged two sliding valves for the induction and eduction of the steam at certain parts of the stroke of the piston, this vessel, which is termed the "hot condenser,' and which is intended only to partly condense the steam, is provided with a force pump at its lower part, which impels the hot water collected back again into the boiler and to various parts of the manufactory as above stated, and returns again, at a greatly reduced temperature, to assist in the condensation of steam for the purpose of heating more water; the valves above referred to, it will perhaps be necessary to state, are intended to conduct the uncondensed steam to a perfect condenser, which we presume is intended to be of the ordinary construction, as no other is referred to.

The second improvement consists in the application of a double cylinder, or two cylinders placed side by side, one of which the patentee terms a conjugate cylinder. These cylinders, which as observed, are placed side by side, have a piston, the rods of which are connected, we presume in any convenient manner, to two cranks placed at different angles upon the same shaft, presuming one piston to have performed about two-thirds of its stroke, the other has performed about one third, both of which are travelling in the same direction; the two cylinders are connected together, and a communication is established between the top and bottom of each of the cylinders, which communications can be opened and shut by means of two sliding valves, connected together by a rod; the steam parts and valves for introducing or admitting the steam from the boiler into the cylinders not being shown, as the inventor does not deem it necessary; but, however, steam is to be admitted into one of the cylinders from the boiler until the piston of such cylinder has performed as has been observed, about two-thirds of its stroke, (as near as we can judge from examining the drawing,) the piston of the other cylinder having performed about one-third of its stroke, at this juncture the steam from the boiler is cut off and a communication is formed between both cylinders, which allows the steam to act on the underside of both pistons at the same time; the steam after having performed its functions is allowed to pass off to the " hot condenser" before referred to, and a similar operation is performed for the down stroke of the piston, &c. alternate.

There are several other improvements described, one of which consists of an apparatus for supplying high pressure boilers with water, and consists of an additionol boiler, or hot well, placed a little above the level of the water in the boiler, and at one end or side thereof, from the underside of this hot well, which in a locomotive may be placed in the smoke box, there is a pipe which conducts the water from thence into the boiler; from the steam chamber of the boiler there is a bent pipe which leads into the top of the hot well, and which pipe terminates in a two way cock, the other way forms a communication with the atmosphere; this two way cock is actuated by an arrangement of levers and floats placed within the boiler; the action is as follows—presuming the boiler to have a plentiful supply of water, the opening of the two way cock will form a communication between the hot well and the atmosphere, and the condensed water from the engine will be pumped into the hot well; but should the level of the water in the boiler become too low, the float will fall, and by means of the arrangement of the levers the two way cock will be turned so as to close the communication with the atmosphere and open a communication between the steam chamber of the boiler and the hot well, whereby an equilibrium of pressure is established between the boiler and the hot well, and the surface of water in the latter being somewhat higher than that in the boiler, the water will proceed to flow from the hot well into the boiler, and is prevented from returning by means of a ball valve, when the water has attained the desired level the communication is again formed by the two way cock between the hot well and the atmosphere, and that one closed with the boiler.

CARRIAGE WHEELS.

Samuel Atkinson, of Manchester Street, Gray's Inn Road, in the county of Middlesex, turner, for "*Improvements in the construction of wheels for carriages.*"—Granted March 4; Enrolled September 4, 1844.

Fig. 1.

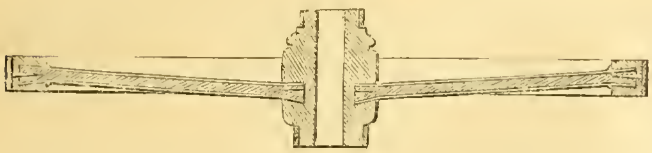


Fig. 2.

These improvements consist in combining iron spokes with wood felloes and wood tyre in the manufacture of wheels for carriages, which spokes may be of any required form; in the accompanying figure we have given a view of one description of spoke referred to in the specification, there being several forms and also several modes of fastening the same within the felloe and nave of the wheel. Fig. 1 shows a view of a spoke similar in form to those now in use, the lower end being rounded and burred up with a diamond tool, so that when driven into the nave of the wheel such projections may assist in retaining it therein, the opposite end of the spoke being fastened to the felloe by means of a nut and screw. Fig. 2 shows a transverse section of a wheel and two spokes, which in this case are made hollow, or tubular, and then filled with wood, the ends of the tubes having an opening or slit on each side, the object of such opening being that when fastening the end of the spoke within the felloe or nave, an iron wedge being first inserted into the opening, the spoke on being driven into the aperture enlarges the end thereof, and retains it firmly within.

The inventor claims the means of manufacturing wheels for carriages whereby iron or other metal spokes are combined with wood felloes and wood naves as described.

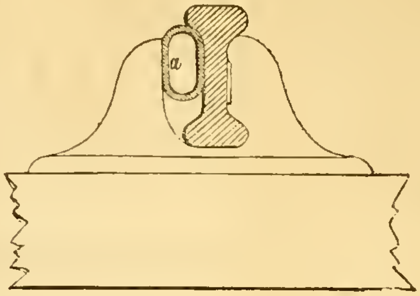
RAILWAY KEYS.

William Henry Barlow, of Leicester, civil engineer, for "*Improvements in the construction of keys, wedges, or fastenings, for engineering purposes.*"—Granted March 6; Enrolled September 6, 1844.

The nature of this invention consists in the application of hollow metal keys for fastening railway bars to the chairs, and also the chairs to the blocks or sleepers, in place of solid keys of iron or wood as heretofore employed, and which hollow metal keys are applicable to other engineering purposes.

The mode of applying these hollow metal keys is precisely the same as those heretofore in use, as will be seen by referring to Fig. 1, which shows an elevation of a railway chair, and end view or section of a rail which is fastened within the chair by means of one of these improved hollow metal keys, which

Fig. 1.



is also shown in section and marked *a*, the same being applied to fasten the rail in the ordinary manner, viz. by driving the key between the rail and the

Fig. 2.

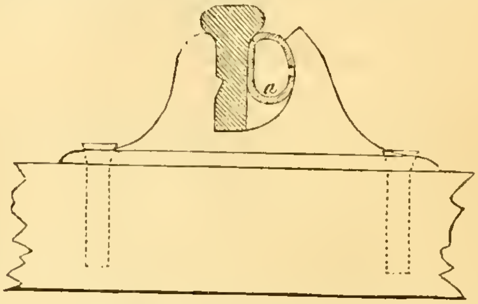
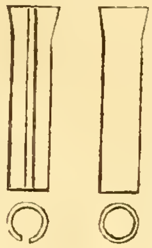


Fig. 3.



cheek of the chair. Fig. 2 shows another form of key, which is left open on one side; in using this description of key it would be advisable to let the ends meet so as to form a butt joint. Fig. 3 shews an elevation and end view of two hollow pins for fastening the chairs to the sleepers, one of which, it will be seen, has a slit or opening on one side throughout its length; for which the inventor claims the mode of making wedges, keys, or fastenings, for securing railways chairs to the blocks or sleepers, and other engineering purposes, by forming such keys or fastenings of hollow metal.

GAS FOR LIGHTING.

Alexander Angus Croll, Superintendent of the Gas Works, Brick Lane, in the county of Middlesex, and William Richards, of the same Works, for "*improvements in the manufacture of gas, for the purpose of illumination, and in apparatus used therein, and when transmitting and measuring gas.*"—Granted March 7; Enrolled September 7, 1844.

It would not be convenient to enter minutely into the details of this invention, the specification of which is accompanied with fourteen sheets of drawings, but as it is above observed, should any of our readers require any information as to any particular part of the invention, the same can be forwarded with a drawing of such part or improvement. The first improvement relates to a method of manufacturing gas, and consists in a peculiar mode of arranging certain apparatus, and in such manner that water may be decomposed by the application of sulphuric acid, (which operation is performed in a leaden vessel), the gas evolved from this process being mixed with the fumes or vapour of naphtha, or other proper fluid, for the purpose of giving colour to the light obtained from burning such gas.

The second part of this invention relates to a peculiar mode or modes of arranging and fixing clay retorts in an arch or arches whereby the same are said to be more advantageously heated, thereby effecting a considerable saving in fuel in the manufacture of coal gas; the peculiar arrangement consists in so combining three arches that they may be heated by two fires, each of the fires being placed under the retorts of the two end or side arches, the centre arch and retorts being heated from the two fires; the heat, which after passing over the retorts in the end arches passes through flues at the lower part and on each side of the centre arch into the same, and after passing over the several retorts contained in that arch, finally escapes through a flue at the top of the arch. There are two modifications of the above arrangement described and shown in the drawings of the specification, and also another, which consists in a mode of arranging two arches one above another and heated by one fire, which is placed immediately above the crown of the lower arch, the heat from which fire, after having heated the retorts in the upper arch, descends and heats the retorts of the lower arch.

The third part of this invention relates to a mode of manufacturing clay retorts, and consists in making them in two parts, the division being in the middle cut transversely; the mode of making such retorts is as follows. A mould of the proper size and form of the external part of the retort is firmly fixed upon the ram of an hydraulic press, another mould corresponding with the inside of the retort is firmly fixed and properly adjusted above the other, the clay of which the retort is to be made being placed within the lower mould, the same is forced over the other mould which forms the retort by means of the clay being pressed or forced upwards between the two moulds; the inner mould being hollow is heated by means of steam for the purpose of expanding it, and then left to cool for the purpose of contraction, in order that it may be more readily withdrawn.

The fourth and last part of the invention is for improvements in gas meters, the principal features of which are in the so combining of two flexible partitions that a continuous and uniform stream of gas may be obtained from the burner and thereby produce a steady flame; and also in the mode of arranging or constructing the flexible partitions in such manner that the leather or other material of which they are made is, in the working of the meter only bent one way, that is to say, the flexible part is not bent backwards and forwards, which bending has, in a great measure, a tendency to destroy such partitions; and lastly, in the peculiar mode of transmitting motion from the flexible partitions to the registering apparatus.

STEAM BOAT PROPELLER.

WM. FAIRBAIRN, of Manchester, in the county of Lancaster, engineer, for "*Improvements in machinery used for propelling vessels by steam.*"—Granted March 7; Enrolled September 7, 1844.

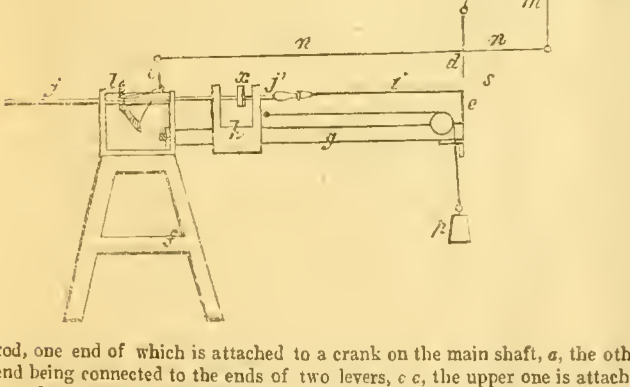
This invention consists in the application of an internal toothed wheel fixed on the main or crank shaft of the engine of a vessel, when such vessel is to be driven by screw propellers, in which case it is necessary that the number of revolutions of the propeller shaft should be considerably increased beyond the number of revolutions of the main or driving shaft.

The drawing shows the elevation of an engine of the same construction as the land engine, in which the beam is above the cylinder, and is provided with a connecting rod, crank shaft, and fly wheel, which latter forms an internal wheel, in the teeth of which work the teeth of an external wheel or pinion keyed on the end of the screw propeller shaft. The object of using an internal wheel is said to be—firstly, that such arrangement admits of a much larger driving wheel being employed, and also that the propeller shaft can be got much nearer the bottom of the vessel; and secondly, that the power transmitted from the driving wheel to the driven is received in a greater number of parts, that is to say there is a greater number of teeth of the driven wheel in contact with the driver than would be the case if the wheel of the propeller shaft was driven by an external instead of internal wheel.

NAIL MACHINERY.

BERNARD PEARD WALKER, of North Street, Wolverhampton, clerk, for "*Improvements in machinery for making nails.*"—Granted March 6; Enrolled September 6, 1844.

This invention relates to certain improvements in nail cutting machinery, and in order to render the same intelligible we have given a diagram which will no doubt be sufficiently clear to those who are at all conversant with mechanics. *a* is the main or driving shaft of the machine; *b* is a connecting



rod, one end of which is attached to a crank on the main shaft, *a*, the other end being connected to the ends of two levers, *c c*, the upper one is attached to a fixed centre, and the lower one is attached to the end of a sliding bar, *d*, which carries the moveable cutter, *c* being the fixed cutter; *f* is a portion of the frame of the machine, and *g* a triangular bar which carries a slide, *h*; *i* is the flat bar or plate of metal intended to be cut into nails, and is held by means of a pair of clams or holders attached to the end of the spindle, *j' j*, which spindle passes through a hollow shaft, *l*, and by means of a fixed key is allowed to slide endways, but not to turn within the hollow shaft; *m* is a cranked lever actuated by a cam or eccentric on the shaft, *a*, to the lower end of this lever is attached one end of a connecting rod, *n*, the opposite end being connected to a lever, *o*, to which there is attached a toothed sector working in the teeth of a bevel wheel keyed on the hollow shaft, *l*. Thus at every stroke of the slide or cutter, *d*, the plate of metal, *i*, which is at an angle with the cutter, is turned over by the apparatus last described so as to cut the nail off tapering from head to point, the plate being drawn along as the nails are cut off by means of a weight, *p*, and cord which is attached to the slide, *h*.

The principal novelty in this machine consists in the application of an universal joint at *x*, which as the plate, *i*, is turned over allows the end thereof and that part of the spindle marked *j'* to rise. There is another machine described in the specification, in which the raising of the plate as it is turned over, is effected by eccentrics. The patentee claims as his invention the mode described of combining machinery for making cut nails, whereby the holder of the flat plate of metal from which the nails are cut is caused to rise in the act of turning over the metal; and also attaching the strip of metal to be cut to an advancing holder.

IRON CASTINGS.

CHARLES HARRISON, manager of the Coed Tallon and Leeswood iron works, Flintshire, for "*certain Improvements in the manufacture of cast iron pipes and other iron castings.*"—Granted March 14; Enrolled September 14, 1844.

This invention consists in a peculiar mode of making or forming the moulds for casting pipes, pillars, and other articles of a cylindrical form; in carrying out these improvements the inventor proceeds as follows.

In the first place two "shells" are to be provided, or what is technically termed the moulding box, consisting of the top and bottom which when put together are cylindrical in place of square, as heretofore, the internal diameter being somewhat larger than the external diameter of the pipe to be moulded.

These two parts of the moulding box have on their inner surface a number of projections, the object of which is to cause the loam or wet sand to adhere firmly to the sides or inner surface of the box, which loam is to be plastered over the whole of such surface with the hand; this operation being performed on one half of the box, a piece of board which has been cut on one edge so as to form a profile of the external part of the pipe, and of the same length is mounted upon an axis in such manner that the board forms a radial line to such axis; the axis or shaft to which this board or template is attached is then placed into its bearings, which are formed at each end of the moulding box, it will therefore be evident, that on giving motion to the axis or shaft, the edge of the board will describe a circle whose plane will be equal to the external surface of the pipe intended to be cast, and will therefore form a half mould of loam in the aforesaid box. This operation being carefully performed in the top and bottom parts of the box, the same are taken to the stove and dried, after which the edges are carefully cleaned off, so as to make a good joint, and the surface covered with charcoal, the mould is then ready to receive the core, and afterwards the metal for casting the pipe in the ordinary manner.

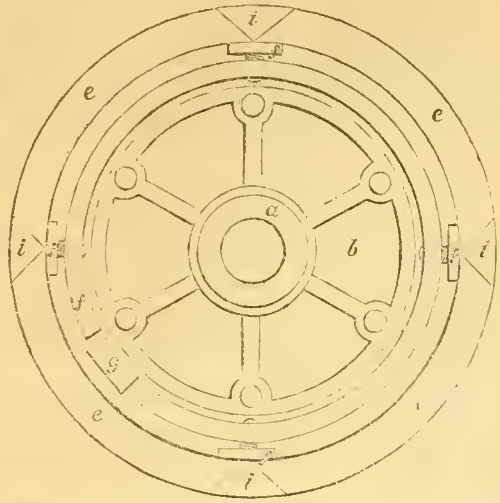
The object of this mode of proceeding being that when a casting has been made in such mould it is only necessary to examine the mould, and if required, to repair it in such parts as may have broken up, when it will be ready to receive another casting, &c, so long as the mould lasts.

STEAM ENGINE IMPROVEMENTS

EMANUEL WHARTON, of Birmingham, engineer, for "*certain Improvements in steam engines, which are in the whole or in part applicable to other motive engines, and to machines for raising and impelling fluids,*"—Granted March 14; Enrolled September 14, 1844.

The first part of this invention relates to a peculiar mode of constructing metallic pistons, fig. 1 being a section taken through the centre of the piston, and fig. 2 a plan thereof showing the upper plate removed. *a* is the boss which receives the piston rod; *b* the bottom part upon which the boss is cast, and *c* the upper part; *e, e, e, e*, are four segments, the inner surface of which are of a conical form as will be seen by the section: *f' f'* is a ring which, it is said, if made of cast iron should have a piece cut out so as to give it a degree of elasticity. This ring, which is placed between the projecting part, *b'*, of the bottom part of the piston, and the four segments, *e*, is furnished with four screws or screw blocks, *f*, which have their heads bevelled in such manner as to fit the conical or inclined surface of the segment; *g* is a projection or stop for keeping the ring in its proper place. It will therefore appear evident that if the ring *f' f'*, with its adjusting screw blocks, be dropped into its place, and a pressure applied to its upper surface, that the segments will be forced outwards in a direction from the centre of the piston, this downward pressure of the ring, *f f*, is effected by means of a projecting ring cast on the underside of the cover, which, as the cover is screwed on, presses on the upper surface of the ring and adjusting screws; *i i i i* are four wedge pieces, the object of which will be as clearly seen without the description as given in the specification as with it.

Fig. 2.



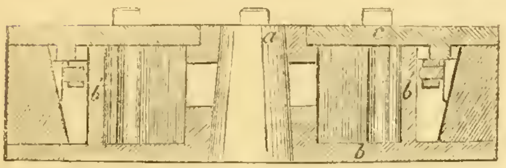


Fig. 1.

The second part of this invention consists in a peculiar mode of applying metallic packing to those engines known by the name of patent disc engines, whereby the use of hempen packing therein will be "almost entirely superseded," although the inventor in his description prefers to use a little; for which he claims, first the application of segments or rings of a conical form on their inner surface in combination with an elastic ring and adjusting screws, and second in the application of packing as described, which is calculated to supersede almost entirely the use of hempen packing in that class of engines called patent disc engines.

Moses Poole, of Lincoln's Inn, in the county of Middlesex, gentleman, for *Improvements in steam engines, steam boilers and furnaces or fireplaces.* Being a communication.—Granted March 14; Enrolled September 14, 1844.

The first part of this invention has reference to an apparatus for raking and clearing the fire, which consists of an arrangement of levers supporting a rectangular frame below the fire bars, upon this frame there is a number of projecting blades, which blades, as the outer end of the frame is lowered or pulled downwards, enter between the grate bars. The levers which support the frame are so arranged as to allow of a longitudinal, or backward and forward motion being given to the frame, which when the aforesaid blades have in the manner described been forced between the grate bars will have the effect of thoroughly clearing the fire. The ends of the bars are shewn as being bent downwards at right angles to the bar and terminating in a trough containing water for the purpose of keeping them cool, or the same may be made hollow and have steam or water passed through them.

The second part of the invention relates to a mode of evaporating the water, which passes off with the steam from the boiler, and also in a mode of regulating the temperature of the dry steam. This the inventor proposes to effect by reheating the steam after it has passed from the boiler, and thereby evaporate any particles of water which may have passed from the boiler; but in order that the temperature of the steam may not be too great so as to burn the tow or packing, and also dry up the oil intended to lubricate the various parts, he proposes to arrange the parts in such manner that wet steam, or steam from the boiler, may be introduced into the chamber receiving the evaporated steam by means of a cock, which can be regulated according to the quantity required, which can be ascertained by means of a thermometer.

The third part relates to certain improvements in steam boilers, which have little claim to novelty; and the fourth to an apparatus for preventing explosions in steam boilers, the latter consisting in the so arranging the safety valve by means of a lever and float that it will open when the water in the boiler gets below the proper level, and also when the steam is raised above a certain temperature.

The fifth and last part of the invention relates to certain mechanical arrangements to be used in combination with the governor for regulating the speed of the engine; the defect in the ordinary centrifugal governor is stated in the specification to be, that when the balls have been moved beyond their ordinary position, either to open or shut the throttle valve, they cannot return to their original position without again changing the state of circumstances which caused them to move; the object, therefore, is to remedy this defect by the application of an arrangement of mechanism situate between the governor and throttle valve, the action of which is as follows—as the speed of the engine is increased the balls will expand in the ordinary manner and the throttle valve will be partially closed, but as the speed decreases, and consequently the balls and arms of the governor collapse, the valve, in place of being acted upon as heretofore, so as to open it, and therefore pass over the same space in the collapsing as well as expanding of the governor, will remain quiescent during such motion of the governor until the engine gets below its ordinary speed, at which time the throttle valve will again be acted upon by the governors in a reverse direction so as to open it, and the same circumstances take place as above described with regard to the closing of the valve.

MISCELLANEA.

The New Royal Exchange is expected to be opened at the end of the month of October; Her Majesty with Prince Albert it is announced are to attend the opening.

The New Building Act.—The Commissioners of Woods have appointed Mr. Higgins and Mr. Hoskins as the two Official Referees; two gentlemen in every way qualified for the duties. The office for both the Registrar and Referees is fixed at No. 4, Trafalgar Square. The day upon which the Act comes into operation, as regards the new districts and buildings, is the 1st January, 1845.

The Basilica of St. Louis at Munich was inaugurated on the 8th Sept., it is built in the style of the basilicas of Italy, and is ornamented with numerous sculptures, paintings in oil and fresco, and also stained glass.

Obituary.—We are sorry to have to announce the demise of Mr. Henry Robinson Palmer, of Great George Street, Civil Engineer, Fellow of the Royal Society, and many years a Vice President of the Institute of Civil Engineers, he was extensively engaged upon numerous public works throughout the United Kingdom, particularly docks and harbours.

Mr. Nasmyth *versus* Captain Warner.—We understand, from undoubted authority, that Mr. Nasmyth, engineer, of Manchester, has submitted to the consideration of the Lords Commissioners of the Admiralty, the plan of an iron steamer, bomb-proof, which will effectually destroy any ship or squadron. She is propelled by the Archimedian screw, and, when going at the rate of six knots an hour, she will run stem on to a ship, and leave a hole in her many feet wide, below the surface. It is, in fact, the power of two ships coming in collision with each other at the rate of ten knots an hour, placed, by mechanical means, in the hands of not more than three men. We understand that this invention is now under their lordships' consideration, and there can be no doubt but it will put Captain Warner's invention at a discount.—'Devonport Independent.'

Attempted Ascents of Mont Blanc.—MM. Bravais and Martins have been for some time engaged in attempts to ascend Mont Blanc, but without success. After spending the intervening time in collecting a series of meteorological and geological observations in the Alpine country which surrounds the mountain, the ascent was happily effected on the 29th ult. The travellers found their tent on the Grand Plateau uninjured, and formed the design of passing a night each on the summit of the mountain, while their companions (M. Lepileur being now added to the number) encamped in the tent. But the intense cold defeated this part of their project. The thermometer stood at 7 4-10 degrees below zero, in the shade, at a quarter past 2 o'clock in the day, and the ascent was most painful, notwithstanding the fineness of the weather. At a short distance from the summit they were assailed by a piercing wind, and the cold which it brought was so intense, that they describe their sensations on attaining the summit, when they had in some measure escaped its severity, as being that of men who had entered a well-warmed saloon.

Berwick Castle.—That venerable and interesting monument of antiquity, the ancient Castle of Berwick, is to be levelled with the ground, in order to allow space for the terminus of the railway forming between that town and Edinburgh.

Rhine Steam Navigation.—The Dusseldorf Rhine Steam Navigation Company (in correspondence with the General Steam Navigation Company of London) established in 1836, although having already done a great deal towards the improvement of steam navigation on the Rhine, not only as regards speed, but also in comfort and superior restauration on board, appear determined, if possible, to equal the fastest Thames steamers in point of speed. This company have just received from the factory of Messrs. Miller, Ravenhill, and Co., Blackwall, London, a new iron steamer, which has been named the Elberfeld, and she, on account of her extraordinary speed over all the steamers now on the Rhine, has created quite a sensation. A few days ago this vessel, previous to being placed in active service, made an experimental voyage from Dusseldorf and Cologne to Mentz and back, and to the astonishment of every one, performed the journey from Cologne to Mentz, against the strong stream, in 13 hours and 20 minutes, and from Mentz to Cologne, with the stream, rather under seven hours, inclusive of stoppages. To form a comparison with what the Dusseldorf Company have accomplished, whose vessels are all propelled by English engines, it is necessary to add, that in 1837, previous to their formation, it was held an extraordinary feat to proceed by water in two days from Cologne to Mentz—namely, the first day from Cologne to Coblentz in 14 hours, and the second day from Coblentz to Mentz in 13 hours, making together 27 hours, now performed in half the time and in one day.

The Earl of Rosse's Leviathan Telescope.—Sir James South in a letter to the Editor of the 'Times' observes that it is "with pure delight do I communicate to you, and by your permission, through the 'Times' journal, to the civilized world, the fact that the leviathan telescope, on which the Earl of Rosse has been toiling in his demesne at Parsons-town now upwards of two years, although not absolutely finished, was on Wednesday last directed for the first time, to the sidereal heavens. The letter which I have this morning received from its noble maker, in his usual unassuming style, merely states, that the metal, only just polished, was of a pretty good figure, and that with a power of 500, the nebula known as No. 2 of Messier's catalogue was even more magnificent than the nebula No. 13 of Messier, when seen with his lordship's telescope of 3 feet diameter and 27 feet focus. Cloudy weather prevented him turning the leviathan on any other nebulous object. Thus, then, we have, thank God, all danger of the metal breaking before it could be polished overcome. Little more, however, will be done to it or with it for some weeks, inasmuch as the noble Earl is on the eve of quitting Ireland for England, to resign at York his post as President of the British Association, and to visit his noble relatives at Kilnwick and at Brighton. This done, he returns to Ireland; and I look forward with intense anxiety to witness its first severe trial, when all its various appointments shall be completed, in the confidence that those who may then be present will see with it what man has never seen before. The diameter of the large metal is six feet, and its focus 54 feet. Yet the immense mass is manageable by one man. Compared with it, the working telescopes of Sir William Herschel, which in his hands conferred on astronomy such inestimable service, and on himself astronomical immortality, were but playthings.

THE SURFACE OF THE CITY OF LONDON.—During excavations for the sewers in different parts of the city, information has been gained relative to the depth of artificial ground above the natural surface. The following is the very curious statement relating thereto made by Mr. R. Kelsey in evidence before the "Commissioners for inquiring into the state of large towns and populous districts:"—Thickness of made ground at Paul's wharf up to St. Paul's Churchyard, 9 feet to 12 feet; Watling-street, 11 feet to 12 feet 6 inches; Bread-street, 17 feet 6 inches; Cheapside, the natural earth was not reached—the cutting varied from 14 to 23 feet; Gracechurch-street, 14 feet to 18 feet; King William-street, 12 feet to 17 feet 6 inches; Princes-street, 10 feet to 33 feet 6 inches; Moorgate-street, 16 feet 6 inches to 21 feet 6 inches; Fenchurch-street, 15 feet 6 inches to 17 feet 10 inches; Bishopsgate Within, 9 feet 6 inches to 16 feet; Fish-street-hill, 5 feet 6 inches to 18 feet 10 inches; Eastcheap, 12 feet to 15 feet; Redcross-street, 7 feet to 9 feet; Barbican, 10 feet to 13 feet; Cannon-street, 9 feet throughout; Rosemary-lane, 8 feet to 12 feet; Water-lane, Fleet-street, 5 feet to 9 feet; Cateaton-street and Lad-lane, 12 feet to 14 feet 2 inches; streets in Cloth-fair, 4 feet 6 inches to 12 feet 6 inches; streets in St. Ann's, Blackfriars, 4 feet to 13 feet 3 inches. The plinth of Temple-bar is buried in accumulation. The east end of Newgate-street was lowered about 12 inches when the present Post-office was built. London-wall has in part been raised above 2 feet within the last 25 years. The Pavement and Little Moorfields have been wholly re-arranged within the last 10 years. All the improvements from London-bridge to London-wall have largely altered the surface of the main line, and of the adjacent streets. The north side of what is termed Holborn-bridge, the north end of Farringdon-street, has been raised about 2 feet. Such occurrences as these are distinctly noticeable in some way, but the insensible alterations are equally great and curious; as, for instance, from levels taken in 1770 and 1842, it appears that in Bishopsgate-street Without, at Bishopsgate Churchyard, the surface has risen 2 feet 2 inches in 72 years, but at Spital-square only 12 inches in the same time. The result of this examination is confirmed by the depths of the sewers as originally built and as they now measure.

THE WELLAND CANAL.—In our last number we gave a brief statement of the unprecedented and rapid increase of the trade of Lake Erie, and the small proportion of it as yet secured for Canada, by the St. Lawrence. But we have no doubt that the efforts now making, by the improvement of our water communications, to divert this commerce into its natural channel, will ere long be crowned with success. The enlarged works connecting Lakes Erie and Ontario are in a state of great forwardness—those on the feeder approaching nearly to completion. The steam-boat lock at Broad-creek, built by M'Culloch, Clark, and Co., is now finished, except hanging the gates, and is considered one of the best structures in the province; the piers at Port Maitland, the mouth of the Grand River, are in a forward state, and within one month this important channel will be opened—important, inasmuch as it will be an open outlet from Lake Erie, 54 miles west of Buffalo, and above the barrier of ice which keeps that port closed for many days, and in some years, weeks, in the spring. Owners of vessels, which can now pass through this canal, may therefore prepare with confidence for the opening of this navigation early in the ensuing year. In addition to the above, there is every prospect that the locks from St. Catherine's to Thorold will be completed on the enlarged scale—150 feet long by 26½ feet wide—during the present fall. The contractors are making the most strenuous exertions to effect this object, and unless some unforeseen obstacle occurs, it will be accomplished. The four locks (Nos. 4 to 7) contracted for by Mr. Barnet, will be finished this month as well as the two adjoining (Nos. 8 and 9) by Boyee, Courtwright, and Co.; also one by Mr. Simmerman, and another by Sharp and Quinn; and we hope in another month, to announce the certainty of the entire line being completed, so as to insure the opening of the whole route in the spring.—' St. Catherine's Journal.'

EXTRAORDINARY ESCAPE OF AN IRON STEAMER FROM DAMAGE.—A few days since we mentioned the circumstance of the Pacha, Peninsular and Oriental Steam Navigation Company's vessel, having been taken into dock at Portsmouth to be examined, when nothing the matter having been discovered she was taken out again and proceeded to Southampton. We have since learned the reason why she was so examined, and as the fact of a ship of 700 tons burden falling nine feet without sustaining any material injury is unparalleled, we give the following particulars:—Last month the Pacha, the only iron vessel belonging to the company, of 210 horse power, was hauled up at White's building slip at Cowes, for the purpose of applying to her bottom a composition prepared by the scientific and talented superintendant of the company, to prevent the accumulation of barnacles and seaweed, the successful operation of it on a small scale justifying the speculation on a larger. The workmen left the vessel on the slip, under the impression that she was perfectly secure; but a short time after they had departed, the vessel slipped over on the larboard side, and fell nine feet off the slip, bringing the paddle wheel in violent contact with the piles of the slipway, and bending and injuring the outer ring and lower paddle arms, which of necessity were obliged to be cut away in order to free the ship and enable her to be launched again. Next day the gutters were knocked out, the parts injured were straightened, and a fire having been lighted in the inside of the vessel, an iron plate which had been bulged in by the paddle float, in the fall, was brought to its proper shape, and patched on the inside. The vessel was then taken to Portsmouth Dockyard, and inspected by the authorities, but they could discover neither twist nor defect of any description, the form of the vessel being perfect in every respect. As a proof that no derangement had taken place in the machinery, from the time of admitting the water into the dry dock at Portsmouth, to that of her arrival at Southampton Docks, including the getting up the steam, the fires not being lighted until she was out of the basin, was only two hours and 25 minutes, the distance steamed 22 miles. Every one who has seen her, or heard of the affair, thinks it a most miraculous escape, and that if she had been built of wood, she must have been crippled by such an accident. The whole expense of repair was under £25. She was built by Todd and Macgregor, of Glasgow.—"Dublin Advertiser."

NEW STEAMERS.—On Saturday, September 14, the twin steamers, Her Majesty and the Royal Consort, intended for the Fleetwood and Ardrossan station, started for a trial trip down the Clyde to exhibit their sailing and seagoing qualities. After going easily down to Greenock, the ships then commenced a friendly trial of speed, which was kept up until they reached the lighthouse on the Little Cumbrae, and declared by Mr. Dennie, the timekeeper, to be at a speed of upwards of 15 miles an hour. These vessels are fully 600 tons' burden, are supplied with engines of 300-horse power, and are similar in every respect in model and construction, with the exception that the paddle-floats of Her Majesty are solid, while those of the Royal Consort are divided. It was the wish, therefore, of the builders, Messrs. Todd and M'Gregor, to test the capabilities of the different paddles, Mr. Todd acting as chief engineer on board the Consort, Mr. M'Gregor filling the same situation on board Her Majesty; and the result is, that the solid float has been found, in point of speed, to be superior to the divided one. It is scarcely possible to describe the interest and excitement attaching to the race between these two beautiful steam vessels; for nearly three miles they were as near as may be "neck and neck:" but Her Majesty, with the solid floats, gradually shot a-head. The weather was wild and boisterous, and admirably fitted to test the capabilities of the boats as sea-going steamers. They are each supplied with tubular boilers, direct self-acting engines, and fitted up with five compartments; and at the time of the highest speed we are informed by the engineers that the pressure on the boiler was not more than six pounds to the square inch. Several of the shareholders, with their wives and families, were on board the ships, and notwithstanding the perils of the "dark and stormy water," there was much hilarity and enjoyment. At 4 o'clock, Captain Wilson, late R.N., took the chair in Her Majesty, and Mr. Smith, the manager of the Fleetwood station, officiated as croupier. Several good speeches were delivered, and amongst many statements in favour of the iron boats, Mr. M'Gregor stated that they were cheaply constructed, would not burn, would not take dry rot, and while they were built in compartments would not sink. An agreeable party also dined, under the presidency of Captain Ewing, in the Royal Consort. We look upon the construction of these boats as adding another triumph to the ship-building capabilities of the Clyde.—' Glasgow Herald.'

NEW MOTIVE POWER.—M. Selligues, who some short time since reported to the "Académie des Sciences" a discovery of a motive power which he then thought would be a substitute for steam, and which consists of combining atmospheric air with hydrogen gas, by which an explosion is produced when ignited, has, at a recent meeting of the Academy, made another communication, from which it now appears that the detonating power ceases under pressure. This phenomenon has proved an obstacle to the experiments of M. Selligues before the Committee appointed by the Academy. Notwithstanding the difficulties which have interposed themselves, M. Arago has convinced himself of the importance of the discovery, and has reported to the Academy that with so small a quantity as 3 to 5 litres (6 to 10 pints) of hydrogen gas, mixed with atmospheric air, a weight of 1000 kilogrammes (= 2205 lb.) was rapidly raised to the height of 3 ft.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM AUGUST 29, TO SEPTEMBER 19, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

James Pillans Wilson, of Belmont, Vauxhall, gentleman, for "Improvements in treating fatty and oily matters, and in the manufacture of candles."—Sealed August 29.

William Brunton, jun., of Poole, near Truro, civil engineer, for "Improvements in the manufacture of shovels for mining purposes."—August 29.

Francois Stanislas de Sussex, of Bethnal-green, chemist, and Alexander Robertson Arrott, of Torrington-square, chemist, for "Improvements in the recovery of manganese used in making bleaching powder."—August 29.

Mark Freeman, of Sutton-common, for "Improvements in apparatus called ever-pointed pencils."—August 29.

Moses Poole, of the Patent-office, London, gentleman, for "Improvements in pumps." (A communication.)—August 29.

James Smith, of Queen-square, London, civil engineer, and William Gairdner Jolly, of Endrick Bank, Scotland, for "certain Improvements in the form of tiles for draining, in implements for manufacturing thereof, and in the modes of manufacture."—August 29.

Frank Fielder, of Old-street, St. Luke's, for "certain Improvements in wire-work for the manufacture of paper and the application thereof to such purposes." (A communication).—August 29.

William Newton, of Chancery-lane, civil engineer, for "Improvements in the means or apparatus for preventing shocks or accidents on railways, or in lessening the dangerous effects arising therefrom." (A communication.)—August 29.

Pryce Buckley Williams, of Llegodig, North Wales, for "certain Improvements in the manufacture of artificial stone."—August 29.

Jean Albert Palmaert, of Brussels, in the kingdom of Belgium, colonel of staff, for "Improvements in the means of economizing and applying heat obtained from known processes." (A communication.)—August 29.

Hipolyte Auguste Richard, of Skinner's-place, Sise-lane, gentleman, for "A certain improved apparatus for heating and lighting."—September 5.

Robert William Sieviere, of Henrietta-street, Cavendish-square, gentleman, for "certain Improvements in looms for weaving, and in the mode or method of producing plain or figured goods or fabrics."—September 5.

James Pillans Wilson, of Belmont, Vauxhall, gentleman, for "Improvements in treating fatty and oily matters, and in the manufacture of candles."—September 9.

George Bucknall Picken, of Crosby-row, Wandsworth, linendraper, for "Improvements in umbrellas and parasols."—September 12.

Martin Cawood, of Leeds, iron-founder, and William Pritchard, the elder, of Burley, near Leeds, for "Improvements in power looms."—September 12.

John Chanter, of London, civil engineer, and George Lodge, of Leeds, engineer, for "Improvements in furnaces, fire-bars, hot-air generators, and flues."—September 12.

Alfred Simpson, of Farnham-place, Gravel-line, Southwark, hat manufacturer, for "Improvements in the manufacture of hats."—September 12.

Charles Wearg Clark, of Westbourne-grove, Paddington, surveyor, and James Reed, of Hamworthy, Dorsetshire, brick and tile maker, for "Improvements in the manufacture of bricks and tiles for chimneys and flues and for other uses."—September 12.

James Power, of Threadneedle-street, London, merchant, for "Improvements in the manufacture of candles and soap, and in treating a certain vegetable matter for such manufactures and for other uses."—September 12.

William Newton, of Chancery-lane, civil engineer, for "certain Improvements in treating and preparing oil or fatty matters." (A communication.)—September 12.

James Vibart, of Chilliswood House, near Taunton, Somerset, lieutenant in the royal navy, for "certain Improvements in the means of obtaining and applying power for working or driving thrashing machines, mills, chaff-cutters, and other machines or apparatus."—September 12.

Henry Cooper, of Royton, Lancaster, cotton-manufacturer, for "certain Improvements in machinery or apparatus to be used for doubling cotton, worsted, and other fibrous materials."—September 12.

Elias Robison Handcock, of Rathmoyle House, Ireland, for "certain Improvements in mechanism applicable to a method of propelling vessels on the water."—September 12.

Webster Flockton, of the Spa-road, Bermondsey, turpentine distiller, for "certain Improvements in machinery or apparatus for sweeping or cleansing streets, roads, or ways."—September 12.

Robert Ferguson and John Clark, of Glasgow, Lanark, for "Improvements in printing and calendering.—September 14.

Christopher Vaux, of Frederick-street, Gray's-inn-road, gentleman, for "Improvements in apparatus for bathing."—September 19.

William Birkmyre, of Mill Brook, chemist, for "certain improvements in the manufacture of potash and soda, alums, sulphuric acid, and sulphate of soda."—September 19.

James Francis Pinel, of Skinner's-place, Sise-lane, chemist, for "certain Improvements in the modes of treating farinaceous substances."—September 19.

Michael Fitch, of Chelmsford, gentleman, for "an Improved substance for preventing decomposition in provisions, and for the method of manufacturing the same; and of condensing and applying a certain gas or fume to certain perishable articles."—September 19.

Antoine Vieyres, of Pall-mall, watchmaker, for "Improvements in the manufacture of cut nails."—September 19.

William Newton, of Chancery-lane, civil engineer, for "Improvements in machinery to be employed in the manufacturing of nails, rivets, screws, and pins."— A communication.—September 19.

CANDIDUS'S NOTE-BOOK.
FASCICULUS LIX.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. According to the description given of it, the Durham Testimonial appears to be as arrant a piece of "*nonsense architecture*" as can well be imagined,—at once a professed copy of a Grecian Doric temple in some respects, and in another utterly unlike any temple or any other building ancient or modern, except a "parish pound" for stray cattle. We are told that the edifice is *hypœthral:* but—to make use of a more apt than elegant proverb, "fine words butter no parsnips:" any structure from which the roof had been blown off, or had fallen, might with equal propriety be so denominated. An "hypœthral" temple does not mean one without any roof at all, or appearance of it, but only that peculiar kind of temple in which the *cella* was left partly uncovered, after the manner of an inner cortile with colonnades along its sides, with a smaller order forming galleries over them, rising up to the slope of the roof. Consequently the Durham Testimonial—or as it might more properly be called, the Durham "Folly," does not at all answer to the description implied by the epithet "*hypœthral*" since it has neither cella nor roof of any kind whatever. Nevertheless, as if to render absurdity still more absurd, and inconsistency all the more glaring, this roofless edifice is to have a "magnificent pediment" at each end! For their magnificence, however, those superfluous features, it seems, will be nowise indebted to sculpture, although that would serve as some apology for the introduction of them, if any thing could possibly excuse such gross and palpable violation of meaning and common-sense. In fact the design does not provide for any sculpture at all—not even for a statue or any thing else to express the purpose of the "Testimonial," and point out the individual whom it is intended to commemorate. On the contrary, we are told that "*nothing in the shape of ornament* or *meretricious decoration* will be introduced;" and so far, it may be presumed, this classical structure will manifest a very great improvement upon such a meretriciously tricked out building as was the Parthenon with all its lavish parade and pomp of sculpture. This is refining upon Athenian taste, with a vengeance! Still, it may be thought that what is so undisguisedly a mere sham as a building, without even the appearance of answering any purpose whatever as such, stands in need of more than an ordinary degree of embellishment in order to reconcile us in some degree to the utter want of utility, or even the mere semblance of it. A monumental column at least expresses its intention, without any deception, whereas here, on the building being approached, it will show itself to be a mere sham—all outside show,—a mere platform quite open to the sky, yet edged round by useless columns supporting nothing but their own entablatures. It is consolatory however to learn that these last will be turned to some account, as they are to form "promenades," whence, after having first crept up and squeezed through a staircase, within one of the columns, (which are not more than five feet in their upper diameter), visitors may enjoy "a panorama of the surrounding country,"—that is, standing on a narrow ledge not more than between four and five feet wide, with the blocking courses as parapets to it, so that they will have to promenade somewhat after the fashion of crows in a gutter! Well, at any rate that will be a novel idea; only the *prospect* of having to descend the awfully narrow corkscrew in one of the columns, must be anything but a pleasant one. Surely the architect might have exerted the powers of contrivance a little more rationally,—in fact so as by providing a commodious platform or terrace on the top of the building, and an equally commodious ascent up to it, he might at the same time have kept up the character of a peristylar temple, whose colonnades form an external sheltered ambulatory around the enclosed sanctuary or *cella*. That this might very easily have been accomplished is evident from the plan: there are in all eighteen columns so disposed that the structure is tetrastyle at each end, and heptastyle in its flank elevations, in other words, these last consist of six, and the ends of three intercolumns each. This of course leaves only the space of one intercolumn and two columns for any interior chamber or cella (unless indeed the plan were altered to a pseudo-peristyle); yet although it would be hardly sufficient—of much too narrow proportions for any sort of sepulchral chamber or mausoleum containing a statue of the nobleman to whom the structure is dedicated, it would, according to the dimensions stated afford a clear breadth within, of about eighteen feet, by somewhat more than sixty feet in length, consequently enough for a staircase of convenient width, consisting of two or more flights forward in one direction, and then returning again similarly in the other. This being done there would have been a sufficiently spacious terrace on the top of the building, extending over the colonnades, or all that part of the plan not occupied by the staircase. Another advantage would have been that had such an idea been adopted, the external walls of the cella (staircase) might have been rendered significant and historic, by being sculptured with a series of reliefs and inscriptions, illustrating the deeds and merits of the individual to whom this classic "monument" is professedly raised. At present the only satisfaction to be derived from it is that the exquisite absurdity of the design will operate as a powerful warning in future. It is a pity the public have not been informed who are the wiseacres to whose judgement and taste they are indebted for the selection of such a precious piece of maudlin and make-believe classicality—of what may fairly be called classicality run mad.

II. Should Welby Pugin ever favour us with a Supplement to his Contrasts, he will no doubt bring forward as one most egregious instance of architectural bathos the unlucky structure commented upon in the preceding paragraph. He might also hold up for reprehension a good many *Pecksniff* specimens of Gothic and Tudor of very recent date—certainly more recent than would be imagined, for some of them seem to be almost twin-brothers to Strawberry Hill, or else to the front of Guildhall. To say the truth, the Gothic style has not thriven in the metropolis; rather quite the reverse, for even the least exceptionable examples of it scarcely surpass a kind of respectable mediocrity, while the rest fall very far short even of that. Will it hereafter be believed that the range of "Gothic" building in the Inner Temple, facing the Garden, was erected in the very same age with the "Palace of Westminster," and not more than a score of years earlier?—or that the City of London School takes precedence in point of date by little more than a single lustrum, of the new Hall and Library of Lincoln's Inn? Those two unhappy Gothic abortions, the church in Little Queen Street, Holborn; and that in Berwick Street, Soho—the latter with an "area" and kitchen windows—are paltry in the extreme—not better than some of the wicked caricatures in Pugin's book, or than some of those suburban abominations in brick and compo ycleped "Gothic Chapels." Nor is it only when the Gothic style is affected for them, but nearly all the ecclesiastical structures which have been erected of late years either in or about the metropolis have been singularly unhappy—most meagre, tame, dull, poverty-stricken things, devoid of design or character—buildings naked even to meanness, converted into *soi-disant* Greek, by having four or six columns stuck up in front, as if in open violation of all consistency, and the most obvious principles of good taste. Although not absolutely the very worst of their class, such buildings as the Church in Wyndham Place, and St. John's in the Waterloo Road, are barbarous monstrosities; and yet for the first of them we are indebted to the great classical architect of the age—he who copies Greek columns with the nicety of a Chinese artist, but violates the principles and spirit of Greek architecture by wholesale. The portico of St. Pancras Church—an avowed copy indeed—forms a most striking exception to the generality of modern churches in that style, but then the admiration excited by the columns and doors abates wonderfully if we raise our eyes at all higher than the architrave of the entablature, for then the spell is broken, all above that member looking bare and unfinished, and in most dissonant opposition to the florid richness of the capitals, no *proportion* whatever being regarded as to the due distribution of decoration.

III. In addition to other difficulties that beset the question of Fresco-painting, one of no small magnitude now presents itself as regards the choice of subjects. It certainly will be a puzzling matter to select such as shall be in every respect well adapted for pictorial representation in that style of art, and at the same time of such historical importance as to express the most momentous points in our national annals. Neither is that all, since it will probably be made a *sine-qua-non*—that all subjects shall be avoided which are likely to give umbrage to the prejudices, whether political or religious, of any one sect or party. Pleasant steering it will be, truly, between the Scylla and Charybdis of opposed opinions! The individual who to please one party, must be drawn as a patriot, will by another be regarded as a traitor; and he in whom some will behold only a faithless tyrant, must to satisfy others be delineated almost as a saint and martyr. How are the antithetical reigns of those two royal viragos Mary and Elizabeth to be adumbrated on the walls of the Palace of Westminster; or must they be given up as impracticable, and as an equivalent for the latter of them, must we be content with the old scene of Sir Walter Raleigh damaging his cloak in order to repair his fortune?—a very loyal and safe subject, but also one fitter for an engraving in an annual, than for a fresco in a senate-house. Is the expulsion of the Stuarts to be passed over as dangerous matter for the pencil?—must not the "glorious Revolution" be commemorated—or the passing of the Reform Bill; and if they are, how and in what manner are those events to be expressed?

—poetically, in the enigmatical language of allegory, or in the plain prose and vulgar tongue of matter-of-fact reality?—Lord Mahon seems to entertain some remarkably curious notions in regard to what would be suitable subjects for the occasion. Among others which he recommends are "Queen Margaret of Anjou encountering the Robber in the forest; Anne Boleyn *in her bridal array!* Lady Jane Grey at her youthful studies; (as a *pendant* there might be Prince of Wales pondering over his primer;) Queen Mary receiving the news of the Battle of the Boyne, the battle itself perhaps being, in order to prevent mistake, represented on the hangings of the room. Truly, a goodly selection of subjects—all of them exceedingly dignified and of paramount national interest and importance! Admirable mode of illustrating the history of our constitution and the annals of the British people! The gallant viscount might as well have recommended that "Old Bess," and the other wax-work figures in the abbey, should be stuck up in Mr. Barry's building. Unless the painters can get better advisers, or get rid of advisers altogether, matters are likely to be confoundedly *messed.*

IV. Although there is just now almost a mania for ornamental design intended for almost every conceivable purpose, no one, it seems, has been able to produce any ideas that would help to extend the comparatively narrow limits of architectural ornament and decoration. Nay, to abstain from any attempt of the kind, in regard to what is termed an *Order*, is considered a positive merit, and so very great a one as to make amends for all other faults and deficiencies. No matter how much at variance every other part of a design may be with the intention and character of the order adopted for the occasion, so long as the columns and their entablature are in strict conformity with some established specimen, they at least are safe from critiscism, and entitled to be recognised as classical, whereas any *pro re nata* modification of such members, any deviation from literal and mechanical copying, as far as they are concerned, is condemned at once; therefore the practice of those from whom we derive such types—converted by us into *stereotypes*—ought in consistency to be condemned likewise, since the ancients, both Greeks and Romans, never repeated their orders literally, but almost every example is marked by some individual peculiarity, slight as it may be, and many examples of the same order are of decidedly different character, although all retain the same general indicial marks. The Ionic, for instance, ranges from almost Doric severity to Corinthian luxuriance. But we have thought proper to reject for ourselves all such artistic liberty. To compose from the study of ancient examples something that should resemble no single one of them, and yet be true to the genuine type, its spirit, its capability, its latent and undeveloped suggestiveness, is on no account to be thought of. It quite revolts all those old-womanly prejudices which cause architectural design to stick fast. It would be attempting what we are told cannot by any possibility be accomplished, or if it could, must not even be so much as thought of.

V. It happens not a little curiously that after exclaiming so lustily against architectural amateurs and non-professional writers, more especially clerical and collegiate ones, Joseph Gwilt has now actually joined the "British Archæological Association"—virtuosi who have very little sympathy with him and his architectural orthodoxy, but would freely give up the writings of both Vitruvius and Palladio, doubtless of Gwilt himself too, in exchange for some quaint and, perhaps, unintelligible, certainly now useless, terms from "popular medieval writers"—*popular* here meaning writers whom only the most courageous bibliomaniacs and venerators of black letter would dare to encounter. Laudable as may be, in themselves, the professed objects of the "Association," there is far more of bustling, fussy parade in their proceedings than is consistent with good taste; so much of it, indeed, that to the uninitiated there must seem to be a good deal of quackery and charlatanery in them. They seem to direct their attention chiefly to all the little knicknackeries and odds and ends of antiquarianism—those *nugæ difficiles* which are only so much lumber in the way of study, at least of architectural study. It certainly does not say much for the profit derived to this latter from the micrological inquiries of antiquaries, that notwithstanding so much has lately been written upon church architecture, and so many structures of the kind have been described, the merits or defects of the respective examples are hardly ever discussed, or even adverted to, in an intelligent and instructive manner, but merely a dry, plodding, tedious and drawling account is given, interlarded with laboriously raked-up stuff, of no other use whatever than to stow away in a head that would otherwise be empty. As to the Association's whim of holding a sort of annual ambulatory Bartholomew Fair, it is no doubt very "innocent"—exceedingly *innocent* indeed! probably its greatest recommendation of all, in the opinion of those who think *anticking*—jaunting about and junketing in troops, the best part of antiquarianism, more especially as such doings, and the names of those who "assist" at them, are reported, or we should say "chronicled," with a microscopic fidelity that magnifies them, and those concerned in them, into apparently gigantic dimensions. Hence even Ainsworth's Magazine has gone quite out of its usual track, and devoted several of its valuable pages to what its readers must consider excessively dull—a very stupid sort of Canterbury tale—viz., a long-winded account of the late proceedings at Canterbury, Harrison Ainsworth having been the leading literary notability present—the one, we presume, by whom "severe" history was represented, in like manner as were we told "severe architecture" was by Charles Barry and John Britton—what an *association* that! Poor Gwilt, however, seems to have represented just nothing, for he is treated as a mere cypher.

EPISTLE TO CHARLES DICKENS.

Now that you have concluded your Chuzzlewit or Chuzzlewitty history, greatly to the satisfaction, it would seem, of your readers and critics—a sort of double-meaning phrase,—and greatly to your own regret, and having done so, have thought fit to dedicate to a lady what in some of its chapters cannot be considered particularly lady-like reading;—now that you have done this I say, allow me to enact the part of slave behind you in your triumphal car, and to whisper in your ear that you are not altogether what the acclamations of the multitude would proclaim you. To decline such distinction, as not sufficiently worthy of it, would in you look far more like conscious misgiving, or even cowardice, than unaffected modesty. If you cannot now bear to hear a little wholesome, though unpalatable truth, who can? You are not in the position of one who is struggling to obtain a footing in public favour, and whom a blow from ungentle criticism might perhaps lay prostrate at once. On the contrary, you stand loftily; see that you also stand firmly. In your case the press has been so prodigal of applause, and so unanimous in its opinions, that your reviewers seem to have taken their cue from, and said DITTO to each other. Their praise has been pushed to flattery—even to adulation. Yet it would perhaps have been better for you had a little sober criticism been mingled along with it, since that might both have helped to keep the praise from evaporating like so much sheer puff, and have stimulated you to prove yourself more deserving of it, by merely doing justice to your own talent, and bestowing more care on your productions. At present, you evidently do not blot, neither do you file—at least not *Anglicè*, being rather addicted to *filer* a good deal of whimsical, and merely whimsical stuff. Very possibly, this may be excellent policy enough if your ambition limits itself to present popularity: in that case it has been as successful as it can be, since you are already placed by acclamation on the pedestal of popularity, as the popular writer *par excellence* of the day. Though it may be quite unintentional, the last expression carries with it something of wholesome and corrective warning: "of the day," is well put in.

Modern literary history affords not a few striking instances of extraordinary vogue of popularity which have lasted for "the day" and no longer. Not to posterity alone, but even to the next generation have names become unknown which were once familiar to all; and such very sudden falling-off of public favour has generally been in those cases where it was as suddenly bestowed all at once without any sort of reserve or discretion. Towards a declared favourite, the public is apt to show itself a very passionate and ardent lover, but also a very inconstant one. So long as the honeymoon of love lasts the object of admiration is all perfection; that over, indifference succeeds to rapture—may be, not only indifference but disgust.

The very craving for novelty, which has so great a share in elevating into notoriety the writer who has struck out into a new path, becomes after a while a circumstance against him. What was at first admired in him as freshness of manner, if not positive originality, comes to be looked upon as mere mannerism, if the repetition of it be not attended by progressive improvement. Defects that either passed undetected, or else were indulgently excused so long as the charm of novelty lasted, or allowance might fairly be made for inexperience, begin to strike more and more. But to cut short all this random and impertinent prosing, what I have really to say is, that in your last production, you have played your cards very clumsily.

After bringing forward at the outset what promised to be a decidedly new character, as belonging to a profession which has never yet been brought forward either in the drama or the novel, you suffered it to dwindle to a mere appellation, thereby showing either that you had no aim at all in pushing forward such nominal character among the actors in your piece, or else found upon trying to do it that you could make nothing whatever of Pecksniff in his capacity of architect. To "label" him, therefore, so pointedly as a member of that particular profession, when he might just as well have been of any other, or of none—for there is not a single professional trait in the portraiture,—looks not much unlike pitching upon that profession for no other purpose than that of identifying with it a most thorough-paced scoundrel and most clumsy hypocrite. It is true "Pecksniff" has become both a name and an epithet of reproach, and is now frequently used as synonymous with whatever is imbecile, contemptible and absurd in architecture, but certainly not in consequence of the clever and striking manner in which you have shown up the foibles peculiarly characteristic of its followers, and the artifices and charlatanery practised by those who disgrace it. In Pecksniff, you sink the architect entirely, notwithstanding that as such he was quite a new character, which might have been drawn out and coloured up very effectively. That you should have left it a mere blank is the more surprising, because you have touched and wrought up, *con amore*, the not always particularly delicate *professionalisms* of Sairey Gamp—forgetting, perhaps, at the time your Dedicatee.

Most assuredly you showed no great tact in taking up—as it now seems, quite unnecessarily—what afforded a very fair opportunity for the exercise of much wholesome satire and correction, because, by not so availing yourself of it, you have let it be seen that you attempted what was so wholly beyond your power to execute that you felt compelled to abandon the idea almost as soon as it was formed, and to shirk the matter altogether, trusting that no one would call you to account for a breach of literary promise. Either such is the real state of the case, or else you must have omitted—mislaid and forgotten sundry pleasant and instructive, if not exactly edifying, episodes and scenes illustrative of Mr. Pecksniff's professional career and practice, his opinions on art, or what might pass for such, included. Yes, there must be several chapters belonging to the history of that worthy which you have either wilfully or carelessly put upon the same shelf with the lost comedies of Menander and the lost decades of Livy; and in exchange for them, or even one of them, gladly would we give up all the rest of your book, since they would have been most valuable and serviceable in the way of enlightening the public as to certain mysteries and arcana which it has not yet had an opportunity of peeping into. You, who show yourself so eagerly disposed to scourge and pillory humbug and quackery of all kind, no doubt set out with the intention of giving us a full length delineation of the Quack Architectural, and provided yourself with materials accordingly. Rummage your desk again, and you will perhaps be able to find the notes and illustrations which you had collected for the purpose, nay the rough draughts of some of the chapters wherein you intended to exhibit Pecksniff in his character of architect, and in so doing to disclose to the uninitiated certain professional doings more curious and ingenious than altogether praiseworthy. Therefore that so much which would have been perfectly new, and which you would have coloured up so piquantly, should have been *accidentally* omitted, is supremely tantalizing. Had you but lifted ever so little the mysterious curtain which now hangs over Pecksniff the professional man, you would doubtless have explained how he contrived to *seem* to instruct the pupils with whom he received such unusually high premiums. Highly amusing would it have been to see Peck—himself an ignoramus of the first magnitude—peacock himself before those raw recruits, bamboozling and mystifying them at the outset by what were to them deep cabalistic terms and expressions, delivered in the tone of an oracle, and freely interlarded with exclamations hinting at the transcendental virtue and efficacy of "Proportions," with an occasional flourish about "the age of Pericles," leaving them to wonder what how the old Mr. Pericles was could have to do with the matter.

I am persuaded that had you not bestowed so much of your affection upon Mother Gamp, or else, if that was not to be thought of, had extended your canvas accordingly, you would have drawn out the *professionalism* of Pecksniff capitally. You would have fully revealed many notable arcana,—would have shown—what so far from comprehending, the world does not seem to be aware of—how very possible it is for the emptiest pretender to art or what should be art, to pass for so very much more than he is, and to impose upon us his own base Brummagem for sterling coin. You would have exposed some of those *artifices* by which such persons make up—to themselves at least—for their incapacity in art, and by dint of which, their ugliness being veiled by the name of business-like shrewdness, they contrive to maintain a "respectable" position; nay, if they are befriended by particular good luck, or what is nearly the same, by particular interest, may attain to eminence in their profession. That done, they may defy public opinion, or rather, can lead it by the nose wherever they list,—even to the admiration of their own imbecillity and blunders. Incredible as it may seem, the commission of one blunder or abortion in architecture secures for the "eminent man" the opportunity of displaying his peculiar talent in another, viz.—the talent for flinging away, not indeed from himself, but so far as art is concerned, every opportunity he gets hold of, while perhaps real talent watches in vain for some tolerably adequate opportunity of showing what it could accomplish under more favourable circumstances. Spell-bound or overawed by an "eminent" name, the public receive successive failures as successive triumphs; and so long as the many applaud, the growlings of the few are not heard, or if heard and listened to at all, not until after mischief irreparable has been committed. That there are very many instances of the kind I do not say, because the occasions themselves are limited, as buildings of the Buckingham Palace *genus* are not erected every day; but in proportion to the opportunities afforded such instances are lamentably numerous:—*circumspice!* There are Pecksniffs in all grades of the profession; I don't mean persons who like your hero make a trade of religious hypocrisy, and bandy about the slang of sentimental cant after the most maudlin fashion, but those who possess about the same *quantum* of talent, and of either intelligence of, or feeling for art; and some of whom might not unjustly be described as no better than hypocrites and impostors in it.

In order to work out all this suitably, you must of course have introduced other characters and incidents into your piece. Why then didn't you? You might have exercised your *vis comica* upon them quite as wholesomely, and some degrees less preposterously than you have done in those American ones, where it pleased you to represent Mrs. Hominy and Co. giving vent to a flow of balderdash utterly unintelligible. You might even have rendered a real service both to the public and the profession, had you let us seen a little of the curious machinery and its workings, employed for Competitions, and by what sort of legerdemain tricks behind the curtain are made to show as fair and honourable dealing, at least escape without more than presumptive detection. On some occasion of the kind you might have let us see Pecksniff put over the heads of other people in the most barefaced manner,—in fact, suffered to walk quietly into a snug job, while the duped retire with the solitary satisfaction of getting their pains for their trouble, and the committee come off with the credit of having manifested their anxiety to obtain as excellent a design as possible, by liberally inviting all to an open competition, and as liberally allowing perhaps, ten days for studying the subject and preparing drawings. Here you could hardly have coloured up too highly: likelier far is it that the most forcible touches would have fallen short of the truth.

Fair opportunity, again, there was for having a hit at that strange hobbyhorsical architectural mysticism which has come up of late under the denomination of Ecclesiology, by making Pecksniff affect to be an adept in its arcana, and descant with "unction" on the recondite meanings and enigmatical fancies in vogue among the church-builders of olden times, and which some would now fain make us believe constitute by far the most important part of design in such edifices,—that without which, all beauty of style or immediate design is unavailing: comfortable doctrine for the Pecksniffs, who can thus make up for the heterodoxy of their taste, by the strait-laced orthodoxy of their "principles."

I might continue to point a very great deal more of which you have deprived us; but I forbear, choosing in turn to deprive you of some valuable hints. Nevertheless I don't mean to let you off yet, having a word or two to say touching your Tom Pinch. Why Man! you have positively made him an arrant Tom Noodle! Upon him you have been particularly hard, by making him particularly soft. A fine specimen truly, be of one who follows a liberal art! Had he himself possessed the slightest feeling for architecture,—had he not been a mere clod, worthy only to be a patient drudge, he must at any rate have detected the utter shallowness and incapacity of such a fellow as Pecksniff, however he might have been duped by his hypocritical flummery. You have not given your Tom Pinch a single "pinch" of the stuff which an architect should be made off. You make him go to Salisbury, and for what?—not to gaze with raptured and exploring eye on the noble fabric which is the pride of that city, not to seize the precious opportunity of indulging any love of art by studying that edifice, but to while away his time in staring at shop-windows, and market-carts! I fling him off from all sympathy, after such a trait in his character. Even allowing that to have been a oversight,—that you either forgot that Tom was at Salisbury, or that Salisbury had a cathedral; you might at least have redeemed it on some other occasion. But no, in no one instance have you bestowed on Tom a single touch of the character that marks the architect. When you bring him up to London, he has neither eyes nor feelings for any thing relating to his own profession: he has no soul at all to be moved that way, or else moved it must have been at meeting with so many things calculated to awaken the liveliest recollections of his former occupation in the Pecksniffian school of design. You make him familiar with Furnival's Inn and—oh! I could have forgiven you all the rest had you but let him burst into a flood of tears on first beholding the ultra-Pecksniffian taste displayed in the portico within the court. But you did not! and so I have now done both with Tom Pinch and with you; merely adding for finis that you flung away the best trump card you held in your hand, and that if you popped off your P P's with the intention of hitting the true professional character of architect,—both the worthy and the unworthy, you have for once decidedly missed your aim.

CANDIDUS.

ROYAL ACADEMY.

No. III.

The power of evil in the Academy "has increased, is increasing, and ought to be diminished." It is an obstruction to the greatest plans for the advance of the arts, and a dead weight on every noble aspiration of the student, the people, the sovereign, and the nobility.

Let the genius of any man be what it might, let him be ready to sacrifice his life for the advance of the High Art of the Nation, let him be ready to lay his head on the block for the freedom of the artists, what has been the eternal clog on his efforts, the encumbrance on his shoulders, the obstruction to be removed, or the curse to be avoided? The Royal Academy of England. Tell me a scheme to improve the people they have not opposed, a plan to enlighten the nobility they have not baffled, a school to advance the mechanic they have not blasted, or a principle to raise the art they have not withered, by their diplomacy, their scurrility, their sarcasm, their selfish, silent, heartless, practised invisible diplomacy. I defy the reader to reply. The same cautious, wary sneers, the same heartless affectation of doubting the public feeling, the same ridicule of every attempt to improve it, the same pig-headed, dull obstinacy to persevere in the beaten path of 70 years ago, the same insolence of avaricious grasping at all the unjust advantages their position affords; in short, what was the character of the Academy 70 years since, is the character now; and ever will be, viz. a malignant determination to keep themselves up, and the artists down, as long as the sovereign, the nobility, the house, the artists, and the people, are weak enough to let them.

Whilst their emoluments are undiminished, their honours unimpaired, and their power the same as ever, they laugh at the people, and chuckle at the helpless condition of the profession, and inwardly swell at their irresponsibility.

Here is an institution, under the sanction of a constitutional sovereign, without a constitution, and which, as a pure despotism, is suffered to exist, and defy the authorities of a country, the sovereign of which would be dethroned at the mere attempt. Such is the anomaly the Academy presents in England—free, "Habeas Corpus," "Bill of Rights," England. How long is this absurdity to exist? As long as the upper classes are without instruction in art! And who has baffled the attempt to give them Professors of Art? The Academy, and the Academy alone. In short, whether it be a Professor of Art, or a school of design, whether it be a vote of money, or a decoration of the Lords, the Academy will oppose it, if they are not consulted, and entangle it if they be.

When Professor Greswell came from Oxford, came in the sincerity of his heart, to consult Sir Robert on the necessity of a professor, at the University, of the Fine Arts, the Academicians got hold of him first, pumped his intentions, prepared the minister, and established a refusal before even the question was asked! Why? Because their predominance would be endangered; don't enlighten the nation—the Academy will suffer; don't instruct the nobility—the Academy will be found out; don't let the mechanics draw the figure—Sir Martin will be no longer infallible. Let things alone; preserve the people ignorant; the longer the Academy can keep the art to themselves the surer the members will be to keep their emoluments and privileges—exclusiveness, selfishness and despotism.

Amid the many acts of fiendish malice which the members are guilty of, there is nothing equal to the sturdy rejection of all proposition for the admission of the exhibitors, with themselves, on the day set aside to fit the pictures for public inspection after they are hung, as the exhibitors are admitted at the British Gallery, and all other institutions which are founded on, and guided by honesty, justice, and common sense. Had the artists the spirit of mice, (which they have not,) they would never cease till they got abolished this nefarious insult. Will they? not they, they will go on for 70 years more, they like to be slaves, they like to be degraded, to be insulted, to go on their knees, to crawl to Trafalgar House, to lick their path, to lift the knockers with their noses and to give single knocks, lest touching the sacred handle with their hands or knocking like a gentlemen, would have an air of presumption, and prejudice their election, their hanging, or the condescending smile of recognition at the lectures. Poor creatures, they deserve all they meet with and more, for more they will have to endure; the sufferance of one insult generally is but a preparation for greater ones.

Your readers, perhaps, have to be informed that a week before the private view and dinner of the Royal Academy, the members of the Academy *only* are admitted, to retouch and varnish their works; this is an opening for every species of malice, for it is a fact if a member finds his picture interfered with by the superior work of a youth who is not a member, he is allowed to go seriously to work on his own, and by raising every colour unnaturally to a high key of florid glare, so completely to overwhelm the purity and nature of his youthful rival as to leave no hope for the youth, either for sale or patronage. What is the result? The youth by next year sends a picture of such yellows and reds as will defy out-Heroding; but his sense of truth is then contaminated, he becomes a mere exhibition painter, the lowest, the most degraded, the most corrupt of the species—a species not known in Titian's time.

Academicians have been known to get colours of chemists, foretold at purchase to stand only for the summer, and they replied *that was long enough!*

Of all the painters living, whose great genius has been utterly ruined by the perpetual poison of contesting for the glare of the exhibitions, Turner is the most fatal beacon to youth; his early works, fresh from nature and study, were worthy of any period of landscape splendour, his latter, a disgrace to the sprawlings of insanity. They are not art, and certainly not nature; they are galvanistic twitchings of dotage, which has dipped its toes in sulphur, whiting and lobster sauce and kicked them about on a smudged canvas, as an experiment how far the asses would go who admired him, or how contemptible he could render his haters who suppressed their utter disgust in adulation—because they wanted his vote.

What a system of art to elevate a nation! what a system to refine its taste! what a preparation for fresco and a high style! Let that pass; the disgust to complain of is the exclusion of the rest of the exhibitors, that the malignity of those who are let in may have full swing; for I take it, no fiend in hell would wish greater gratification than the power to paint down a rival's picture, by painting up your own whilst *he* is within sight and knowledge, and conscious his prospects of life are every hour narrowing, by this diabolic privilege to those whose interest it is to destroy him and deny his power. The shocking thing is, that the pangs each painter has felt at this infamous injustice does not make him feel sympathy for those he leaves in the same condition when he gets member himself, but generates a hideous feeling of revenge; he does not say, *now* I have power I will relieve you—no; now, he feels, *I* have power, curse ye, you shall feel, with double force, what I have felt myself.

I repeat, it is a power that generates the worst feelings in the best breasts, and deadens at last the moral feelings of right and wrong. Northcote once was deliberately dirting down a picture near his own he could not equal—"That is not your picture," said Beechy. "I know it," said he, "but *it wants tone*;" and Northcote was not the only one who had often thought it of other works in similar situations.

How can any talented body, in a profession of honour, endure such a degradation? But, it is replied, a portion of the exhibitors are admitted. Yes; but when?—*after* the private day, and all the world of fashion have been; *after* the dinner, and all the nobility have dined; *after* the rooms have been full of dirty plates, empty bottles, footmen and valets; after the *elites* of the patrons have had the choice: two hours before the public, on the Monday it opens, the select *dishonoured* get a dirty, wafered note, from a dirty subordinate, to admit them to varnish their work! What condescension! If all the artists tore their notes in pieces and enclosed them by post to the Council, it would be too respectful a way of conveying their contempt. But, said Sir Martin, it is one of the privileges of being academician! yes, and to be able to bow-string your minister is one of the privileges of being Sultan; but, does its being a privilege make it justice?

If artists made a stand against this studied insult, they would put it down; but they have not the manliness, the bottom, the spirit, the unanimity. Sorry am I to say what the world will echo, there is no treachery like the treachery of talent! The temptation to lower a rival is so relishing, the evil of our nature rises to the brim to such overflowing, that humanity is not proof against the Circean whisper. No united, embodied, decided, energetic movement to remove, remodel, or reform this nightmare on the beautiful and heaving bosom of English art, can ever take place, or ever will be attempted by a profession, each member of which gets enchanted at the admission, let what will be the sacrifice. The architects have set a noble example, the sculptors should follow them, but as to the poor, dyspeptic painters, the thought, the mere thought, of opposing the Academy would bring on, in the whole profession, such alarming symptoms that calomel would rise in the market! Kick them Academicians, put your feet on their necks; well may Nelson and George IV. turn their backs on such an assemblage. Look at an old R. A. at a rout, or a conversazione. Do you see that pale faced, timid, crawling creature, creeping along by the pictures, afraid to bow, or see, or speak, or think, dressed like a Guy Faux, *doing* the gentleman? do you see him meet Haydon? do you see his blank stare, as if he never saw him before when others can remark it? *at that very moment he is squeezing his hand, beneath the crowd, in approval of his opposition*,—that's the thorough-bred old R. A.

One great cause of their influence is the careless ignorance of the upper classes; all over the country the pernicious consequences are visible; there is a freemasonry not only in the members, but in the profession who wish to become so; the danger of it is great, because whatever the Academy does, the apparent motive is totally different from the real one; the Academy as a body, and each member of the body, make it a law of their practice to obtain the object they aim at by keeping attention directed to one they are utterly indifferent about. Minister, nobility and sovereign are thus always thrown off their guard, when the reasoners have an object to gain, and up they start in an opposite direction, fixed, prepared and ready, to the incredulity of all; next to High Art and enlightening the people, there is nothing they hate so much as zeal; and it was the zeal, the unalloyed zeal of Haydon, when a student, that first attracted their remark, and then their hatred; they saw, with their usual sagacity, if they did not advance him he would advance himself, and seeing him brought into high life, by the first patrons, with orders for his historical pictures, before even he had touched a brush, their hatred became an insanity; without any cause, they drove him to exasperation by the greatest injustice, and then complained of temper! Deprived him of all income, by eternal calumny, and then sneered at him for being poor! Denied him all talent, harrassed him four times to a prison, and then brought forth his misfortunes as an excuse for greater persecutions; in fact, whatever he did, whatever he said, whatever he wrote, whatever he painted, he was always wrong; and their hatred increased exactly in proportion to their convicted consciousness of being in the wrong themselves from beginning to end.

Every human being is composed, as we all know, of good and of evil—a man of genius is like other men, in sharing the frailties of his species; his perceptions are too keen not to penetrate the motives of others, and exactly in proportion to their injustice is the evil part of his nature brought into play. Tiberius, Caligula, Louis XI., Borgia, were not naturally evil, as at last, but their treatment had been so unjust that what was good had been overwhelmed by the eternal excitement of the evil, and when elevated to power, where their revenge could be gratified, they had too long practised retaliation to stop when there was no obstruction to their propensities.

Oppression raised in Haydon a dormant power of expressing his thoughts, which he was not aware he possessed, and hence the art has been kept ever since in a continual state of uproar and excitement, which never would have taken place if he, as a youth, had been allowed to progress regularly to that position which he was entitled to by his genius, his education, and his respectful conduct to his elders—at that time without reproach.

I do not wish to excuse the violent manner in which he revenged the abominable injustice of a body of men, whose duty it was to have taken him, as a deserving student, by the hand; far less do I desire to palliate their eternal and inhuman treatment, for not content with denying him his rights, they were compelled to decry his character to excuse their inexcusable aversion; and every student for the last 30 years, who has been educated at the Academy, has been regularly drilled to consider Haydon a monster, with whom no terms ought to be kept; he is never alluded to with the decency of common breeding, that fellow Haydon, that scamp Haydon, that scoundrel Haydon, is the common appellation in the conversation of painter, sculptor, or architect. And pray what has he done? Has he taken half price from the nobility and kept them for years without their orders? never. Did he ever pass his word with a patron and break it? never. Did he ever, in 40 years, receive his money in advance and fail in his honour? never. Did the Duke ever advance him £5,000 for a grand picture of all his generals and himself, and did he die without even beginning it? never. Did any lady of fashion ever leave her jewels with Haydon to be painted, and when she wanted them for a rout was obliged to redeem them from a pawnbrokers? never. Has any nobleman any cause to complain of him in his engagement? not one. Ah, but he has been in prison. Certainly, and was tried by a jury of creditors, the severest of all juries. Could every Academician have borne such a test? no, I, Timon, answer no, because I know it.

You first drive him to prison, by calumniating him out of employment, then reproach him for being there. Had he £5,000, £6,000, or £8,000 a year for years? He had no income for 16 years, and yet produced great works. Did the evil of the Academy end with its own members, they might be let alone to eat each other; but they are the Tarantula of British art, the Boa constrictor of painting.

Their long legs and fibrous fangs extend over the empire; there is in every great town an Academy party and an opposition, but the people are not yet taught enough to understand the question on either side, and hence the Academy carry on the game at a gain; they grasp at every available influence, and if the ministers do not take care every office in art will fall into their hands; then, woe to genius. Already it is hinted the national pictures should be boarded up, to give more room for the exhibition, amiable proposal; Why not say at once—the Ganymede of Titian is an inconvenient comparison! Seguier is dead, or such a plan would never have been proposed.

Under the *clypeum septemplicem* of their great protector in the house, there is no antic, defiance, oppression, or impertinence they will not indulge in. But some people are never so dangerous as when they are affectionate; and let them beware, for with great talents, their Protector has tendencies which almost render nugatory the promptings of his genius, though he is the very man for the time, for with less prudence and more heroism, with less common sense and more enthusiasm, he would be a dangerous leader at this grand period of moral and intellectual combustion; the Radicals hate him, because he will not destroy; the Tories detest him, because he will improve; the Reformers dread him, because, in acknowledging the propriety of cleansing the walls, he takes care of the foundations; and such is his apparent intermediatism that he is more than suspected of being a dormant Whig; his virtues become vices, in great emergencies, for wishing to secure all interests, he runs the risk of benefitting none, and opposes so long the just demands of common sense, as in Schedule A and Catholic Rights, till, being compelled to grant what he cannot refuse, what he yields has more the look of apprehension than conviction, and thus he always loses the popularity of bestowing a grace.

This distinguished man is said to be without friendships, affections or sympathies—it is a falsehood, he has a tender heart, but exacts more submission than is consistent with the dignity of independence; he never forgives any man who has exposed him to himself; he never forgives any man who has discovered a weakness; to obtain his attention you must believe him infallible; his high honour is not always faultless; pride perhaps is the basis of his correct morality, and perhaps his religion is founded on his pride.

In his enmities he is not charitable, no helplessness or destitution in one with whom he is displeased, averts for an instant a final thrust if the opportunity presents itself; he is quickly offended, and never forgives, and would stride over the dead body of an offender he had reduced to ruin and death, (if he had dared to oppose him,) as a just and necessary sacrifice to offended wealth.

He defends the Academy, not because he is convinced it needs no correction, but he considers it a link in the chain of constituted authorities; convince him the altar and the throne will be safe if the members be increased; shew him the colonial estimates will go on as usual if the incomes of the officers be doubled; prove to him that devoting two centres to High Art in the great room by law, will not endanger our empire in India; appeal to him, when the pressure on a great chain is becoming too tight for its resistance, if it be not better to add a new link, than risk the bursting of the whole chain together; —approach him thus, you will ease his apprehension and carry the day. His defence of the Academy was no credit to his understanding, and his decision on the cartoons no honour to his taste or his heart.

I have now done with the Academy for the present; I have a great deal to say on Eastlake's reports, in the mean time, I caution the youth to be wary of the last—it is full of experimental vehicles, and will tend to revive, if followed, that pernicious insanity which the introduction of pure oil, by Wilkie and Haydon, so usefully destroyed.

The art is in a considerable degree of inflammation, a blister, I think would relieve it, there are a great many pimples on its fair face, I shall therefore, with your leave, apply a large one next number, and suppose, in future, we head all communications from me in your excellent Journal as the "ART BLISTER," the next letter to be No. I.

"That the whole life of Athens were in this,
Thus would I eat it. (*Eats a root.*)"

TIMON.

THE PRESENT STATE, PROSPECTS, AND THEORY OF PAINTING.

No. II.

Timon *may* be correct; many a devil of angel's face *may* have graced the ranks of the Royal Academy, but where, good Censor, is the Assembly without one? Even in the office of this Journal a devil, of no grace at all, called lead *chargeable* instead of "*changeable*," and made me speak of Aglio,—the spirit embodied of Moorfields immortality,—as if a common thing, with a little "a;" when his "Recollections of Naples,"—a really near approach to Claude Lorraine upon plaster—amply demanded the largest pica,—the pearl therefore was thrown "unto swine:" and, to the devils of the press,—in their slavish servility—we owe the continuance of the evil,[1] but, to return.

I have said that, oil painting requires only to place its reliance on the vehicle, not the individual permanence of each colour, and that the vehicle, not the pigment, changes.[2] I have given one proof in the green skies painted with ultramarine, wherever rather more oil than usual had been used; I will now give another—let any artist examine his picture three weeks after painting, by which time the obvious yellowing, skinning, and consequent lowering of tone will have taken place, let him scrape off the skin and there he will find the colour in its pristine state; hence the chalkiness of a majority of "*cleaned and restored*" pictures, so disgusting to the eye and inimical to the original effect; while, on the contrary, wherever the skies have been painted with *less* oil and *more* turpentine (an analogy of house painters' flatten),—skies which are readily injured, nay rubbed out, by the cleaner's cotton wool, albeit protected by the usual dip of oil,—there, I say, ultramarine never yet was seen green in tone.

Let us rapidly examine the theory, first of the rising of the oil, secondly of the skin and its yellowing, for these, ultimately, comprehend the brownish yellow horn; which, as Sir Martin Archer Shee observed to me, is "*what the experienced artist wishes to avoid alone.*"[3] Let us then trace the *cause* of the yellowing, and the wisdom or folly of the majority of artists in the use or abuse of dryers; and that generalization of practice which leads the man, accustomed to paint in England to furnish himself with the same material in preparing for the East Indies; in a word, to forget climate, of which I shall speak again, when John Van Eyck shall be named, merely recording here an assurance of Sir David, then Mr. Wilkie, (in 1821,) that he had seen Italian artists use olive oil to *prevent* the drying of their pictures, precisely as Roman masons kept their mortar to become carbonated, and thereby weakened, on the surface to adapt it to their atmosphere, and that from sheer necessity, not wisdom or choice.

Times and circumstances change; the artist is no longer his own manipulator; he no longer buys his materials of the apothecary, who, as a man of education, knew his business; and happily so for us, in some of its consequences; instances of *mala praxis* are common enough as it is, and might be quadrupled if that learned body the Apothecaries Company had once more to grind Naples yellow and orpiment, arseniate of copper, or red oxide of lead, however qualified to manipulate brass. He buys his materials mixed to his hands, of a hundred qualities and of a hundred hues, by a motley group of pencilmakers, brushmakers, comb sellers and perfumers, Jews, Christians, and Quakers, scarcely one of whom could be found reared to, and understanding his trade. He therefore works, like a mole, in the dark; and even among the exceptions where reading, thought and acumen are conspicuously his, many cases of which I know, so strong is the force of habit, so intense the weight of old prejudices, he merits often the Chinese compliment to an European, he has "one eye" truly, and that one constitutes the Cyclops at best; but, enough.

The rising of the oil is simple and mechanical. The colourman grinds his pigment with nut, poppy, or linseed oil, and, as no precautionary measures are taken to prevent it, the gravity of the colour and levity of the oil must be called into play the instant it is placed at rest in the bladder or tube, to which, in the latter case, are added—as a just chastisement for the use of a frippery of the day—chemical and galvanic influence. This half deranged mixture is then as carelessly, loosely, and I have often seen dirtily, blended on the palette, and transferred to the canvas, to rise more efficiently as it dries, and that so obviously it may be seen in cups by an ordinary lens; then comes direct chemical action to complete the painter's infliction; the value of time and money, anxiety and climate, combine to increase the hue and cry for dryers—metallic oxides and boiled oil, Mac Gellup and gumption, japanner's gold size, and other expedients are recurred to; the doom of the modern picture is inevitably sealed, and that in the direct ratio of its smaller size and elaborate finish; and to these, again, are added, as with Wilkie in his later day, asphaltum—lamentable proofs of the effects of which are fast shewing themselves in the cracky tendency of many of his pictures, which one day or other will vie with those of Reynolds.

Here it may be well to digress a little, and call reflection and common sense into play: Reynolds saw, like Merimee, that something similar to varnish was visible in ancient pictures, and thence took up his crotchets, but, unlike the Frenchman, never adhered very long or faithfully to any; neither of them saw the true and simple principle of permanence, and both were deceived by the foolish, yet alluring presumption that such addition of varnish gave effect and beauty, depth and bearing out to the work, an inference as deceptive as it is plausible; for, I assert fearlessly, "*there never was, and never will be a varnish made* (taking the word in the ordinary sense) *which gives half the splendour*[4] to any pigment that is always given by pure oil alone, nay the addition of wax, which gives a semi-opacity, surpasses the admixture of the most elegant compound.

Here we see the rock on which the barque of Sir Joshua struck; here the fog in which his fine mind foundered, for here is the point where his brain became a mass of curds and whey—his practice an ever vacillating, muddled dash at crude experiment; for, contrary to the allegation of the person who professes to hold, in his own handwriting, a diary of practice, very ingeniously woven out of scraps and patches by some keen observer of his habits, he kept *no* journal, and declared, in the hearing of Sir M. A. Shee and others still living, "I'd give a thousand guineas if I knew how, and with what I painted this, and that, and this." Here M. Merimee, with the true acuteness and brilliance of French theory joined to flimsy practice and extravagant assumption, took his stand. Varnishes obviously produce a certain effect, by preventing the opacity of oil, if properly made and modified; but, in his opinion, by increasing the gloss and beauty of colours; and therefore, neck or nothing, helter skelter, varnishes and wax, boiled oil and asphaltum, resin and alcohol, mastic and chio-turpentine, yellow resin and Mac Gellup, mastic and mummy with the one, and oil copal with the other must be used, not as an auxiliary means, carefully moulded, but the grand panacea, the *vis vitæ* of the art, and I appeal to the careful observer of passing events whether every successive follower of either has not failed?

M. Merimee was besides perfectly ignorant of the assumed fact on which, as a base, his superstructure was raised; he was grossly ignorant of copal and all its attributes! he had never *seen* any such as he describes, much less made any; Theophilus *did* not, Sarsfield Taylor *could* not, follow practically his formulary. Merimee, *par accident*, had used some weak copal and found it a slow dryer, and was delighted with the saddle which fitted the back of his hobby, but he knew not the fact that, *if* made with linseed oil alone, it would never dry without a stove. The translator, I repeat, never saw any, simply because it is never made, and if made would never sell; but I will enlighten him—the, so called, oil copal of trade is a compound of boiled oil,

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1 Nothing better proves this than toe trash vomited often by Scotch editors, I dare say with reference to Wilkie. Timon calls him "timid and selfish," aod Timon knew him long,—so did I, and I call him paltry, shuffling, dirty, unfeeling and mean. I saw him and appealed to him in 1836, at the Manor House, to save from starving a fellow man; one too, who had served, and materially served, his art, aod who, in 1821, was his personal, intimate friend. The exalted David, with great difficulty, remembered such a name at all,—buttoned up his well-lined pocket, and retired! Now mark the difference, wreath the laurel for the worthier head, and 'meruit qui palmam ferat.' My return was past the gate of poor John Varley, the landscape painter, then doubly locked to keep out the bailiffs. John heard the case with a genuine mingling of pity and disgust,—emptied his pockets of ten shillings aod aome copper coin, which, with tears in his eyes, he halved for his fellow man! I solemnly pledged myself to do justice to both, aod such, before my God, I do in the service of man.

2 This has one exception. Oil painting on plastered walls—in which case the pigment not the vehicle changes; and to prevent which nothing more is necessary than first, to secure it from damp, as suggested by Mr. Eastlake in the Royal Commission's 2nd report; secondly, when the plaster, that is the intonaco, or last coat, is sufficiently dry to paint on, to first prepare it with a proper panel ground, for which oone are better qualified than a Mr. Wing, of Fording Bridge, in Hampshire, some of whose Flemish grounds I have seen beautifully prepared; the material should be Cornish porcelain clay (not whiting) finely washed, as used by the repairers of German clock dials, if injured in their transit from the Black Forest. But here a caution, 'en passant,' if some saccharine matter be forgotten parchment or any other size will ultimately crack under subsequent varnish; painting executed in oil would then change by its vehicle alone—in a word, be on a par with that on panel. Hence, also, arose a similar blackening of some Venetian pictures on lime or gesso in lieu of aluminous grounds.

3 And which, as the Secretary of the Commission observed, with equal justice, has 'good' as well as 'bad' properties; for as much as, it protects the base, although it depreciates the surface during drying, so 'perfectly' that, if it could be subsequently cleaned off readily and safely, he would prefer "all his pictures to skin." In fact, one artist I am acquainted with, increases this skin first, to get rid of it by friction or scraping afterwards, and then, hear it Hibernians, listen to it Timon, glazes with the same or similar materials, and it must be confessed he makes durable work; but, notwithstanding, it is a circuitous, clumsy means of effecting the end, and one too, which could never be practised at all with small and highly finished work of much detail, and when nitric ether, or sweet spirits of nitre and water, one part to eight, would wash it off.

4 M. Merimee having taken up this crochet at once fell into another, viz. that Theophilus, who described a method of turning gumma glassa, or gum fornis, into varnish, must have meant, and did mean, the gum resin copal, without one shade of even presumptive proof; and his translator pledges his honour that it is gospel truth, which reminds us of Johannah Southcote and Shiloh faith!

copal, anime and umber with oxide of lead. In which we see again exemplified the folly of the mania for fierce dryers, as well as the deceptions practised upon artists (not being, as of old, their own manipulators). Could M. Merimee have even suspected, or can you digest this good translator of Le grand Œuvre? but to ask such a question of such a man is supererogation wild. The varnish maker, in nine cases out of ten, is himself ignorant of the theory of the process; and can your looking glass, can your kid gloves or eagle's quill assume even a varnish maker's head? Fie; dissolve, like a Polytechnic view for a fourpenny bit instead of a shilling fee, the Physioscope suits you not, and will-o'-wisps suit not me; while I love and honour the humblest image of his God who serves mankind, I look with ineffable contempt on learned men of the pseudo school, the butterflies of the race: and, to close this digression, I assert—first, that which it sold as such is not copal; secondly, there is no copal, nor any copal and anime, sold dissolved in raw oil; thirdly, the compound sold both browns and cracks, as every coach painter's boy knows; fourthly, Theophilus never made any, and, in all human probability, never saw copal; fifthly, M. Merimee, in his enthusiasm over his crotchet, followed Theophilus' example, and assumed his facts precisely as the broom seller undersold all his competitors, simply by stealing brooms and ready made; sixthly, that if his translator were to try the experiment with *raw oil*, in a glass vessel, he would not have a *fall back*, as the varnish maker calls it, but fall *into* the fire, and, albeit the *Tailors* are a numerous brotherhood, of similar mental calibre, he might prove equally unlike Shadrach, Meshach or Abednego with reference to practical scorching.

Now let us return to oil. This should be chosen, like the dryer, with reference first to climate, next to body; poppy oil then, I repeat, for small pictures and high finish, linseed for larger ones, and the loaded brush and free touch in this and all similar climates; sulphate of zinc, dried but *not* calcined, alone where a metallic dryer is added; or, the zinco-crystal dryer prepared by Messrs. Winsor and Newton. But for Italy, the East Indies, or similar temperatures, walnut oil and calcined bones in lieu of zinc, for the simplest of all reasons, the climate requires such adaptation, and the duplicate effect drying and bleaching are alike the desired end; but to yellowing and subsequent horn.

It must be known to many artists that oil bleaches by exposure to light, and further, that this bleaching or deoxidizing process is increased materially by adding water and sulphate of zinc[5] (undried), but it is not known that while *this salt* leaves the oil in *statu quo* as to drying power, so bleaches it, while acetate of lead acts in an opposite way, and *increases* the yellowing and drying power, giving a still stronger tendency to skin, because a still stronger affinity for oxygen; in fact, though paler and weaker, it is a solution of lead, an analogy of boiled oil. To recapitulate then—the object should be first to lessen the tendency to rise; secondly, to lessen the avidity for oxygen; thirdly, to *bleach*, if possible, that which now yellows in drying; and how are these desiderata to be accomplished? First, by choosing, as before said, an oil adapted to climate; secondly, a dryer to supersede boiled oil, Mac Gellup gumption, or japanner's gold size, and which must dry by *evaporation alone*, not by forming a skin; and thickering by such evaporation, so as preclude *rising* as much as possible, that is, acting as a binder of the oil and colour; and lastly, such a metallic matter "as, by deoxidising and bleaching, prevents the yellowing as the colour sets, for when once fixed, especially if painted in a fine light, it never, *under any ordinary circumstance*, changes or can change at all."

I have said a fine light, and such is a *sine qua non* in my estimation, and I fancy I can perceive a difference between such pictures as Wilkie painted in Phillimore Place and those he subsequently finished in the studio of the Manor House; and were I a painter possessing the means to the finest possible light and air I would add the temperature of Italy, by steam pipes, never by stoves, and, above all things, never turning the face of the picture to the wall.

Here, too, it is necessary to say Davy's assertion was correct, "all oils become varnishes by time;" nay, he might have said, *are varnishes of the highest cast.* How then could Merimee or Reynolds, or the exquisite Taylor distinguish a metamorphosed oil from an admixed varnish? Artificial ones were used, but not to brighten colours—they were used to modify the drying power and lessen the skin, too obviously conspicuous to escape the keen eyes of men who were their own manipulators and varnish makers, and in ages of close observation and absolute work, not theory, impudence and trick. John Varley, many years ago, painted a landscape in oil (in Titchfield Street) with ordinary ochres and natural pigments of the commonest cast, on this principle with very fine effect; and Bonnington painted, in Paris, for the Exposition, assisted by an amateur[6] of great judgment and observation, two others in distemper glazed in oil which gained great *eclat*, were brought to Colnaghi's and sold as oil of the finest grade, and in neither did boiled oil exist at all, or any of its analogies.

Now to the much talked of vitrifiable powers of Venetian pigments; the miserable impostures called glass media, silica media, &c. &c.; and the ridiculous assertions about John Van Eyck, which two years ago infested the papers and poisoned the minds of the younger artists and amateurs, nay, one paper I could name was occupied, and by very talented pens too, in suggesting means of doing the impossible.

History would lead the rational man to infer no more than this—John Van Eyck revived a then almost disused system of painting; and having placed a picture to dry in the sun it cracked to pieces, when, as a student, he set himself about lessening the drying power which, even in his climate, was too fierce, and by the addenda, wax and burned bones—then to be found in every apothecary's shop and every student's laboratory—he fully accomplished his object. The peculiar flatness alone of Van Eyck's pictures, as quite distinct from that of Hans Holbein who never could paint a round surface, amply testifies the fact, for wax entails this painful consequence if largely used; and I should sooner expect to find Van Eyck's bones marked with Hume's permanent ink in his pictures, than any other agent; whence, then, arose the maniacal assumptions referring to borax or borate of soda, a fourth of which may be considered as better fitted for the laundress who frets her day at the tub, for it is soda, veritable common soda equal to Scotch? whence came the ridiculous assertions respecting this salt when vitrified, and called, for similitude sake only, glass of borax; whence, above all, came the brazen assertion of its being a good dryer at all? or how came the salesmen to tack to its mixtures the idle, unmeaning imposture of, not glass alone, but silica media? for neither glass nor silex ever entered this more than Morrisonian hotch potch. Why simply thus: an ingenious man, I believe of the navy, who had read, in the cockpit, of Venetian pictures staggering the chemists of France by their often vitrifiable powers; and knew that a precocious son of Galen had surprised his pupil by seeing in the Hippocratic visage of his patient proofs of his having supped from oysters, simply because, Nature having endowed him with ubiquity of vision, he saw, at the same time, shells beneath the bed; which the gifted boy turned at once to profit, for, on visiting the man on the following morning and perceiving a saddle beneath his bed, declared promptly the fellow had swallowed a horse! Knowing these facts, I say, and that borax is often used to fuse enamels, &c. this ingenious man at once declared borax was the agent of John Van Eyck, and conveyed by his pupil, Antonio de Messina, to Italy where, it died a natural death, and bore over the tomb of ages this inscription "Resurgat in Brittania."

It is needless to add, in water the thing is worthless, nay injurious, as an alkaline efflorescent salt; in oil worse, as a bad dryer, a great yellower, in fact, a filthy soap making, silly compound. And, while neither glass nor silica ever existed in any of it, and therefore the name alone was a fraud, one fact is clear, the man who used it needed no glass in his *os frontis* to render visible as he ran, this gratifying proof of phrenology—I am a goose. So gullible, however, are we, proverbially, every colourman in the metropolis, save Newman, and Messrs. Winsor, Newton, stocked himself with bottles, pots, and papers of the trash, which was openly asserted to be capable of conveying all the powers of enamel, hitherto given by fire alone, to every pigment with which it was blended; and one Paracelsus of the arts actually asserted that a silver cup had been voted to him by artists of rank for vitrifying an ass's skin! *O tempora! O mores!* a long list of artistic names actually followed, and were blazoned again and again in the Art Union, which of course was not answerable for the truth of an advertised puff.

It has been asserted that Apelles possessed the secret of a compound which conveyed to the likeness of Alexander the immortality of the man. If this be true, like the dismantled statue of Ozimandias king of kings, or the famous Pharos and its duplicate inscription, the day of its glory has been the life of the May fly, and the sun which rose on its birth set o'er its death. History is silent, as far as proof goes, and her assertions only assure us, first that Apelles systematically flattered his sitters by keeping ideal beauty in view; that secondly his pictures had something of the Murillo tone, as the name of his vehicle would lead us to think; that thirdly men, women, and children were equally Getanæ or gipsies in hue; and, therefore, the only conjecture left to the hypothesist of posterity is, that Apelles used Jew's pitch or asphaltum probably dissolved in natural naphtha; for even amber, then and long after constantly used, would not produce these combined effects; the whole question, however, belongs

5 This must not be confounded with the object of the manufacturer in a valuable process given by Dr. Andrew Ure in his Dictionary of Arts, Manufactures, and Mines—there the object is to get rid of mucilage, increase limpidity, and make it more saleable.

6 This valuable man is still, I believe, living, viz.— Henderson, Esq.

more to the antiquarian than the modern philosopher—the visionary than the painter of this day, when, in all human probability, the resurrection of a true Apelles painting would, if not disgust the eye, remind us more of the want of sarcophagi and their alleged power of swallowing up decayed remains, than the preservative tomb of Daguerrotype shades; to which, by the bye, a word *en passant*—however ingenious these bubbles may be, what is their worth to man? Modern science is infested by gingerbread and Dutch metal; and ere long some booby of parchment brain will recommend us to walk about in wire gauze, with plugged nostrils, to prevent infection, and fill our halls, churches, and Houses of the Wittenagemotte with nitrous oxide to secure extatic sensations and pure thoughts,—the air of heaven is already washed for the Lords, and even Joseph Hume may allow cheap, vulgar, yellow soap suds for Commons' use,—what next?

The second advent of painting is at hand; in less than twenty years artists will move as an exalted race of men, and art be the high road to rank and fame. Even Timon will live to see the desired change; and I trust sincerely such a portrait as one of your correspondents has given of the driveller Northcote will rarely blot the page of history. Man usually wears a domino in the masquerade of life, and he who casts it aside and exposes, with Timon, the soul within, at least renders a greater moral service to mankind than all the sectarian speeches at Exeter Hall in a century; aye more, infinitely more, than all the so called philanthropy of the day could achieve, although its tocsin arouses at once men, women, children, and cash.

I have said enough to show how much I should recommend the old-fashioned bladder, especially if folded and tied round a quill for the neck, as done by one colourman[7] if not more, and how much I detest the namby pamby frippery of tubes, entailing as they do a real injury to many, if not all, pigments; but, I must add, the older practice of powder colours, merely ground finely in turpentine and left dry, for the mixture of the artist himself, *secundum artem*, is preferable to either; and I have full confidence in the conviction that a kindly attention to, and faith in, these facts, the result of many years arduous, costly, and incessant enquiry, and in promulgating which I have no personal interests at stake, will ensure a simplification of the art, a defence against empirical trickery, and its final success.

I have stated the only bad quality of wax,[a] its disposition to shrink and flatten, if not cup, on the surface when joined to oil in painting. It has, however, many good and recommendatory properties, and to it alone, I believe, we owe the existence at all of many of Reynolds's beautiful pictures; nay many damaged ones in which it *had* been used were probably injured by a too rapidly applied coat of exterior varnish; for in proportion as slow dryers and tough materials are used should be the length of *extra* time allowed before varnishing at all; and asphaltum, alike the Scylla and Charybdis of his career, be shunned.

WILHELM DE WINTERTON.

October 3rd, 1841.

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[7] Harvey, 10 Catherine Street, Strand.

[a] Wax might be made intensely useful in protecting the backs of pictures, generally nearly in contact with walls, whether damp or dry, for the backs are the most vulnerable parts, and yet, hitherto, neglected 'in toto,' and more might be done. I remember, some twenty years ago, a Mr. Dinsdale giving to the Commissioners of the Navy Board, a plan for protecting canvas from dry rot and mildew, by soaking it in tan liquor, as the Venetians, I believe, did with their picture canvas, and the Dutch now do, with all their sails in the fishing marine.

*** In my first paper, of last month, by the accidental omission of interlineations, when speaking o lead, I appear to say, "Flake white or, what is better, sulphate or muriate of lead."—The sentence was intended to read thus,—"Flake white or, what is better, German kremnitz,—the sulphate, though beautiful, being deceptive; and muriate of lead a French folly—which is not only very yellow (in fact a patent yellow made without heat) but, instead of defying sulphuretted hydrogen changes instantly before it."

†+† Another, a singular, and special instance of the "rising of oil," and its consequences, in setting at nought the "inherent permanence of ultramarine" was presented to my notice yesterday; an excellent landscape in the possession of a highly gifted friend, painted by the late Reverend John Thompson, after the mixed fashion of many of the Venetian masters, viz., with a vehicle of thick size, from boiled gluten of wheat, with a "little" acetic acid to assist its solubility—then glazed in oil with ordinary MacGellup. This landscape, I say, presents "yellow, horny clouds" for "warm white ones;" and, a "profusely dense ultramarine blue sky, markedly green!" Mr. Thompson was an excellent painter, had high prices; and, merited them; he scrupled not to expend twenty guineas worth of ultramarine over single pictures; yet, was his glorious spirit robbed of more than half its reward from his reliance on "inherent permanence of colour in oil painting:" when, had he glazed with poppy oil and the "spirituous dryer," before spoken of as given to the Secretary of the Commission of the Fine Arts for publication, and henceforth to be prepared by Messrs. Winsor and Newton, artists colourmen to His Royal Highness Prince Albert, and then varnished, at the proper time, his picture would have lived at least 500 or 600 years with its original blue sky, relieved by white and floating clouds, which now, alas, in despite of his bold pencil and vivid colouring, look scarcely better than a daub of Rosa de Tivoli, at least, to inexperienced eyes.

ON THE OBSERVATORY OF PARIS.

Translated for the Civil Engineer and Architect's Journal from a Report made to the Chamber of Deputies by M. Arago.

The Minister of Public Works at the urgent request of the Board of Longitude has asked of the Chamber a grant of £3,760 for the Observatory at Paris. This sum will serve to erect at the top of the slightly elevated eastern tower of the edifice, a hemispherical turning cap, under which powerful telescopes may be arranged, and applied with exactness to the great astronomical phenomena discovered of late years. The Committee has therefore thought it right to take this occasion for casting a rapid view over the successive improvements in the National Observatory.

When, a short time after the foundation of the Academy of Sciences, Lewis XIV. determined, at the request of Colbert, to erect the Observatory of Paris, no national establishment of this kind was then in existence. The astronomers in the several countries, confined to their own resources, were obliged to make use of inferior instruments, and to place them in inconvenient and often unstable edifices, and no systematic and regular course could therefore be undertaken or pursued. The plan of erecting our national observatory was fixed in 1667, and in the month of June the astronomers of the Academy regulated the exact orientations of the several faces of the edifice. The masonry works began only in 1668, and the building was finished on the 14th Sept. 1671, at a cost of more than two millions of livres, or nearly a hundred thousand pounds. It might have been thought that after such an enormous expenditure France would have possessed an observatory worthy of science and herself; it was not however so. The architect had laid down the plan of the edifice without sufficiently consulting the observers, and their complaints arrived slowly or were not listened to. Claude Perrault although he had not yet constructed the colonnade of the Louvre, found himself more powerful than all the French astronomers put together, and rejected with pertinacity and hauteur arrangements of which Colbert himself had acknowledged the utility; he resisted in fact the great minister himself, in order not to break, as he said, the architectonic lines, or produce any interruption to the harmony and regularity of the masses. These idle assertions unhappily carried the day over the well founded provisions and remarks of men of science, and it is said that that sometimes happens even in our own time. The Committee would show too much severity towards the man of genius to whom Paris owes the Colonnade of the Louvre, if it did not at once state that at the time when Perrault prepared himself, by executing the modest edifice of the Faubourg St. Jacques, for the works which were to immortalize him, the art of observing had undergone a complete revolution, and that astronomers were by no means agreed as to the uncertainty of the measures of angular height obtained with gnomons. It may be added that very favourable and decided opinions, obtained in Italy from a celebrated authority, asserted the utility of this apparatus, and also of an interior colossal sun-dial, so that the great rooms now unused in the Paris Observatory, and the heaviness of appearance of the north façade, which has been so severely criticised, must not be laid to the account of the architect alone.

The eastern tower, left without roofing, and the large room called the meridian room, served to receive the non-achromatic telescopes, 16 or 20 yards long, to which observers towards the end of the 17th century resorted when they wished to study the physical constitution of the planets and their satellites. Excited by the singularity of the discoveries with which these large instruments had enriched science, astronomers and opticians endeavoured to make still larger ones. Some were soon produced very long, and with very large openings. In fact one of them was 98 metres (300 French feet or 321½ English) feet in length. The new edifice not being then capable of receiving or supporting them, they were set up in the open air on masts of great height, and in the garden a colossal wooden tower was raised, from the top of which the Marly engine a short time before supplied the water for the reservoirs at Versailles. One experiment in observing was to put the object glass at the upper end of these masts, or of the high tower, the observer holding the eye glass in his hand; the telescope reduced to these two extreme pieces was therefore without a tube. Difficulties, as might have been foreseen, rendered fruitless these essays, the most considerable in the annals of science. It was evident, *à priori*, that the observer could not concentrate, with the requisite precision, two crystalline lenses unconnected between themselves by any rigid medium. The necessity of observing, when such apparatus was employed, a few minutes only before the passage of stars to the meridian and a few minutes after would besides have prevented any longcontinued and systematic researches.

The defects inherent in Perrault's edifice became particularly manifest at the time when it was felt necessary to apply meridian instruments to observation of the stars. Thus, in 1732, no place in the large building could be found adapted to receive a mural quadrant of six feet radius; an enclosure covered with vaults entirely closed and having walls of extreme thickness and considerable height would nowhere have allowed a continuous meridian opening, through which it would have been possible to discover all the stars from the horizon to the zenith at the time of their culmination. The Academy of Sciences was obliged, therefore, to set up an external chamber contiguous to the eastern tower. In 1742 the same difficulty occurred with regard to a moveable quadrant, and a second chamber was put up alongside of the other. A few years after, in 1760, a little turret with a turning roof was erected, to the south of the two former appendations, in order to facilitate observations of corresponding altitudes for the determination of the exact time of phenomena. These three little rooms, constructed with extreme parsimony and without durability, for many years formed the real observatory at Paris. The majestic edifice of Perrault towered over these hovels, but it only constituted to make use of an expression of the time, a show observatory.

This great observatory, moreover, like most of the other monuments of the capital, had suffered from the carelessness and inattention which characterised the latter years of Lewis XV. In 1770 it was falling into ruins. Care was obliged to be taken in entering the rooms, particularly after a thaw, and the walls and arches were falling to pieces, ruined by the rain water. The incessant applications of Cassini the Fourth, backed by the reports of the Academy of Sciences, were at last listened to, in 1775, by M. D'Angivillers. This enlightened minister determined that the restoration of the edifice should be forthwith attended to. For more than a century the astronomers in their various pursuits had had to suffer from the bad arrangements of the old observatory. This explains why Cassini proposed to pull down all the building above the meridian room story. M. D'Angivillers, however, strongly objected to this. The work of Perrault, said the minister, from its imposing mass and severe style, must be ranked as one of the chief ornaments of the capital. It was not possible to propose seriously to Lewis XVI. to destroy a monument erected by his forefather, a monument which was not yet a hundred years old, and where besides the great king had used to go and observe in person. Further, the Intendant General of Crown Buildings might have rejected any plan of demolition on other grounds—on those of brilliant scientific remembrances. It was in this building, then condemned to the hammer, that Picard, rejecting the ancient pinnulæ, applied telescopes provided with wires to graduated instruments, and thus laid the foundation for the exactness of modern observations. It was there, also, that the life of astronomers was doubled, if we are allowed the expression, by showing that the stars could be as well observed in the brightest sunshine as in the depths of night. It was in the building threatened with destruction that Picard and Auzout, bringing into use the filar micrometer of their invention, for the first time calculated with precision the angular diameter of the stars, and thus surmounted difficulties against which the genius of Archimedes had failed. The rooms of which the demolition was proposed had been witness of the experiments and minute preparations which were requisite before attempting, with any chance of success, the celebrated measurements, executed in France, Peru, and Lapland, for the purpose of determining the size and figure of the earth. Richer observed there the rate of his pendulum before starting for Cayenne; he verified it there after his return, and ascertained by means of these comparisons a capital phenomenon, that the weight of bodies is affected as they approach the equator. J. D. Cassini, sheltered by the same roofs, laid down the remarkable laws of the libration of the moon, discovered four of the satellites of Saturn, the movements of rotation of these new stars and those of the satellites of Jupiter, the flattening of that immense planet, and the zodiacal light. It was, in fine, in those halls that the first serious suspicion arose touching the successive propagation of light, and it was by means of observations of the eclipses of the satellites of Jupiter, made from the windows of the Paris Observatory, that Roëmer, an astronomer of the Academy, gave the first approximate data of the velocity of a luminous ray, a result which, by being carefully perfected after a century and a half of assiduous researches, has been definitively fixed at 200,000 miles per second. In any country, feeling an enlightened love for science, such remembrances would have been amply sufficient to save the most defective Observatory from destruction.

The promise of restoration obtained from Messrs. De Breteuil and D'Angivillers began to take effect in 1777, on the small closets on the east tower. These first works, very restricted in plan, were carried out in a still more stinted manner. On the other hand the restoration of Perrault's edifice, planned with grandeur by the two architects Brebion and Renard, was effected from 1786 to 1793, so as to defy centuries. From 1793 to 1830 the buildings of the Observatory received no improvement worthy of note, but the wretched buildings which masked it on all sides were demolished. In the same period were executed the magnificent avenue which leads from the north façade to the Luxembourg Palace; the mound, forming on the south side of the building, the planted terrace, well adapted for magnetic and meteorologic observations; and the gates, railings, and retaining walls which now isolate and enclose the Observatory and its appendages.

In 1832 works more directly useful to astronomy followed up these measures. In the course of 1831 the Chamber of Deputies, made acquainted with the real state of affairs, determined that our national observatory should be on a par with the most celebrated observatories in Europe. The Chamber voted spontaneously, and in one sum, a grant double that asked by the minister. This grant allowed not merely the simple repairs to be carried out according to the original moderate request, but the complete rebuilding of the observing rooms on the east tower. A little while after the Chamber voted a large, convenient, and richly decorated theatre, which has been ably joined on to the other buildings by its skilful architect, and to which the love of astronomy draws a large audience. The rotunda with the moveable roof dates from the same time, and is constructed on the upper terrace; in it is now raised a fine parallactic instrument. We are stating the opinions of the most celebrated astronomers in Europe, when we assert that the new rooms for meridian observations unite convenience and durability to elegance, and that they leave nothing to be desired in the present day.

It was not only the state of disrepair of the fine buildings of Perrault, and the restricted size of the temporary erections added to the old works, which, in the Observatory of Paris, grieved every Frenchman animated with patriotic feeling; but everywhere, down to a late date, the eye was struck with instruments almost exclusively foreign. If we looked at the telescopes they bore the names of Campani, Borelli, Hartzœcher, Huygens, Dollond and Short. The mural circles, the meridian glasses, and the great repeating circles, were the work of Sisson, Bird, Ramsden or Reichenbach. The astronomical clocks alone proceeded from the shops of our countrymen. Now, all the large instruments of the Paris Observatory are French, and without having sacrificed exactness to national self-love (for such a sacrifice would have been a great piece of dupery), we only see on the faces of the eastaspect walls, or on the columns of the high or low rooms, magnificent divided circles, meridian and equatorial instruments of Fortin and Grambey, and every one can observe that the large achromatic telescopes, sheltered under the vaults of the old building, have been wrought by the skilful hands of Lerebours and Cauchoix. What has been the real origin of this radical transformation, where our former inferiority appeared so well established, so sanctioned, that it seemed as if it must last for ever? The answer is very easy. We said to the French workmen—Do not seriously care for the universal opinion as to an asserted innate superiority which the workmen of England and Germany have over you; go boldly to work! These words were listened to, and their success has surpassed all expectations. In our country, *to dare* is almost always synonimous with *to succeed*.

Of late years all the governments in Europe seemed to have agreed to improve the old observatories and form new ones. In England, Greenwich, already so justly celebrated, has received a great increase of plant and staff. Now the observatories of Edinburgh, Cambridge, Oxford, Dublin, and Armagh, may almost rival that which Flamsteed, Halley, Bradley, Maskelyne, and Pond have made illustrious, and which is fortunately still in very good hands. Analogous establishments, on a vast scale, have been erected at the Cape of Good Hope, Sydney and Madras. We may perhaps be allowed, without infringing truth, to class among the great English observatories that founded by the Rajah of Travancore.[1]

The Neapolitan government did not think it had done its duty towards science even after having constructed the great observatory at Palermo, to which Piazzi so gloriously attached his name in the beginning of this century. A fine astronomical observatory has within the last few years been constructed at Capo di Monte, near Naples. A meteorological and physical observatory is now being erected on the side of Vesuvius. The observatories of Florence, Milan, Padua, Turin, and Vienna would be open to criticism, perhaps, if we looked at the buildings only; but, on the other hand, the knowledge of the directors, the number and beauty of the instruments, would suggest unlimited praise. Every one knows the successful exertions which the Belgian government has made to provide the city of Brussels with an observatory worthy of our day. Every one knows too that

1 M. Arago has not alluded to the other numerous and excellent observatories munificently maintained by private individuals, the Earl of Rosse, Lord Wriothesley, Sir John Herschel, Mr. Bishop, Treasurer of the Royal Astronomical Society, Sir Thomas Brisbane, &c. &c.—Translator.

the new observatory of Geneva takes a part successfully in the progress of science. Denmark possesses at Altona a model astronomical observatory. Bavaria can equally pride itself on the establishment founded near Munich, and Hanover on that of Gottingen. The observatory of Hamburgh is also worthy of remark. In Prussia the courses of the stars are studied, under the auspices of the government, at Berlin, Bonn, Breslau, and in particular at Konigsberg. The instruments are excellent, and the buildings constructed on purpose, in compliance with the minute requisitions of modern science. In this general career of emulation, by which the most magnificent of sciences everywhere profits, Russia has placed herself in the foremost rank. Not satisfied with having very useful observatories at Dorpat, Abo, Kieff, Kazan, and Nicolaieff, on the Black Sea, she has just caused to be built a true monument on the top of the Pulkova hill, near St. Petersburg. This splendid central observatory of Russia has cost more than two millions of rubles (£200,000), and among its finest instruments is to be observed a telescope bought at Munich for 80,000 rubles (£8,000).

If discontented dispositions believe that such a great number of observatories is useless, we would undeceive them by observing how much more rapidly the field of science has been extended than the means of investigation. We would, for instance, observe that looking at first only to the stars perpetually visible, more than 150,000 stars, formerly wrongly called fixed stars, are displaced each year, in proportions of which it is incessantly necessary to determine the exact value; and that milliards of stars, hitherto neglected on account of their excessive smallness, now attract the attention of astronomers, and seem intended to unveil the mysterious wonders of the firmament, and that as to comets, of such short appearance that they must be observed of a sudden, it has been necessary to provide against the long cloudy atmospheres, which in Europe, sometimes render observation impossible at a given spot for some weeks. Besides, was it not natural that, in the nineteenth century, every nation should have the noble ambition of taking part in astronomical discoveries, those of which mankind should be the most justly proud, on account of their certainty, magnificence and utility. In France, moreover, in this respect we are far from prodigality; set aside the observatory of Marseilles, often paralysed by the bad state of the building, and the observatory, nearly finished, which the municipal corporation of Toulouse have just erected with such rare intelligence and such great liberality, and what have we got left? The establishment in the capital, in favour of which the Minister of Public Works now asks a special vote.

Taken altogether the ardour which is exhibited in the present day,[2] by those engaged in the improvement of achromatic telescopes and large divided instruments of observation, has contributed more to the progress of astronomy than the exertions of all the governments in Europe, in constructing new observatories and in modifying the form and arrangements of the old ones. The first telescopes of the poor optician of Middleburg, who invented those wonderful instruments, had only a foot and a half focal distance. The telescopes with which Galileo discovered the satellites of Jupiter and the phases of Venus hardly magnified seven times. In none of the instruments of the immortal Florentine did the linear magnification exceed thirty-two times. Huygens and Cassini possessed telescopes which magnified a hundredfold, and they only reached this proportion by extending the focal distance to 8 yards. A little later an object glass was brought out by Auzout which magnified 600 times, but had 300 feet focal distance; and, as we have already said, notwithstanding a thousand clever contrivances, the management of a telescope in length equal to the height of the spire of the Invalides would present insurmountable difficulties. The opticians discouraged directed their whole attention, in imitation of Newton, to reflecting telescopes. Very good instruments of this kind were executed, but of very restricted size. In 1758, John Dollond, the son of a French refugee weaver, executed in England what Newton had declared to be impossible, namely, telescopes depriving the images of stars of the rainbow borders which all simple objects engender. Achromatic telescopes of small dimensions were found to magnify as much as the 200 or 300 feet object glasses of Dampani, Borelli and Auzout, and attention was then exclusively turned to them. The English, whose manufacturers could alone produce flint glass without streaks or striæ, became possessed of the supply of achromatic telescopes for the whole world. The skill of our neighbours, however, in the manufacture of glass was not such as to produce for the use of opticians pure discs of flint and crown glass more than 6 inches diameter. The images produced by a six-inch glass not having intensity enough to magnify the planets so much as the wants of science required, recourse was again had to reflecting telescopes. It was then that the colossal instruments were produced, at the expense of the King of England, which have immortalized Herschel. Achromatic telescopes were necessarily again in vogue when the Swiss workman in a glass work near Munich succeeded in making flint glass without streaks. Stimulated by the skill with which Fraunhofer turned the glass to account, the English government endeavoured but in vain, to recover possession of a branch of trade which it had allowed to be carried off. The most powerful telescopes now used, even in the English observatories, are made in the shops of Paris and Munich.

The largest achromatic telescope known has only 14 inches aperture. The effect of such an instrument it seems might be equalled and even surpassed, within accessible sizes, by reflecting telescopes. Lord Rosse, a wealthy peer in Ireland, is therefore now expending, with infinite ardour and remarkable perspicuity, enormous sums in experiments on the construction of telescopes of unused dimensions. Things had reached this point when Messrs. Gumaud and Bontemps presented to the Academy of Sciences masses of crown and flint glass 19 inches diameter, which seemed free from bubbles and streaks, and these artisans engage to supply such masses even a yard wide. On the other hand, opticians generously place at the disposal of learned societies the mechanical means which they possess of modelling, softening, and polishing these gigantic lenses. The most eminent workman in our country also has promised to direct the undertaking. In a brief space of time, if the Chamber carries the motion of the Minister of Public Works, French astronomers will possess reflecting telescopes superior to anything which yet exists, superior indeed to anything that the most ardent imagination could last year have dared to hope. In the meanwhile, the parallactic stand and the turning roof of the east tower will allow us to turn to account several telescopes which the difficulty of managing now leaves unused.

Will the discoveries which great instruments presage be brilliant enough to justify so much trouble and such great expense? If we quote a few facts, the Chamber will be able to reply for itself. Till of late years we had not succeeded in determining the real distance of a single star. All that astronomers knew was a limit within which none of these stars could be situated. Now, by means of observations, which will become easy with the large telescopes which the Board of Longitude hopes soon to possess, the true distance of *one* star is known. The small star called the 61st of Cygnus is so distant from the earth that its light takes ten years to reach us. This star, therefore, if suddenly annihilated would be seen ten years after the catastrophe. It must be remembered that light runs at the rate of 200,000 miles per second, that the number of seconds contained in a day is 86,400, that the year contains 365 days and a quarter, that the product of these three numbers is to be multiplied by ten to ascertain in miles the interval which separates us in a straight line from the 61st of Cygnus, and it will be natural that astronomers should pride themselves on such a result, and that they should desire to apply to other stars their magnificent operations of surveying. Large telescopes with parallactic fittings and of high magnifying powers will enable us to perfect our observations on the fixed stars. The fact is now established that the stars of almost all the binary groups are dependent on each other, forming systems of suns, generally coloured, revolving around their common centre of gravity. The exact measure of these movements of rotation, combined with the determination of the real distance of the two grouped stars, would mathematically conduce to a knowledge of the sum of the two masses. When by a series of irrefragable deductions mathematicians and astronomers succeeded in finding that the mass of the sun is equal to 355,000 times that of the earth, or, in other terms, when they recognized that the radiant star, placed in the scale of an immense balance, would require for its equilibrium in the opposite scale 355,000 globes such as the one we inhabit, the world was struck dumb with astonishment. We can assert that still more will yet be done. Men determined formerly the mass of a star which shows itself as an immense globe, a star around which the earth revolves, a star which governs by its attractions, that is to say by an action dependent on its mass, all the planetary movements. Every one, *à priori*, could have vaguely foreseen some connection which might lead to the desired result. Now, the question is to calculate the masses of certain suns, suns belonging to other systems, suns placed at distances which confound the imagination, suns which under the telescope present no appreciable diameter, suns which the mere thickness of a spider's web will conceal from the sight of an observer—here the strength of science will be shown in all its majesty. The astronomer provided with a telescope of large opening and high magnifying power, mounted parallactically, and delicately governed by a clock, will still find a field of research, almost untouched, in the vast and varied nebulosities with which the heavens are sown. He will study the progress of concentration in the phosphorescent matter; he will mark the period of ounding in the external contour; the period of the appearance

[2] And in England for a very long time.—Translator.

of the central luminous nucleus; the period at which this nucleus, becoming brilliant, will remain only surrounded by a slight nebulosity; and the period at which this nebulosity in its turn will be condensed, and the observer will have followed the birth of a star in all its phases. Other regions of the heavens will show by what laws these same stars weaken, and end by disappearing altogether.—Without leaving our solar system, a large telescope promises discoveries of another kind, not less interesting. We know very little as to the atmosphere of Venus, or of the very high mountains with which that globe, nearly as big as the earth, appears covered. The snowy spots which spring up, grow, lessen, and disappear periodically, sometimes at one pole of rotation of Mars and sometimes at the other, according as the sun is in such or such a hemisphere of the ruddy planet, have not been sufficiently studied. With large telescopes what is still doubtful would appear manifest, what has only been half seen would become evident. Although Jupiter has not been yet assiduously explored by means of instruments with large openings and high magnifying powers, it is known with certainty that there exist in the equinoxial regions of that planet winds analogous to our trade winds, that the atmosphere is subjected to enormous perturbations, and that the clouds are sometimes carried along with a speed of 240 miles an hour. If observations made in an off-hand way, with middling instruments, have led to such curious results, what may we not expect from assiduity united with power. The mysterious ring of Saturn, that continuous bridge without piers, 30,000 miles wide and less than 250 miles thick—a bridge which at all points is 20,000 miles distant from the planet it surrounds, certainly reserves capital discoveries for him who can follow it in all its phases with a very high magnifying power. The continual observation of the brilliant satellites of Jupiter has so much enriched science that we must expect as much from the uninterrupted observation of the satellites of Saturn and Herschel. The continuous examination of the movements of those microscopic satellites is now impossible in every observatory, on account of the too limited power of the telescopes. The study of the continual change of form to which comets are subjected, ought it would seem, to enlighten us on the physical condition of the ethereal space. If this study has until now made little progress, it is only attributable to the want of power in the instruments with which astronomers have been compelled to observe those nebulous stars.

Let us take a rapid sketch of what may be reasonably expected from the application of very large telescopes to the observation of the moon. 1093 mountains on our satellite have been exactly measured. Of this number 22 exceed Mount Blanc in height, and that it is known is 3000 yards high. One of them, Doërfel, reaches 4700 yards, the top of Newton 4500 yards, and of Casatus 4300 yards. The craterform constitution of most of the regions of the moon has not been studied with less care; the depth of each crater and the height of the central mound are now known with precision, and astronomers have obtained these results with magnifying powers of not more than two hundredfold. Should we then fear to deceive ourselves by placing great hopes on a telescope of which the light will allow a magnification of 6,000 fold; so as in fact to show the mountains of our satellite as Mount Blanc is seen from Geneva? Last year Dr. Robinson examined the moon with a reflecting telescope, 3 feet diameter, belonging to Lord Rosse, of which the light was only a quarter of that which would be possessed by an achromatic telescope a metre in diameter. The magnifying power was moderate, but the celebrated astronomer of Armagh instantly recommended philosophers to resort to Ireland, to Parsonstown, if they wished to study the physical constitution of our satellite. He asserted that from such an examination would result entirely new information as to the mode in which the forces acted which in our globe influenced the formation of volcanic districts.

If, after having heard this long enumeration and observed the various researches which large achromatic telescopes will allow to be undertaken with every chance of success, the Chamber will condescend to remark that what is unforeseen is always the most fruitful, brilliant and rich, the Chamber will understand that its Committee unanimously recommend a grant to the Minister of Public Works of £3,760 to be employed in completing the Observatory of Paris.

The King of Prussia has been graciously pleased to confer on Matthew Habershon, Esq., of London, the great gold medal for science and literature, in token of His Majesty's high approbation of his work on the "Ancient Half-timbered Houses of England." Mr. Habershon, who is the architect of the church and other buildings erecting at Jerusalem, was honoured with a long private interview with the King of Prussia, relative to those extensive works, on his return from the Holy Land last year.

NATIONAL EXHIBITION OF THE ARTS, MANUFACTURES AND PRODUCTIONS OF THE ENGLISH EMPIRE.

Energy, enterprise, competition lie at the root of commerce; to carry out a great and successful trade, we must exert those qualities not merely to maintain and extend our position, but to prevent rivalry. However successful may have have been our exertions, however high the position we may hold, we must labour on with the same activity, unless we are willing to lose our gains; no vain pride must delude us in our career. As we availed ourselves of the experience and skill of those we have supplanted, so should we be as ready to profit by any action of those trying to supplant us. Holland succeeded Venice and Genoa—we have succeeded Holland in commercial supremacy, but we must recollect that we have many anxious and active rivals, nay it is the very nature of successful enterprise to stimulate others to clutch the same gains, and if we relax in our toil one moment, half a dozen eager nations will push on and make way upon us in the struggle. At the same time every individual in the commonwealth is interested in maintaining our position. Let no one rest so securely on his fancied independence as to neglect the prosecution of the general interests; the landholder in the decay of trade would lose his rents, the stockholder his dividends, the professional man his employment, although at the present moment he may scarcely feel or appreciate the nature of the connection. So, too, will the increase of trade promote their welfare, as its decline would threaten injury.

These remarks have urged themselves upon us the more strongly in consequence of the late triennial *Exposition of Arts and Manufactures* at Paris. France is, it is well known, not the leading manufacturing country, but in setting up an exhibition to which all Europe is invited, and which has no competent rival, she is enabled to make false impressions, by which to advance her interests. On that occasion Paris was crowded with strangers from every part of France, from Germany, Italy, Belgium, and the remote parts of the continent; the foreigner saw productions on, which, as he had no comparison by which to weigh their value, he was inclined to place too high a value; the manufacturer received a stimulus to fresh exertion, and the feeling was impressed that France was a great manufacturing country, and a high character given to her among her customers abroad. Let us not either neglect this point of character; are we not often ready to buy French silks, French ribbons, French shoes, because French? and does not the stamp London made, Manchester, Birmingham, or Sheffield made, produce an influence among the remotest tribes of the earth, which rival traders are ever anxious to supplant by falsification and imitation. In political economy, as in every department of morals, the influence of character is great; it takes a long while to obtain a character, and with common care it may be long maintained and cannot readily be supplanted. To appreciate the Paris Exposition properly, we must consider that our great customers on the continent were invited to witness the competency of the French to supply them with produce, and the records of the transactions shew that this result was produced. Many goods changed hands, many new commercial connections were formed, and many merchants discovered a source of supply with which they were before unacquainted. To the French manufacturer it gave this benefit, that however lowly, instead of having to send travellers to solicit orders for his cutlery, his cottons, his silks, his machinery, in distant countries of Europe, their representatives were concentrated in one spot, and he was made known to them. That the system of the Exposition answers well in France we can easily appreciate, for a general satisfaction is expressed with regard to it, it is anticipated with national anxiety, and carried out with increased efficiency on every successive occasion. It has now, indeed, reached a pitch when we can no longer regard it without making some serious exertion. When France was a close country during the empire, it was nothing; while France was paralyzed, and the confidence of its commercial classes shaken, under the restoration, it was to us insignificant; but now, after the revolution of July, a long peace, a prudent monarch, and the predominance of the trading interests in the government, the Exposition has taken a great development, in common with everything which concerns the progress of the country. The system, too, has been imitated, and with effect, in most parts of Europe; Berlin for Prussia and Leipzig for Saxony have just held Polytechnic Unions, and even Lisbon for Portugal, while Austria and Hungary contemplate the formation of a similar institution.

To England, under these circumstances, it becomes evident that some exertion must be made—local circumstances are most favourable—while we have all the means of producing the most valuable exhibition of manufactures that can be formed, the renown of our workmen will draw visitors and customers from all parts of the world, and our means of steam communication give cheap and commodious access to our shores. We urge, therefore, that immediate steps be taken for the formation of a National Exhibition of the Arts, Manufactures and Productions of this country, its colonies and possessions, to be held in the metropolis at stated periods. That London must be the seat of the exhibition is evident, being the greatest commercial port, a great manufacturing city, having the best accommodation, and the most convenient access for the country at large, and visiters by steam boat from every part of the continent, advantages which no other city unites, besides which it has its natural claims as the centre of the national transactions.

The exhibition would include the raw and manufactured produce of every part of the empire, and would equally interest the landed proprietor and the manufacturer in England and the most distant colonies.

It would call on the landowner for specimens of grain, rice, straw for plaiting; cotton, tobacco, opium, drugs, hemp, flax, New Zealand flax, coir, hops, indigo, madder, wood, vegetable dyes, cocoa nut and other fibres, sugar, tea, cocoa, preserved and other fruits, ginger, cinnamon, spices, rapeseed, oils, seeds, cabinet and other timbers, galls, staves, wool, cashmere and vicugna wool, goats' hair, silk, tallow, hides, furs, horns, the productions of England, Canada, the East and West Indies, Ceylon, and Australia. No doubt in such an exhibition notice would be obtained for many productions of our distant possessions now little known or neglected.

The miner would exhibit gold, silver, iron, copper, tin, lead, zinc, antimony, bismuth, manganese, arsenic, diamonds, precious stones, marble, granite, lime, slate, building stone, coal, salt, sand for glass, porcelain clay, and the many other mineral objects with which our empire abounds.

The fishing interests would be able to send whalebone, tusks, oil, seal and other skins, spermaceti, pearls, mother of pearl, tortoiseshell, salt and pickled fish.

The manufacturing interests would be represented by all the varied productions of London, Manchester, Glasgow, Birmingham, Sheffield, Leeds, and other great producing towns, our metals, watches, mathematical instruments, machinery, cutlery, hardware, plate, jewellery, fire arms, shipping, glass, pottery, colours, dyes, cottons, silks, woollens, linens, leather, saddlery, hats, paper, books, stationery, clothing, millinery, beer, cider, wine, soap, candles, and the many varieties of these and minor productions.

On all these grounds a title is made out for extensive support, but local interests are also concerned. The influx of strangers to the metropolis would be great, (in Paris a bed was scarcely to be had at the time of the Exposition,) and the traffic of coach, railway, and steamboat proprietors considerable.

We have said nothing yet about the government, but its co-operation, in a general point of view, could not be denied, while it is deeply interested as a matter of revenue, both general and local.

The objects to be exhibited would require a large locale, either one of the great bazaars or some temporary erection on a waste space of ground, and a considerable sum of money should be devoted in medals and prizes to exhibitors worthy of praise.

Now with regard to the means by which this can be carried out. We are well aware that any immediate dependence on the government, to carry out such an object by itself, would be vain, and that it requires a great deal of preparation and a great deal of agitation before the requisite impression can be produced; and it will require, also, consideration whether such an object should be carried out by government or by means of a society. It will also be necessary to determine as to the means of carrying it out, by subscription, or by a charge for admission. If possible, however, such an exhibition should be gratuitous, certainly for a considerable portion of time, for the object is to influence even the lowest mechanic, as in him resides the national energy as much as in the greatest capitalist. The general operation of such an institution must not be cramped by any short-sighted and sordid measure.

We therefore recommend that a central committee of manufacturers and public men be formed in London, with branch local committees, for the purpose of promoting the formation of a National Exhibition of Arts, Manufactures and Productions.

*** On this subject we shall be happy to receive any communications, addressed to the Office of the Civil Engineer and Architect's Journal, 10, Fludyer Street, Westminster.

Lithography.—The Madrid papers announce that a discovery has been made in Catalonia, on land belonging to the State, of a rich quarry of lithographic stones, equal if not superior in quality to those of Saxony. The government has granted the working of the quarry to a Madrid merchant.

TO CANDIDUS.

In the last extract from your "Notebook" you have favoured me by making some remarks on the "Observations" which have also appeared in this Journal. Before attempting to reply to the remarks, permit me to state to our readers that the abrupt discontinuance of the Observations was not caused by a want of subject, nor yet by a declining interest in the advancement of the art, but by circumstances over which *I have no control.* You seem, then, to think that I am so short sighted as not to perceive that a missile "flung one way may recoil and strike what it was not aimed at." If a missile be aimed at one object and Candidus interposes his bat and directs it so that it should strike something else, who is to be answerable for that? It may be very well in the game of cricket, but it would not be *candid* in criticism.

However Candidus, in Fasciculus 58 of his Note-book, may disapprove of fault being found with the window pediments of the Vandals, yet in Fasciculus 57 you would appear to agree with me, for coupled with a very decided approval of a row of houses in Maddox Street, "as the best specimen of street architecture any where in town," the absence of the "cocked hats" is mentioned, without any suggestion of the improvement this addition would effect, we may, therefore, conclude, as you say in your motto,

> "I must have liberty
> Withal, as large a charter as the winds,
> To blow on whom I please."

that the wind does not always "*blow*" in the same quarter, and that the mariner who suffered his sails to be filled by it might sometimes be driven out of his course unless he steered by compass.

You have adopted a line of argument as fallacious as it is plausible: you hold that if the name of "cocked hat" be fairly applied as a term of contempt to window pediments, it may justly also be applicable to the pediments of porticos, &c. I do not wish to quarrel about a name, it is the misapplication of the thing which is to be condemned; for instance a cocked hat may be very suitable for the head of a soldier, but if placed on the exuberance of beauty which graces the dorscel elevation of a Hottentot Venus, are you prepared to say "that it does not exactly follow that such after application is a *mis*application utterly indefensible," or that there was no absurdity in the naked savage of Terra del Fuego, who found a pair of pantaloons which he threw over his shoulders and tied the legs under his chin? No, Candidus! there is a rule in Greek Architecture (and of course in its derivatives), of more general application than the one you urge, namely, that *there is a place for every thing, and every thing for its place,* Does a love of variety so far blind you as to make you tolerate the same thing repeated, in small in order that you may have variety in size and scite, if not in figure? Advocate first the same perfection to which the ancients attained, and when we are masters of that, we shall then be able to carry out the same principles in producing variety—but not until then.

I have to express my obligation for your kindness in warning me to beware of the Goths, but I beg to assure you that I neither fear Goths nor Vandals; as to the architecture of the latter (of which a specimen may be seen in the plate of the Gravesend Pier, in the last number of this Journal,) it is so debased, that even those who live by it are ashamed to come forward openly and defend it. As for the true Gothic I love it as much as any one who does not esteem it to the exclusion of the Greek.

In stating in your remarks that "if the principle" (the application of pediments to windows,) "be an erroneous one in itself, it must be as much so in one style as the other." *Candidus is not himself.* You seem to forget altogether that the rules which are applicable to the horizontal are not suitable to the perpendicular style; in the former the parts are, or ought to be, comparatively few, and their application subject to other laws than those which direct the same or equivalent members in the latter, and in it things which are monstrous, absurd, and insignificant in themselves, yet when arranged and placed in position, by the master minds by whom the Gothic was invented and brought to perfection, seem as if they were selected by good taste itself to set off the composition to advantage. I fearlessly deny that there exists any similarity, any analogy between the two classes, or anything in common except the end, namely beauty, which in both can be fully attained by pursuing far different roads and observing very different laws. As far, therefore, as I am concerned there is no ground for your apprehension—

> Of Goth meeting Greek in the tug of war.

You have contended manfully and powerfully against *some* of the errors over which, I believe we both desire to see the art rise superior, you were probably educated in the Palladian school, but I hope yet to see you throw off all its trammels, and then take your place as the most correct, as well as the most able, architectural critic of the day.

HENRY FULTON.

Clonmore, County Dublin,
October, 1844.

PROFESSOR FARADAY ON HEAT.

A course of eight Lectures delivered at the Royal Institute.

LECTURE VIII., *June* 8, 1844.

(Specially reported for this Journal.)

THE nature of flame being of general interest, and intimately connected with the subject, will come under consideration in the present lecture.

Bodies that undergo combustion may be divided into two kinds, those that burn with flame and those that burn without. Charcoal burning in oxygen, becomes glowing hot, throws out large or small sparks, but produces no flame. So when charcoal powder or iron filings are thrown into the flame of a lamp, they scintillate and are consumed, but do not form flame. But those substances which can be converted into vapour, produce flame in burning. Vapours, however, may burn without forming flame. Doebereiner discovered that platinum when finely divided has the property of causing gases to combine without flame, though sometimes the heat produced is so great as to make the platinum hot enough to ignite the gases. Light thrown through flame on to a white screen gives a shadow, those flames throwing the darkest shadow which give the strongest light for instance, that of camphor.

Flame is usually of an upright tongue-shaped, but not necessarily so, as it is made so by the upward currents of air which its heat causes. When two gases which combine, such as chlorine and olefiant gases, are burned in a tall glass jar, the air does not influence the shape of the flame, and it is then in a flat plate. In looking at the flame ot a candle, several distinct parts are evident; the wick, charged with the fluid tallow, around and above which is a dark centre, surrounded by the bright luminous part, and outside of all, a faint blue part. It appears to the eye that it terminates here, but its shadow showed that something belonging to the flame is continually ascending rapidly from it. This is the column of air which it is heating, mixed with the gases which it has formed by combustion. The parts of the flame are shown by holding a wire across it, it will be heated the most by the outer part, corresponding to the bright lines in the shadow. As Davy first taught, the dark part in the centre of the flame is unburnt gaseous matter, which is continually being consumed at the outer part. Some of this can be drawn from the flame by holding a tube slopingly in it; this is not smoke, as may be proved by lighting it at the end of the tube, when it will be found to burn like the other part, only with a smaller flame. Hydrogen gas, in burning, gives but little light, and if oxygen is mixed with it, still less. The light which a flame spreads around does not depend, therefore, upon the hydrogen or oxygen, but upon another constituent which is invariably present in all substances employed for lighting, namely, carbon. In burning the mixture of chlorine and olefiant gases, the latter was completely analyzed, its hydrogen combined with the chlorine, and its carbon was deposited in the form of dense smoke, and soot lining the containing vessel. This is what takes place in all cases where enough air is not supplied to flame, its hydrogen combines with the oxygen of the air, and its carbon flies off as soot, a smoky flame and much less light being the result. A cooling surface being inserted into a flame produces the same result; thus a piece of wire gauze puts out any part of a flame, itself becoming smoked. Flame, therefore, is not mere vapour, but a combustion of vapours, in all ordinary cases it is the union, at a high heat, of the vapours with the oxygen of the air.

That the light produced from flame depends upon the carbon present, is evident from the following experiment:—the flame of hydrogen gas, having scarcely any light, is rendered luminous by throwing into it, by means of a blower, a stream of finely divided charcoal. The rationale of the light produced in flame, as given by Davy, is that when gas, oil, coal, wood, or any common combustible is ignited, part of it is converted into vapour, which is continually supplied by the heat of its own flame; that in combining with the oxygen of the air, its hydrogen burns first, the carbon then from the heat produced, becomes glowing hot and scintillates, and being carried up is brought into contact with the air and becomes consumed, like the charcoal in the oxy-hydrogen flame. By mixing these vapours or coal gas intimately with air previously to burning, these phenomena are altered, and a blue flame, with scarcely any light, but great heat, is produced. As a general rule, gaseous bodies may be said to give little light and much heat, but solids in combustion generally give much light and little heat. Phosphorus, when burning, produces intense light; this is due to the solid phosphoric acid which is produced becoming intensely heated, and thus causing light. If this be so, the luminosity of ordinary flames is not so much due to the combustion of the carbon, as to the effect of its being intensely heated. This may be shown by passing the vapours from burning phosphorus (phosphoric acid) through non-luminous flames, when they become luminous; the vapours are not consumed, and thus might be used over and over again. The same fact is proved by the oxy-hydrogen flame, which by itself gives scarcely any light, but, when lime, magnesia, or other solid bodies which do not consume, are placed in the flame, intense light is the consequence. In Theatres, for the sake of producing sudden bright light to imitate lightning, some powdered substance which is easily vapoured is blown through a tube into a flame, lycopodium is generally employed. Some gases, when highly heated, give light, such as sulphurous acid but air will not become luminous.

By the admixture of various substances, flame may be made to assume various colours, producing what is called a monochromatic lamp. The most perfect of these is the yellow flame produced by burning a mixture of alcohol and salt. Very curious effects are thus produced, no colour but yellow retaining its proper hue; thus, the brilliant red of cinnabar, as in sealing-wax, appears pale yellow; that of cochineal, as in lake and red morocco, looks black; as also do the brilliant blues of cobalt and ultramarine; the red of the blood becomes perfectly black, which gives a ghastly hue to the human countenance.

Combustion of many substances may be carried on at a temperature too low for the production of flame. Thus phosphorus exposed to air, is undergoing slow combustion, producing a luminosity but no flame. A spirit lamp may be fitted with a coil of platinum wire, on lighting the lamp so as to heat the coil and carefully extinguish it, the heated wire will retain heat enough to keep the spirit in slow combustion, itself continuing glowing hot, but without flame, as long as spirit remains in the lamp. Also by pouring a few drops of ether, into a glass jar, and inserting quickly a fine platinum wire heated just below redness, a point will be found in the jar where the ether, combining with the air, will keep the wire at redness, and if the heat increase too much, as sometimes happens, the ether will then burn with flame.

As flame, therefore, requires a certain temperature for its maintenance, it follows that if a cold good conductor of heat is brought into a flame, it ought to extinguish it. And such is the case; a ring of iron placed round a very small flame, instantly extinguishes it, and a series of such rings, of which wire gauze may be considered as composed, will not allow the largest flame to pass, owing to the rapidity with which it deprives it of heat. For the knowledge of this fact science is indebted to the researches of Sir H. Davy, who applied it to the construction of his miner's lamp. An oil lamp entirely enclosed in fine wire gauze, may be inserted into a jar of explosive or combustible gas, which will burn in the interior and perhaps extinguish the flame, but it will not be communicated to the exterior. The value of this to the miner, who is frequently surrounded by the explosive fire damp, is incalculable, and this simple instrument, which annually prevents the loss of so many lives, is of itself sufficient to entitle its inventor to the thanks of posterity.

The lecturer, after thanking his audience for their attention, announced this as the close of the lectures for the present season, and concluded his interesting course.

ON PAPER HANGINGS.

A Paper read by MR. COWLAN, *at a Meeting of the Decorative Art Society, held at their Rooms in Davies Street, Grosvenor Square, Oct.* 9, 1844.

Among the many articles of British manufacture that lay claim to our attention, few are of more importance than that denominated "Paper Hangings," and few have had less of that care and study that it requires; not only is it of importance in a commercial point of view, but it must be considered as a vehicle for the advancement and encouragement of the fine arts of the country.

The art of ornamenting the walls of apartments has been in use from a very distant period; among the ancient Egyptians the pictorial representations on the walls of their tombs may lead us to suppose that their houses were decorated in a similar manner. Among the Greek settlers in the south of Italy decorating the interior of their houses was paid great attention to; the ruins of Pompeii and Herculaneum attest that the art was highly cultivated there. Some of their designs, though wanting in artistic skill, still possess remarkable brilliancy of colour. The houses of the rich patricians of Italy present numerous specimens of beautiful decorations; and the arabesques of Raffaelle and the rest of the Roman school are, perhaps, the finest productions of this kind in the world.

Tapestries, as coverings to walls, were in great use for many centuries in Europe, and among the Eastern nations it was known at a very remote period. Most tasteful and beautiful designs were employed in the manufacture of it, and the refined taste of Athens and the talent of the first Italian artists were called into requisition to furnish models from which to work these patterns; and those invaluable Cartoons of Raffaelle, at Hampton Court, show us how particular they were to procure the best designs and finest specimens of art to ornament the walls, a strong contrast with the character of taste of the present day, which is content with the productions of inferior artists, whose taste and judgment have never been properly cultivated, and, except in some few instances, are totally deficient in those principles of true art, which have been the study and direction of all who have arrived at excellence; and without a knowledge of these principles, no manufacture in which taste is required will ever reach even the length of mediocrity.

With the increased production of paper, also, came the idea of applying it to the purposes of hangings for rooms; and though it has only been in general use for little more than a century, it is nearly two hundred years since it was first applied to that purpose; and it has been used as a substitute for almost every other species of decoration. The varieties of subjects imitated in paper hangings are very comprehensive, and successful efforts have been made to adapt it to the representation of architecture, sculpture, and painting, as well as arabesque designs, ornaments and flowers. At first the aim seems to have been directed to imitations of tapestry, and to produce this was employed a material called flock, a kind of woollen cloth chopped small with a machine, strewed lightly with the finger and thumb over the paper, on which a pattern had been previously drawn with fat, oil or varnish, and the different colours and tints being carefully blended, an appearance of tapestry was thus obtained. This method is said to have first originated in England, and was invented by Jerome Langer, who obtained a patent for it during the reign of Charles the First, dated May the 1st. 1634. We find, however, according to an old French work, that a manufacture of this kind was carried on at Rouen, some 10 or 14 years previously, by a man named Francois, and was succeeded by his son, who continued the business for 50 years after with great success. Originally the material was of an extremely coarse description, and the flock projected considerably from the paper. At Hampton Court specimens of the early productions may still be seen, mostly painted in distemper, but the pattern can be distinctly traced. I have been enabled to procure a specimen of flock paper, which I am assured is not less than 110 years old. In this the surface is very coarse, although a great improvement upon the older fabrics.

In the reign of Queen Anne paper hangings were largely imported from China, and continue in fashion down to the present day. These hangings, though the outlines may be executed with blocks or stencils, are almost wholly done by hand. The colours are very rich and brilliant, exceeding in beauty almost anything we can produce in England.

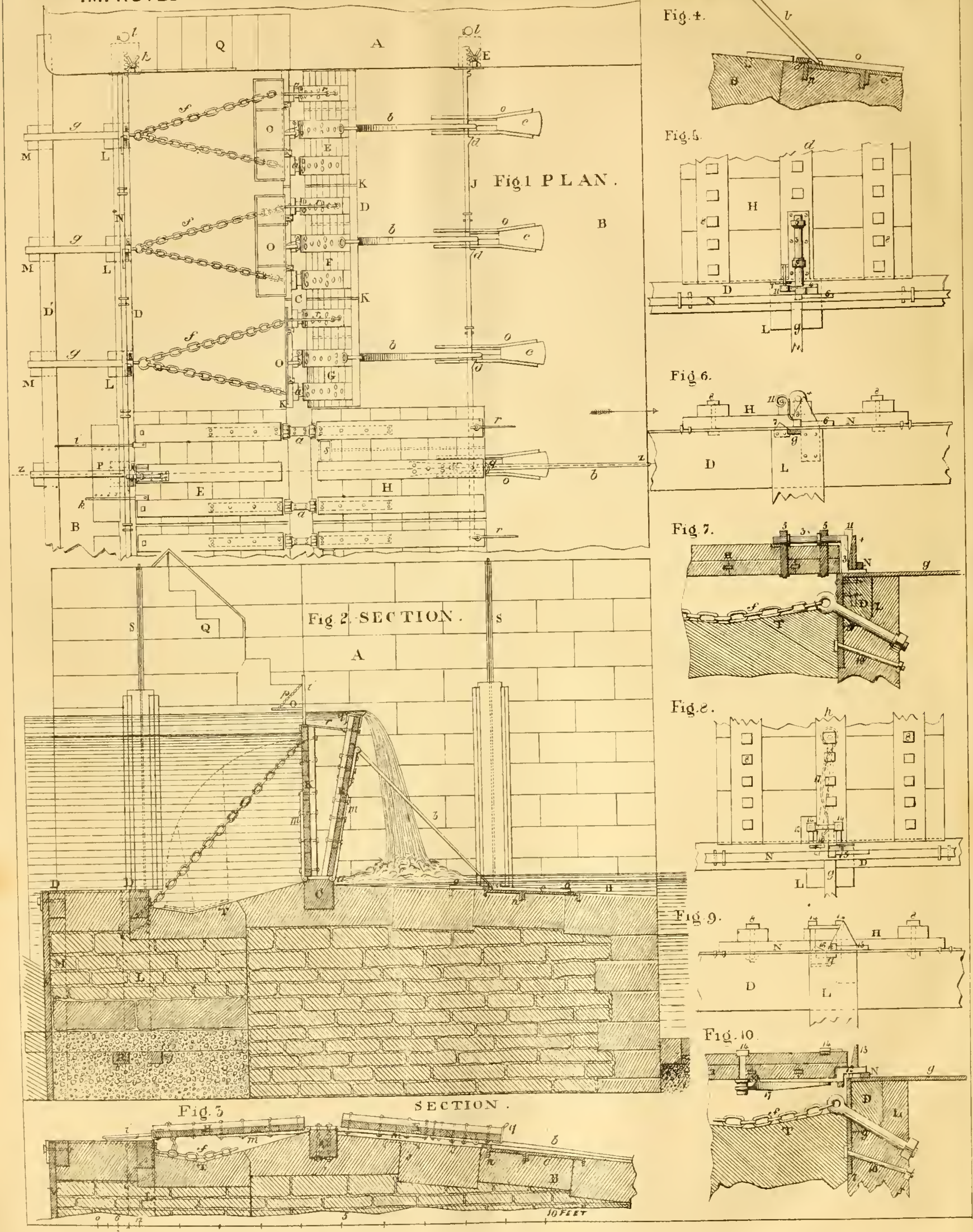
Mr. Jackson, a manufacturer of paper hangings at Battersea, published, in the year 1754, a work on the invention of printing in chiaro scuro, and the application of it to the making of paper hangings, with fruits coloured in illustration. This book was probably used as a sort of advertisement of his own manufacture, and contains many just and well sustained remarks, showing a cultivated and properly directed taste. He purposed, instead of adhering to the old system (for it seems that paper hangings had reached some degree of perfection even then), to employ subjects of more interest than the mere repetition of flowers and ornaments, which prevailed so much, that instead of being a principal, as they were, that they should be merely an elegant auxiliary to designs of more dignified character—as, for instance, copies of the most celebrated classic subjects, statues and landscapes; and remarks that the persons who could not purchase the statues themselves might have these prints in their places, and thus gratify the taste of the possessor. He also proposed, instead of painting paper hangings in the ordinary way with size colour, that oil should be used, and argued the great durability of oil in comparison with size, and that the beauties of the colours continue as long as the paper can hold together, whereas, in a short time the brilliancy of the other is quite lost and requires renewing.

In speaking of the vulgar and gaudy patterns frequently selected, instead of tasteful and harmonious designs, he says, persons who prefer the unmeaning papers so generally met with, to those done in this style, would prefer a fan to a picture of Raffael, Carracci, Guido or Domenichino; and those who choose the Chinese manner, ought to admire, in pursuit of that same taste, the crooked, disproportioned and ugly, in preference to the straight, regular and beautiful. It is by this very means of ill-judgment in furnishing apartments that the true taste of the person is unthinkingly betrayed, those little and seemingly distant things offer the clue which leads to discovering the whole mind, and undoes, perhaps, all the character of being a true judge of the polite arts, which they are so fond of establishing. It seems impossible that any mind truly formed can, without distaste, be capable of letting such objects in upon it through the eye, where the external senses are well-proportioned and just; these monstrous objects of the external must be displeasing and offensive in that breast where the softer sensations of humanity are; in a particular degree, a love of beauty generally accompanies them, and the approbation of natural objects is the proof of these sensations existing in an individual, as the contrary taste is of the ill formation or perversion of that mind which approves of preternatural appearances. There is a close analogy between the love of beauty in external objects, and a kind truly disposed to the feeling of all the softer and more amiable sensations.

The prevailing unfounded idea that the English, as a people, are inferior to other nations in the talents for artistic design and invention is, I am very glad to observe, being overturned by proofs that we are quite as capable, and in some instances more so than the artists of other countries, of producing designs of exquisite taste and workmanship, and I may here mention that the encouragement given to the arts of design by the rebuilding of the Houses of Parliament, is in every way praiseworthy and will give an impetus to native art it has never received since the days when the royal patronage was displayed in the very same spot, during the reign of Henry the Third, six centuries ago. It is sometimes necessary to bring to the recollection of the cavillers at British talent that in many of the arts of design we have far outstripped our contemporary brethren on the continent. Among our early Saxon progenitors we find that they attained to higher proficiency in the art of M. S. illumination than any continental school. It is proved by our records that painting in oil was practised in England 200 years before the time of Van Eyck, who is called the inventor of it, and it is well known that the French, until lately, were far inferior to us in ornamental work. The son of Mr. Taylor, who carried on business during Mr. Jackson's time, went over to France and was able to give the manufacturers there very valuable instructions, and he found that their paper hangings were far inferior to our own both in execution and beauty of design. Why, then, do we now find that we are obliged to confess their superiority in this branch, when we know that patterns of paper hangings (and I have myself seen them,) exist, manufactured 60 years ago, equal, if not superior, to those executed in France at the present day. Several of the blocks used in the production I have also seen, and their beautiful workmanship far exceeds those in use for present purposes. It is true that, until within the last few years, a noxious tax, imposed during the time of Queen Anne, weighed down the spirit and clogged the energies of the manufacturer, but the want of a proper national school of design was the grand evil, and kept in embryo the latent genius of English youth. These difficulties, it is pleasing to notice, are being fast overcome; and I hope soon to find our English name, proud as we all are of it, spoken of not only as retaining its ancient glory, but being as a password to all other nations for all that is talented and tasteful, as well as for all that is noble and honourable. About the year 1786 a Mr. Sheringham threw a new feature into the manufacture of paper hangings; this gentleman, who had spent many years on the continent, returned about this time to England and established a business in Great Marlborough Street. His enterprising spirit and refined taste led him to engage a number of artists of first rate ability, such men as Jones, Boileau, La Brie, and Fuzeli; he was thus enabled to introduce a style of decoration both unique and truly English in its character; he infused into the art a style which, for beauty and grace, was not equalled before nor since surpassed. Sheringham's productions were, indeed, characteristic of the true principle of the art. From this establishment emanated the leading decorators of the present day, and the first houses in London built their fame upon the foundation he had constructed. Sheringham was, indeed, the Wedgwood of paper stainers. About this time the Messrs. Ichardts, who had a manufactory at Chelsea, produced designs of most exquisite workmanship. Besides the mode then generally in use, they adopted a method of applying copper plates engraved to form the outline, and by an under ground of silver and gold worked up by hand in varnish colours, effects of the most beautiful kind were obtained, and they were highly illustrative of the ability of English talent when properly applied. This well directed taste, their eager desire to advance as much as possible their undertakings, their steady endeavour to adopt only the most beautiful patterns, and their determination to get them up in the best and most careful manner, is a lesson to some of our modern paper stainers, which would be well for them to take to heart, and learn by it that while they not only depreciate their own taste by producing, as in many cases they do, patterns which they are almost ashamed of when finished, but the character of the country suffers, and they lose the opportunity of improvement, while they prevent, in a great measure, the encouragement that would otherwise be bestowed.

The establishments of these gentlemen, though conducted with laudable spirit and enterprise, were destined to sink as they had risen, and the spirit of emulation ended with them. From that time paper staining in England kept on in its trodden path, without improvement, and without advance in taste. The French took up the ground that we had left, and their manufacturers were everyway encouraged by the government of Napoleon, and reached that standard of perfection their industry and perseverance so richly merited. But it is true while speaking of the ability of the French in comparison to ours, and of their continuing in the road we had prepared for them, they had no such difficulties as we have to contend with, while a heavy tax was laid on our productions, theirs were entirely free, while their government gave them every facility, we had to fight our battles singly and at our own hazard. While they had the best designs of great and illustrious men continually before their eyes to improve, in fact to create a taste, we were without any ad-

IMPROVED WIERS WITH FLOOD GATES.



vantages of the kind, and had to depend solely upon our own resources. Academies were instituted in France, at which every branch was cheaply taught. Our School of Design has only been in existence the last few years. Still with all these difficulties and drawbacks we have kept on amazingly, and improvements from time to time have been effected, particularly among the minor branches of the art, which were formerly in a very low and wretched state.

It is right that the example of those who have erected their temple of fame almost upon the ruins of ours, should cause a spirit of enquiry into the means to be employed in attaining our lost position. It is not for me as an humble individual to point out any project by which this great desideratum is to be accomplished; but I am certain from the increasing facilities which were and are every year receiving, and the attention that seems devoted to the Fine Arts at the present day, should also be an inducement to draw some important attention to the systems of improving paper-hangings in England.

If we cast our eyes towards the French as our principal competitors, we find that the methods in practice here are precisely the same as they have in use, that in the mechanical branches we are superior, and the colours we employ are far more durable; that at one time we equalled their productions of the present day; and the only difference that exists is our want of proper artists, and of course the want of proper instruction to educate those men for the profession, while they employ, as did our former manufacturers, men who understood the principles of design and the harmony of colouring, and who make it their aim to unite every beauty with taste and cultivated judgment.

We throw all this important branch upon persons who to gain a scanty living, require to unite the two professions of design and dealers in block cutting, and it is not to be expected but that those men will throw off a number of patterns of most inferior quality. They cannot be supposed to pay that attention that is required to produce a good article, nor have they ever had the means to educate themselves sufficiently to enable them to equal work, which is the result of careful, indefatigable study and practice. This shows a great want of encouragement on the part of English manufacturers, that we must hope to see remedied. The designer in England is not deemed the man of talent—the man of genius who is looked up to as possessing great and superior abilities—whose refinement of mind ensures him respect and honour wherever he goes: no! he on whom the manufacturer depends for his success in trade—he on whom devolves the important task of creating from his practised mind beautiful forms and elegant combinations, it is a melancholy fact, is paid less for his labour than the mechanic that is employed to print the pattern after it is prepared to his hand—who has no difficulty to overcome—no necessity for thought, nothing but what is the common power of animal strength to exert.

ON A NEW SYSTEM OF FLOOD-GATES FOR WATER COURSES BY M. THENARD.

(With an Engraving, Plate XVI.)

[This paper, which was read at the last meeting of the British Association at York, by Mr. Oliver Byrne, was kindly presented to Mr. T. Bermingham, from Ireland, on his late visit to Paris, by the inventor, M. Thenard who is about publishing a more detailed report of his experience on the various rivers in France upon which he has been engaged; the models, which are most ingeniously constructed by M. Thenard, are deposited in the School of the Bridges and Highways, and were shown to Mr. Bermingham. It is most highly creditable to M. Thenard and to his brother Baron Thenard that they permitted Mr. Bermingham to bring these inventions to this country unencumbered with patent rights. From the enormous sums which he knows have been spent, and are in course of expenditure upon the river Shannon, he is most happy to lay these invaluable inventions before the public, as in his mind they will tend to lessen the expences on works of the same nature in future.]

Report made to the Society for the Encouragement of National Industry,[1] *by* M. VANVILLIERS, *in the name of the Committee of Mechanical Arts, on a System of Flood-gates, for Water-courses, with Moveable Wiers. Invented by M. Thenard, Principal Engineer of Bridges and Highways; and executed on the river Isle, Department of the Dordogne and the Gironde,* for which the Society on the 6th September, 1843, awarded M. THENARD its Gold Medal.

[Throughout the Report are retained the French technical terms *Barrage-mobile* (a moveable wier) and *Hausse* (floodgate or sluice.)]

Navigation, irrigation and industry require that in almost every situation the running waters should be raised up, in the beds that hold them, at those times when they are least abundant. In seasons of superabundance it is also of paramount importance, that waters should be promptly and freely permitted to flow on in their natural courses. For small water courses, these conditions have been amply fulfilled by the construction of sluices, flood-gates and wiers, the varied compositions and effects of which are well-known. In the case of great rivers, the problem is more difficult to solve, in consequence of ice and broken pieces of floating bodies being drawn in by the current, they require that all obstacles opposed to the free passage of the waters should be instantly removed; to this purpose has the ingenuity of man been directed for the purpose of applying them for the uses of navigation, irrigation, &c.

M. Thenard, engineer in chief, since 1828, of the canal operations on the river Isle, which stood greatly in need of carrying out the foregoing conditions, has been occupied unceasingly in the search of, and experimenting upon the means of arriving at this result.

He has so far succeeded in combining and executing such dispositions, that he can sustain the waters of the river Isle at 7 feet 4 inches above the level of the bed, procure a convenient draught of water to get boats up during dry weather, maintain them at this level sufficiently long so that the free flowing of the river is incapable of drawing them away, and having arrived at this point, restore the waters to their natural course, in order not to expose the vallies to submersions prejudicial to establishments which have for their objects the keeping back of water and navigation.

The first report addressed to the Administration of Bridges and Highways, on the trials made by M. Thenard, is dated in 1831; it announced the good opinion formed of them by the Inspector of the Division. In 1839, so as to verify it, another commission composed of inspectors general and divisional of bridges and highways was appointed by the government. M. Thenard, having prefected with skill and success, a happy idea of a provisional flood-gate, suggested to him by the divisional inspector, M. Mesnager, during the inspection of the navigation of the *Isle*, was enabled to render his system of *Barrage* more complete and applicable to many other rivers. The commission concluded at one visit, that experiment should be made and executed by the commission assisted by M. Thenard, the inspector of the division, and many engineers from the neighbouring localities. On the 4th of July, 1841, the commission concluded their experiments, and reported thereon.

Up to this time M. Thenard had not had occasion to apply his system, except to fixed existing *barrages*, and to elevate the water of 2 feet 6 inches or more above the crest. The central government manifested a desire that he should elevate the water from 3 feet to 4 feet.

Confiding in the certainty of his system, M. Thenard obtained authority to make a trial, the important results of which are the object of his communication to the society and of the present report, and in which the retained body of water above the lower level was raised to a height of nearly 9 feet.

The convictions to which these trials and observations have successively led M. Thenard, are as follow.

The trap doors or sluices that M. Thenard calls *hausses*, are attached to hinges on the upper horizontal surface of the stationary portion or apron of the *barrage*, and in number sufficient to equal its length, the sluices are in length horizontally about 4 feet, and in height 5 feet 6 inches. On the lower face there appears an iron prop similar to the props which are adapted to certain dressing glasses and reading desks, and which abuts against a stop fixed in the apron in the dock.

When the *hausses* are raised and propped up they form a partition or *barrage*, which stops the water and raises it up the river, even to exceed its natural level; if the *hausses* are let down, the water flows and resumes once again its natural course.

To produce this effect, there is placed, along the entire length of the *barrage*, and above the apron a flat iron bar which runs across the river and along the foot of the props. This bar has at one of its extremities a rack which works in a pinion fixed at the bottom of a vertical axis that can be made to turn fromabove by a capstan. This rack is made to move backwards or forwards as many inches as it has *hausses* that require manœuvering. The bar has on its lower edge a tooth or cleet on the side of each prop, and which are subdivided in such a manner that by the removal of the bar the foot of each prop, the hinge of which permits a slight circular motion, is successively drawn away from its bed or berth when the *hausses* are left without support, to turn on their hinges, and lower themselves one by one at pleasure from up the river to its downward fall, on the apron of the *barrage*; the props at the same time stretching themselves down the stream.

When the overflow of water has stopped, and that it is required to raise up the *hausses*, the current is opposed to bringing them back again from the lower to the upper part of the river. To accomplish it, use is made of a system of *contre hausses* of the same length as the *hausses*, but of a height less by 7 inches, and being capable also of being turned down towards the up stream; during all the time that the *hausses* are either raised up or lowered down, the *contre hausses* remain lying on the apron when a spring latch retains each of them against the action of the current which has a tendency

[1] Society for the Encouragement of National Industry, founded in 1802, recognised as an establishment of public utility by a Royal ordonnance of 21st April, 1824, 42, Rue du Bac, Paris.

to lift them up. There is an interval of about a foot between the range of *hausses* and of *contre hausses*.

A flat bar of iron of the kind already described, with shifting movement, regulates the opening and closing the *contre hausses*. At each progression of an inch a staple presses and releases the latch, and the corresponding *contre hausse* submitting to the effort of the current, turns round on its hinges and raises itself to a vertical position, a bridle chain cramped on the solid part of the apron prevents it from going too far. By this method, which produces an immediate effect, is formed a second *barrage* above that which existed before the letting down of the *hausses*; the current remains suspended, the upper edge opposes the flow of water, and allows the lock keeper to raise the *hausses*.

To facilitate this operation M. Thenard has placed on the upper part of each *contre hausse* an iron man-rope, which supports an iron gangway suspended at nearly the same level to which it is intended the retained body of water should rise.

The lock keeper stands on the gangway, furnished with a little portable windlass which he rests on the man rope; and catches the *hausse* with a hook attached to a rope; he rolls this rope on the cylinder of the windlass, and draws towards him the *hausse*, and with it the prop or stay that supports it against the slipper, and at the same time he hooks it on to the *contre hausse*. He proceeds thus through all the *hausses* in succession. When all are hooked he hastens the filling up of the space between the *hausses* and *contre hausses* by drawing with his hand the vent plugs fixed in the *contre hausses*. This done, the latter are balanced by a volume of still water; the lock keeper then unhooks in succession each *contre hausse* and abandons it to its weight, which exceeds that of the volume of water which it occupies, to fall down on to the stone work of the *barrage*, it then latches itself there anew, and the body of water is once again held in perfect retention by the *hausses*.

These manœuvres are performed with precision a d quickness. The report of July, 1841, states, that at the *barrage* of Coly, which is 57 feet 6 inches long, with the *hausses* 2 feet 8 inches high, two men, in 8 minutes, lowered the *hausses*, raised the *contre hausses*, then righted the *hausses*, and relaid the *conter hausses*. In this space of time, 16 seconds were sufficient to lower the *hausses* and make the *barrage* disappear, and 20 seconds *only* were occupied in raising the *contre hausses* and restoring the mass of water in retention.

The report of the Commissioners appointed by the Academy of Science, Belles Lettres, and Arts at Bordeaux, of the 10th January, 1843, states that at the *barrage* of St. Antony, which is 27 feet long, formed by seven *hausses* of 4 feet long each and 5 feet 6 inches high, and by seven *contre hausses*; the *barrage* manœuvre was performed twice in 30 minutes—*i.e.*, in one minute per linear yard of *hausses* or *contre hausses*. M. Thenard flatters himself that the height of 5 feet 6 inches is not a *limit* for the application of his system: he has been obliged to confine himself to this height at the *barrage* dam of St. Antony owing to local circumstances, he thinks he could carry it to the height of 10 or 13 feet the *hausse*.

Already, by practical experience, has he solved a beautiful problem in hydraulics, which has frequently occupied the attention of engineers, and of which there exists but one other solution, totally different, it is the work of M. Foirée, Divisional Inspector of Bridges and Highways.

M. Thenard has combined in his construction many capabilities which facilitate the working of, and prevent the inconveniences which floating bodies and matters deposited by the current might occasion, the consequences of which would be to perplex the operations of the *hausses* and the *contre hausses*, he has fixed vent holes in the partitions of the *hausses* to drive away down the river such bodies as may have been stopped or deposited on the apron. The teeth or cleets of the iron bars move in the whirlpools, the entrance to which is closed by grooved traps which render the deposits less abundant than might be supposed. He can remove those which have already formed themselves by a pressure and a current produced by turning water through the upper opening of the pipe in which it turns the axis of the pinion. To avoid the loss of water which must ensue from openings or interstices of about an inch, which cannot be avoided between two consecutive *hausses*, or between the *hausses* and the side walls there is placed a little board which covers the joint and hinders the flow.

Experience has proved that the *letting down* is unattended with hurtful jolting, because it is done under a sheet of water which is flowing with the greatest rapidity and which instantly deadens all shocks.

The *contre hausses* under the trench of water which covers them over, seem to hesitate a moment in raising themselves up, under the impulse of the current; they do not attain any great degree of velocity until in the last portion of their movement, the acceleration is greatly modified by the mass of water the *contre hausses* already raised up send back laterally against the others. Up to the present time there has not been any serious difficulty experienced in performing the manœuvres; branches, weeds, gravel and sand which might interfere with them are easily dragged away or removed.

It is easy to conceive that within certain limits *hausses* and *contre hausses* of a greater height than 5 feet 6 inches, can be employed and worked.

It is the work of experience and time to pronounce upon the preservation, keeping in repair, and replacing the moveable parts, under and out of the water, of which the apparatus of M. Thenard's *barrage* is composed. It is under the proof of ice formed underneath, raised to the surface and carried away by the current, against the *hausses*, that we can judge definitively of the power of resistance in the actual constructions and the modifications that may be applied to them. We can rely with confidence on the skilful perseverance of M. Thenard to ward off any inconveniences that have not as yet presented themselves.

In the mean time, the *barrages-mobiles*, such as are executed at St. Antony, reflect honour on the inventive talent of M. Thenard; they appear to be susceptible of numerous and important applications, and to justly the approbation that the Committee of Mechanical Arts deem themselves empowered to give, and recommend the Council of the Administration to award to them.

The Committee proposes, besides, to insert in the Records of the Society the present Report, as well as the drawings and descriptions which accompany M. Thenard's memorandum.

Explanations of the Figures and Plans.

Fig. 1. Plan of the *Barrages-mobiles*, or wier with moveable flood-gates, with all their appendages, one set of the *hausses* or gates is thrown down.

Fig. 2. Transverse section of the same on the axis of one *hausse* and *contre hausse* on the line X X of fig. 1.

Fig. 3. Another transverse section, the *hausse* and *contre hausse* being down on the line Z Z of fig. 1.

Fig. 4. Section of one of the slippers, upon which slides the support of the *contre hausse*.

The same letters represent the same objects in the figures of the two plans.

A. The left-hand gangway where the lock-keeper regulates the opening and shutting of the *hausses*.

B. Radiated mason work, or apron, under water, in which the lower portion of the *barrage* is fixed.

C, D, D'. Sills of strong oak beams grooved into the apron, on which they are fixed by as many iron cramps as there are gates or *hausses-mobiles*.

E. F. G. Three gates, or *hausses-mobiles*, raised by a quarter revolution round 3 pair of horizontal hinges, *a a*, fixed on the sill C. These three gates, slightly incline down the river, as shown in fig. 2, and are supported in this position by three strong legs with hinges, *b b b*.

H, I. Two gates, or *contre hausses-mobiles*, lying on the apron.

b, five strong stays fixed to hinges upon the lower face of the *hausses*, E, F, G, to sustain them when they are raised against the pressure of the water retained by these gates.

e, c, c, c, c. Five slippers fastened with cramps upon the stone apron, and in each of which is inserted a short thick piece of iron close to the feet of the iron stays or supports *b*, besides a groove, along which groove these stays glide and allow the gates to drop down when the teeth or cleets *d*, of the longitudinal bar J, which is put in motion by the windlass E, has pushed the stays aside into the groove *n*, furnished with fillets *o*, on each side as guides.

J. A flat longitudinal bar, fixed upon the apron above the slippers and above the feet of the stays which support the gates when they are raised. This bar has as many teeth or cleets *d, d, d*, as there are stays, so that at each horizontal movement that it makes when drawn by the windlass E, towards it, it displaces first one stay, and that the farthest off, and then the others in succession, till all the gates are down.

K, K, K. Three raised *contre hausses* or gates, alike to, and corresponding with the gates or *hausses*, E. F, G. each *contre hausse* is retained in its vertical position, against the pressure of the water, by a double chain *f*.

The *contre hausses*, lying over the lower chambers of their chains, are retained in this position, against the efforts of the current which tends to raise them, by a latch and spring, placed under a chin solidly fixed on the sill of oak iron tie bar bound to the stakes or piles L, L, L.

f, f, f. Three double chains fixed at the upper part of the apron, each has a ring fastened on one of the stakes, L, in order to retain, against the pressure of the water, the raised *contre hausses*.

The stakes, L, of oak, are bolted to a horizontal timber sill or spring to render them solid, they traverse the apron and are bolted below to a frame of timber, as appears in the section, fig. 2.

M M. Five other similar stakes united with the preceding ones by the iron ties, *g g*.

N. A flat bar of iron moved by a windlass longitudinally by means of teeth cut in the extremity of the bar working into a pinion fixed at the foot of an iron axis which is turned on the top by a small capstan. There are as many teeth as there are bolts in the *contre hausses*, it disengages them one after another as the bar draws the cleets against the latces the current of water then raises the *contre hausses* in succession side by side to form a temporary barrier and also facilitate the raising of the *hausses* that are down.

O, O, O. Three gangways of iron, hung on hinges and by two little chains *p, i*, to two iron stanchions *e*, fixed and bolted on the upper border of each *contre hausse.* These gangways are raised by the current with the *contre hausse*, and to put them in place it is sufficient to turn a little windlass. One of the gangways O. is shown raised against the stanchions which support it, as it ought to be at the moment when the lock-keeper goes to let down the *contre hausses.*

P, P. Two gangways lying under the stanchions which support them, these stanchions are bolted on to the two *contre hausses*, H I. *i, i.* The two highest of four stanchions, to which are suspended the two iron gangways of the *contre hausses* when down. *k, k.* Two other stanchions, shorter so that the handle of the little portable windlass can act without interfering with them.

l. A hole in the stone work through which passes a funnel or pipe to be filled, full of water, at the bottom of the pipe is a socket fitted with a plug, which is opened after the pipe has been filled, when all the fine sand and mud which may have passed through the cavity in the stone work, forming the chamber of the windlass, is instantly driven forth; this chamber is otherwise in ordinary closed by a little iron cap, which is withdrawn before the mud is driven forth; this cap is a protection against the entrance of gravel to the chamber of the windlass, at the bottom of the pipe there is a recess hollowed out so as to allow the free passage of the indented extremity of the iron bars, N and J.

Q. Steps cut in the thickness of the masonry to descend to the gangway of the *contre hausses;* it is furnished with an iron hand-rail.

R. Wooden frame under the upper portion of the stone apron; it is to this wooden frame the stakes or piles L are fixed.

S, S. Grooves contrived in the left hand buttress through which the axes of the windlasses pass. These axes are moved by the lock keeper turning a strong horizontal cross, by which means he pulls or pushes the horizontal iron bars, J, N.

T. Cavity in which the chain is lodged when it is coiled up by the clearing of the *contre hausses.*

V. Jointed planks or sheet piling.

m. Iron work of the lower hinge, to the number of two on each *hausse* or *contre hausse.*

q. An iron ring fixed on each *hausse* to raise it with the fangs of a hook directed by the cord attached to a little axle mounted on the two iron stanchions on the back of the *contre hausses.*

r. A hook which provisionally connects each *hausse* with its corresponding *contre hausse*, before lifting the little iron plug placed at the foot of each *contre hausse*, to prevent the water which passes through the plug hole to fill the interval between the *hausses* and the raised *contre hausses* pushing them back and destroying the gangway before the lock-keeper is prepared.

There exists at the foot of each *hausse* iron plugs *s s*, fig. 1, which correspond with those of the *contre hausses;* they serve 1stly, to throw the *contre hausses* downwards that nothing may obstruct the notches *d*; 2ndly to empty the water, provisionally, which may pass through the joints of the *contre hausses*, or even over or beyond them in order that this water may not present obstacles to the raising of those lying down.

Description of some of the Ironwork of the Barrages-mobiles.

Fig. 5. plan showing the spring bolt which holds the *contre hausses* when down, as seen in plan fig. 1. This and the following figures are designed on a double scale. Fig. 6. Elevation of the same, and Fig. 7, transverse section; *g*, ties of iron uniting the two lines of stakes or piles L, M; N, the longitudinal bar of iron; [3], spring-bolt or latch to retain the *contre hausses* when down; [4], chin or staple on which this spring-bolt is caught; [5 5], iron bolts with eyes above to hold down the spring-bolt; [6], a small cleet of iron fixed on the long bar N, to push the spring-bolt aside from the *chin* or staple; [7], inclined plane to enable this bolt or latch to rise and fall; [8], iron bolts for fixing the planks and hinges of the *contre hausses* to the ledges; [9], large iron bolts for holding the chains of the *contre hausses*; [10], other iron bolts for holding the tie *g*; [11], spring of the bolt or latch.

Fig. 8. Plan of a spring latch which can be used to replace the bolt for retaining the gates when lying down. This kind of retaining power has been used for many years in the flood-gates established on the river l'Isle, at Colly, Melette, Fontpierre and Caillade. Fig. 9. Elevation of the same latch, and fig. 10, section. [12], spring latch to retain the gates when lying down; [13], chin or staple on which this latch is caught; [14], iron bolt with gimble to hold the end of the latch; [15], small cleet of iron fixed on the long iron bar N, and intended to push the latch aside from the chin or staple; [16], inclined plane which enables the latch to rise or fall in its movement going and coming; [17], spring of latch.

M. Vanvilliers has made another Report in the name of the Committee of Mechanical Arts, on the projects presented by M. Thenard, for the combination of his system of Barrage-mobiles, with large sieve-like sluices of 65 feet opening, and large channels also of 65 feet opening. This Report we propose to be the subject of a future paper, which is now being prepared by M. Thénard, and which he has kindly undertaken to forward, when complete, to Mr. Bermingham.

ATMOSPHERIC SYSTEM—M. CHAMEROY.

M. Chameroy disposes of his locomotives, applicable to our double line railways, in the following manner:—He places between the two ways a conductor or pipe, formed of iron plates and bitumen, submitted to a high pressure. This conductor, which is of a diameter proportional to the impulsive force that is required, is buried in the soil; throughout its length, and at certain distances, are established branches, which come and terminate at the centre of each line; these branches are composed of a cylindrical tube, to which is attached a cock, the key of which carries a cog-pinion. On this cock is fixed vertically a pipe, in the form of a hollow cone, flattened, and divided internally by a transverse partition. This cone is surmounted by a cylindrical aspiratory tube, placed horizontally, and parallel to the line; the diameter of this tube is one-half less than that of the conductor; it is divided into two equal parts by a transverse partition, which closes hermetically; its length is about a metre. At each of its extremities there is an external gear, and a hollow cone pierced by a certain quantity of holes. On one of the sides of the branch a groove is placed back, in which slides a vertical rod; the superior extremity of this rod is furnished with a plate, and the inferior extremity with a hook, which cogs with the pinion fixed to the cock. The inventor causes to travel on these branches an articulated tube, which he attaches under the wagons, by means of springs and chains. The length of this tube is that of the train; its diameter is equal to that of the conductor; it presents a longitudinal opening, shut by a valve, with two parallel and juxta-posed partitions. Each extremity of this tube is widened, and armed with a valve and lever. Under the first and last wagon are fixed two moveable supports, placed obliquely, and parallel to the wagons.

Description of its Operation.—Stationary, hydraulic, or steam-engines, are established at a distance of 10,000 metres (about 6½ miles), from each other throughout the extent of the line to be worked; these engines serve to work pneumatic machines, which are put in communication with the conductor, or pipe, placed between the two lines. When there is necessity to set a train in motion, there is attached beneath the wagons a towing tube; one of the valves placed at the extremities of this tube is opened, whilst the other remains shut, and that part of the towing tube which has the valve open must be previously fixed in an aspiratory tube; this process being adopted, and after having effected a vacuum in the conductor, the cock of the branch in which the towing tube is engaged is then opened by hand. The communication is immediately established between the conductor and this towing tube by the interior of the branch, and by the aspiratory tube. The atmospheric pressure is immediately exercised in the fixed transversal partition of the aspiratory tube, forming the basis; it exerts itself, at the same time, throughout the external surface of the valve formed of the towing tube, which forms the point of resistance. This pressure determines the movement of the towing tube, which slides in the gear, adapted to the aspiratory tube—at the same time, the longitudinal valve of the towing tube opens for its passing on to the branch to shut itself immediately afterwards. As soon as the posterior extremity of the train arrives at this branch, a support shuts off the cock—and, at the same time, another support, fixed at the head of the first wagon, causes the cock of the second branch to open, by pressing the hook; at this moment the vacuum ceases to be communicated to the towing tube by the first branch, whilst it is produced by the second. The shut off valve of the towing tube then opens to slide over on to the first aspiratory tube; this valve shuts instantly by its own weight. The atmospheric pressure acting again, the towing tube draws the train to which it is attached. To suspend the progress of the train, they avoid opening the cocks, by raising the supports; to stop or neutralise the speed they employ breaks; to retrograde, they open the valve of the towing tube which was shut, and shut the other valve which was open.

Chief Advantages of this System.—A single conductor, or pipe, of iron plates and bitumen, will cost one-half less than a conductor of cast-iron. It will perform the duty of a railway with a double line of rails. This conductor being buried in the soil is out of the way of injury. Its internal and external maintenance amounts to nothing. This conductor forms a vast reservoir, which serves to contain the element of the locomotive power, which can be disposed of at will, either to give to loaded trains the greatest locomotive power, and the greatest possible speed, or for the ascent of the inclines. He can retrograde, diminish, or neutralise, this power for descending the incines, or for stopping the progress of the trains—in fact, this power will not be spent but for useful purposes. During the stoppages, as well as when the trains are in progress, the pneumatic engines perform and store up constantly into the conductor the locomotive power. The conductor being shut, and subject to a high pressure of its contents, there is no fear of the entrance of air. Its position underground will permit its being laid on a level. It will be possible to start many trains on the same line, and, for this reason, to send assistant wagons. The nature of the towing tube, with articulations, will permit the clearing of curves of 300 metres (984 feet), radius, and the jumping motion of the wagons will be neutralised by the towing tube. M. Chameroy has established a model of his system at his factory for iron pipes; this specimen is of 100 metres (328 feet), in length, and many trials have already taken place in the presence of engineers, who have pronounced the idea of M. Chameroy to be very simple and very ingenious. At this time, when the revenue of the state is to be partly employed to determine which is the most practicable and best system of atmospheric motion, it is necessary that every inventor should exhibit his own ideas, and that the ideas of all the inventors should be examined and discussed seriously and conscientiously.—*Moniteur Industriel. Trans. Mining Journal.*

THE NEW METHOD OF EVAPORATION OF M. ADOR.

Report by Messrs. Armengaud, Civil Engineers.

Having been ordered by Messrs. Ador and Bidault to prove the results of which the new system for distilling fuel was capable, when applied to the evaporation of water, and which is the patented invention of M. Ador, we repaired to the foundry of Madame Jammetel, where the apparatus was fixed up, and which we were enabled to examine minutely. This apparatus of M. Ador is composed of a cylindrical boiler of copper, 3 feet 4½ inches diameter, and 6 feet 6 inches in length, and inclosed in a brick furnace, from the end of which it projects 16 inches, or thereabouts. Under this boiler, in front of the furnace, is a cast-iron retort of a form nearly elliptical, having an internal length of 5 feet 6 inches, and an extreme diameter of 21 inches, and a minimum of 10½ inches. This retort is for the distillation of coal, and was heated by means of coke placed on a grating underneath. On the side, and in the same furnace, were two pneumatic heating tubes of 5 feet 6 inches in length, and of 9½ inches internal diameter, constructed of cast-iron plates of about a fifth of an inch in thickness, which are to receive the condensed air by two piston pumps, working rectilinear and alternating, each being of the following dimensions:—Internal diameter, 12¾ inches; the course, 9¼ inches. The diameter of the pipe which conducts the condensed air of the two pumps with the heating tubes was 1½ inch in one part of its length, and an inch near the tubes. These tubes, as well as the retort, communicate with the interior of the boiler. The view, therefore, of this invention of M. Ador, is to effect the evaporation of water by the combustion of gases resulting from the distillation of coal, and brought in contact with a current of hot air, and then to utilise these gases and heated air as an additional motive power to that of the steam from the engendered water. The apparatus works in the following manner:—The retort is charged with coal, as is done in the ordinary gas machinery, to about three parts of its capacity. The boiler is filled with water to the ordinary level, according to the work which is to be performed, when the fire is placed on the grating, this heat is continued until the retort arrives at a temperature sufficiently red hot for inflaming the gas by a light, and its combustion by a current of air. At this moment pumping is commenced and the air sent into the tubes, in the interior of which it heats itself, so as, on going out, it inflames the gases in the interior of the boiler. The result of this combustion is, that the water is heated, and soon gets into an ebullition. Therefore, if we collect the steam which is disengaged, as well as the gases and the heated air which combine with it, there is obtained a motive power so disposable as to be used like ordinary steam. We must remark here, that as in this operation the gases are entirely burnt, and the coke consumed in the grating, there ought to be no smoke from the chimney, and this was proved in the most decided manner. After having made ourselves perfectly acquainted with the nature of M. Ador's apparatus, and its operation, we proceeded to work in the following manner:—The apparatus having been worked overnight, we caused the retort to be perfectly emptied, as well as the grating underneath, when we placed in the retort about 132 lb. of coal. We filled the boiler with a cubic metre (34 cubic feet), or 1000 litres (220 gallons), of water, and as the furnace was still hot, we observed that the temperature of this water was at the beginning of the operation 122° F.; we also weighed out 88 lb. of coke, so as successively to charge the grating. After this, we caused the retort to be heated, and placed the fire on the grating at 5 min. before three o'clock. Up to ½ p. 3, the fire remained very inactive; at 33 min. p. 4 the gas was inflamed, by opening the cock of a small escape tube placed in the interior of the furnace, and used for the purpose of knowing the degree of distillation at which we arrived, but it did not burn without some difficulty, and it was not until ½ p. 5 that the gas was found to burn in an efficient manner by a continuous current of air; at this time the pumps were not going, for which purpose two men were placed at each extremity of the beam which moved the pumps, when we perceived that the water of the boiler had preserved its primitive temperature of 122° F., and that there had been no portion of heat used to heat the water of the boiler, whilst the temperature of the products of the combustion was 248° F. The pumps were kept going, and the grating was charged until a ¼ to 7 o'clock, at which time the steam from the water commenced forming. At a ¼ to 8 we found 6 gallons of water evaporated, and at ten minutes past eight 12 gallons; as the boiler was open at the top, this steam disengaged itself with the gas and the hot air. The 88 lb. of coke weighed at the commencement of the experiment was consumed, and the grating was charged with a new supply of coke, when we continued going till ten o'clock, after some short intervals of stoppage, between eight and ten o'clock, for slight repairs. At the above hour the experiment ceased, when the total quantity of water evaporated was found to be 32 gallons, and the addition to the coke on the grate was 27½ lb. On the next day, the 14th, we opened the retort from which we took 99 lb. of coke, so that 33 lb. had been converted into gas, and served for the evaporation of 32 gallons of water. We drew out from under the grating 26 lb. of waste, containing 18 lb. of cinders. On this quantity we might have employed again 16½ lb., so that the total quantity of coke consumed on the grating was 99 lb.

The above report which originally appeared in the *Moniteur Industriel*, and translated into the *Mining Journal*, is followed by a digest of the operation, and concludes by observing that by the ordinary boiler and burning of coal, that the effect would give less than 2 horse power, and that by M. Ador's improved method the effect produced is equal to 4 horses, from which is to be deducted the motive power of four men for working the pumps, which the reporters consider is equal to ½ a horse power, leaving a power 3½ horses, and even admitting other losses they say that by Ador's system there is a saving of from 40 to 45 per cent.

We are disposed to dispute this reasoning, but we do not consider it necessary to enter into the calculation of horse power, but simply to compare Ador's improved method of evaporating with that of the ordinary method of heating a boiler; according to the above report there were 99 lb. of coke consumed on heating the retort, and very singularly there were 99 lb. of coke taken out of the retort at the conclusion of the experiment, consequently the quantity of coal, 132 lb., that was put into the retort is the actual expense of evaporating 32 gallons, or 5⅓ cubic feet, of water, now according to Watt's data, 132 lb. of coal ought to evaporate ($\frac{132}{8}$) 16½ cubic feet of water, being three times as much as by Ador's method, and if we refer to Pambour's experiments, it will be found that a locomotive boiler consumed on an average 10½ lb. of coke, and in some cases as low as 7·1 lb., for evaporating a cubic foot of water, at the present time this will be found nearer the average, and we have no doubt that many of our marine boilers do not consume more than Watt's allowance of 8 lb. per cubic foot. It will thus be seen that instead of Ador's system of evaporating being an extraordinary saving it will be an extraordinary dear one—when we take into consideration the expense of working the pumps.—*Ed. C. E. & A. Journal.*

ASTRONOMICAL OBSERVATORIES.

As it may frequently be of use to engineers in different parts of the country to ascertain the nearest observatory, we have given the following table, showing the latitudes, longitudes, and names of the observers, of the principal public and private observatories in England, Scotland and Ireland. The longitude is given in minutes and seconds, showing, when marked thus + the time is faster than Greenwich, and thus − the time is slower than Greenwich. It will be recollected that 1° is equal to a difference of four minutes in time, so that it will be easy to reduce the longitudes from time to degrees when required. Thus, to find the distance of Dublin in degrees, convert the time into seconds, $4' \times 60 = 240''$, and $25'\ 22'' = 25 \times 60 + 22 = 1522''$, then $\frac{1522}{240} = 6{\cdot}342°$.

	Lat. North.			Long.		
Aberdeen—Marischal College	57°	8′	57·8″	+0h	8′	22·78″
Armagh—Rev. Dr. Robinson	54	21	12·7	+0	26	35·5
Bedford—Capt. Smyth, R. N.	52	8	27·6	+0	1	51·97
Blackheath—Hon. J. Wrottesley	51	28	2	−0	0	2·7
Bushey Heath—Colonel Beaufoy	51	37	44·3	+0	1	20·93
Cambridge—Professor Challis	52	12	51·8	−0	0	23·84
Dublin—Sir W. Hamilton	53	23	13	+0	25	22
Durham—Professor Chevallier	54	46	14·9	+0	6	18
Edinburgh—Professor Henderson	55	57	23·2	+0	12	43·6
Greenwich—Professor Airy	51	28	39	0	0	0
Makerstoun—Sir Thomas Brisbane	55	34	45	+0	10	4
Ormskirk—Rev. W. R. Dawes	53	34	18	+0	11	36
Oxford—Professor Johnson	51	45	40	+0	5	1·5
Portsmouth	50	48	3	+0	4	23·9
Regent's Park—G. Bishop, Esq.	51	31	30	+0	0	37·1
Slough—Sir J. F. W. Herschel	51	30	20	+0	2	24
South Kilworth—Rev. W. Pearson	52	25	51	+0	4	26

NECROLOGY.—Lepere, the architect of the Church of St. Vincent de Paule, at Paris, in which work he had Hittorf for an associate, died July 18, at the advanced age of eighty-two. Beyond this we have not been able to ascertain the slightest particulara relative to him, for on turning to the "Kunstler Lexicon" of the accurate and pains-taking Nagler (see *ante*, p. 204), all that we could find there was that there is not a syllable about him, notwithstanding that it contains such an innumerable quantity of names which have either been long ago utterly forgotten, or have never been heard of at all.

Carlo Paginini, professor of architecture of Milan, died also very lately; and he, we find, is one of Nagler's very numerous absentees. Neither do we learn anything at all respecting him from the publication which mentions his death,—not even a single date or anything whatever to assist in research.

REVIEWS.

Geology, Introductory, Descriptive, and Practical. By DAVID THOMAS ANSTED, M.A., F.G.S., Prof. of Geology in King's College. London: Van Voorst, 1844.

It is one of the advantages attendant on the establishment of geological professorships in the colleges of the University of London, that as the professorships are working ones and not mere sinecures, and as, too, they are addressed to students intended for many active pursuits, that geology is now being more practically studied, and more practically applied. The engineer, well aware of the intimate connection his pursuits have with geology, and deeply interested in it, has hitherto, when willing to apply himself to the study, been checked either by the meagreness of the information most valuable to him, or by the preponderance of matter of a purely technical or theoretical description. Geological works are either of a purely popular and elementary character, or else addressed so exclusively to speculative points or questions of natural history, that the engineer has rarely been able to avail himself of such productions. It is true that in works of a miscellaneous character much valuable matter is to be found; the writings of Smith, the father of geology, of Delabêche and of Sopwith, abound with practical hints, but the general student either does not know where to find them or has not the time to wade through so many works. In delivering geological lectures to engineering students, it was in the power of the professor to digest and systematize this scattered information, and by this proceeding the way was prepared for supplying a still more important want on the part of the engineering profession, a competent text-book on geology. A work was required which should form a good elementary introduction, but carried out in consonance with the advancement of science, and giving a fair view of general principles, without verging too much on mere speculation or giving undue predominance to the theoretical department, while of course it must be so carried out as to give prominently all the practical applications of geology to the pursuits of the engineer. Such a work has been undertaken by Mr. Ansted, a pupil of the distinguished Sedgwick, and Professor of Geology in King's College. Mr. Ansted has devoted himself conscientiously to the task, and not merely has he brought to bear upon it his own knowledge, and the latest published information, but he has in many cases held personal communication with eminent geologists, so as to make the work a text book of the state of geological science up to the latest moment of publication. Moreover, Mr. Ansted modestly states that, without pretending to be a practical miner or engineer, he has taken some little trouble to qualify himself so far as to be able to appreciate what is required by the practical man, a preliminary too often neglected, though of imperative necessity to form a competent practical teacher. In perusing the work, it appears to us that the author has well executed his task, and we only regret that it has not been in our power to bestow upon it longer time than we have already done, or to devote more of our space than we do on the present occasion to a review of its contents. It is our intention specially to consider that portion of the second volume which is of practical application, and we shall defer until that period the few remarks we have to make as to the value of this study to the engineering profession; although, perhaps, they ought to form our introduction, nevertheless we think it more proper in the first instance briefly to illustrate the necessity which exists for such a work in a general point of view.

Those who have watched the history of geology are fully aware that it is a progressive science. An old text-book on anatomy may be still available, for it is sound as far as it goes, and the general features of the science are unaltered, though more minute discoveries have been made, and increased power of observation has been able to discriminate some of the finer details, such too is the case with regard to most other sciences. Geology, however, has not enjoyed the labours of centuries, it is an entirely new science, founded in our own day, developed under our very eyes, and progressing with the rapid growth of infancy. Every year brings forth some new and most important fact, and every such discovery, as it enlarges the boundaries of the science, throws fresh light on former discoveries, and very frequently necessitates a new classification and new terminology. The unthinking are too apt to complain of this treating words as facts, and not as the representation of facts, they do not well appreciate the nature of either nomenclature or system. Both these are essentially artificial; they are intended as a kind of artificial memory, to enable us better to appreciate the connection of facts and phenomena, but not to imply the existence in nature of such assigned classes, tribes or collections. The whole system is entirely artificial; if we collect together in a class or family for our convenience a number of animals or plants closely resembling each other, we are not to imagine there is in nature any distinct boundary between several classes. It is difficult for the naturalist to draw the bounds between the whale and the fish, between animal and vegetable nature, yet no one disputes the benefit of the received system of classification, or believes that a line of division has been surveyed, staked out and accurately determined. So, too, in geology, we talk of secondary and tertiary formations, but we are not to believe therefrom that the Author of creation left off work and began a fresh and distinct series—the terms are only conventional and convenient. It will readily be conceived, therefore, that any important discovery will enable us to check and revise our existing system of classification, and that it becomes frequently necessary for the convenience of students so to do. Such is the case in every new science, and is particularly so in Geology, and it is essential that competent works should from time to time be compiled, which will enable the young student to begin on sound principles, and the old one to correct his previous studies.

Most of our readers are aware that the classification for some time prevalent went to establish a system of primary, secondary and tertiary formations. The granites, syenites, porphyries, and other unstratified rocks, being generally found as a basis to the strata of the crust of the earth, received the name of primary, it being intended thereby to express that they were of the earliest date. Here, by the bye, we may observe that these questions of classification are not of mere speculative value, but are of great importance to the engineer, the determination of the age of rocks being an important element to enable us to search for coal and other minerals, for slates and building stones, and influencing greatly the nature of the strata in tunnelling, boring, and subterranean operations. Such being the system of classification, recent researches have established that granite and most of the unstratified rocks are of very various antiquity, some indeed being of the earliest date, others however to be found in very recent formations. The establishment of these facts has necessarily very much altered the views of geologists, and these rocks of various dates have been formed into a class by themselves, of crystalline and unstratified rocks, including the igneous rocks, as granites, granitic rocks and porphyry; the metamorphic or altered rocks, as gneiss, micashist, clay-slate, basalt, lava, and trap-rocks. The stratified rocks are still divided into three classes, but the first class is now denominated *Palæozoic*, a term suggested, we believe, by Mr. Murchison, and indicating merely the fact "that the strata so called contain the fossil remains of the earliest formed animals." The other great classes are still called secondary and tertiary, though it has been proposed to term them *Mesozoic* and *Kainozoic*. In the same way as the general classification has been so modified, the same spirit of improvement has affected the minor divisions of the palæozoic, secondary and tertiary formations. The reserches of Professor Sedgwick, in 1831 and 1832, followed up by Mr. Murchison, established the fact that an extensive region in Wales exhibited a distinct formation, the relations of which were determined, and it was thenceforth formed into a new system, and distinguished by a collective name as the Silurian system. One useful result of this in our own country was to determine the true geological place of the older fossiliferous rocks of Devonshire and Cornwall, and in America and Russia the application has been still more extensive. In 1836, Professor Sedgwick and Mr. Murchison examined a group of strata in Devon, that containing the culm measures, the true place of which had been completely misunderstood, and the determination of this again led to the establishment of a new system, called the Devonian System, which in 1839 was recognized in the Rhenish provinces, and subsequently in the Ural chain and in the United States. The Wealden System, it will be remembered, was principally determined by Dr. Mantell. The Permian System has been most recently established by Mr. Murchison. Thus each new discovery has extended the boundaries of the science, and advanced it to its present state, and as it is a matter of some interest to our readers to be in possession of the latest and most accurate information, we subjoin a synopsis of the present system of the classification of the fossiliferous strata, although in noticing the first part of Prof. Ansted's work we then also referred to it.

I. PALÆOZOIC.	The Sub-Silurian and Lower Silurian Formations. (*Protozoic* of Prof. Sedgwick.) The Upper Silurian Group. The Devonian System and the Old Red Sandstone. The Carboniferous System, the Lower New Red Sandstone, and the Magnesian Limestone.
II. SECONDARY.	The Upper New Red Sandstone of England, and the Triassic System of Germany, &c. The Liassic Group. The Oolitic System. The Wealdon Formation. The Cretaceous System.

III. TERTIARY.
- The Lower Tertiaries or Eocene Group.
- The Middle Tertiaries or Miocene Group.
- The Newer Tertiaries or Pliocene Group.
- The Superficial Deposits of Gravel, &c., or Pleistocene Group.

The progress of palæontology, or the natural history of the ancient world, is inseparably connected with classification. The fossils, characteristic of a stratum, are the keys by which we can arrive at its true position, whether we find it in England, or discover it for the first time in the remotest regions of America or Australia; nay, the transmission of fossils from a remote country will often enable us to arrive at an accurate decision as to its geology. This is a department which, as it has been studied with extreme minuteness by professed naturalists, is apt to deter the engineer from enquiring into it, though without adequate cause, as a competent knowledge of the most remarkable fossils can be readily, nay empirically attained, without the elaborate study necessary to make a proficient palæontologist. It will be evident that were we desirous of recognizing the coal measures only, an acquaintance with their distinguishing fossil remains would be desirable, but, indeed, we can never become useful and practical geologists unless we extend this admission to strata generally. Prof. Ansted seems to us to have treated this portion of his work with skill. He has given an admirable introductory essay, briefly but clearly illustrating the general principles, and then he has followed up each separate system with a chapter describing its distinctive fossils, confined as much as possible to the most characteristic specimens, so as not to overburden the practical man too much in the study of what to him must, after all, be to a great degree, a subsidiary pursuit.

The account of the several formations and their characteristics constitutes what is called Descriptive Geology, and to this the whole of the first volume and the beginning of the second is necessarily devoted. The illustrations which are in the superior style by which all Mr. Van Voorst's productions are distinguished, comprise very numerous sections of the several formations. The fossils figured are no less than two hundred and twenty in number, nor is the practical portion of the work less completely illustrated.

On coming to the practical part of the work, we think it right, as we have before observed to point out the importance of geology to the engineer, which we do, not merely to call his attention to the study, but to point out to him the wide field of engineering employment, in connection with applied geology, which the engineer is the instructed man of science to occupy, and which we consider has hardly as yet been properly attended to. The engineer, it must be borne in mind, is not merely an official called in to perform a certain fixed task, but he is to be considered as a skilful counsellor called in to discover resources and to apply them beneficially. The knowledge of commercial economy possessed by our engineers has often to be turned to account, they have frequently not merely to create a railway, dock, road, or canal, but to find the materials to construct it, or the traffic for its support. So, too, the engineer has to turn his geological knowledge to account. The discovery of a mineral or fuel in a convenient position, an adequate access to the market, or to other minerals necessary for the profitable working of an establishment, require able combinations and high powers of mind. The engineer must be a man of science and a practical man, but he must not be merely this—he must not be a mere mechanic, a mere drudge, but he must above all things be a man of business. If we look to the leaders of the profession we particularly recognize this quality, the Stephensons, Brunels, Walker, Locke, Cubitt, are all distinguished for their business powers, while, on the contrary, we shall find many men of great abilities, and who have had good opportunities, who, from want of these characteristics, only occupy a secondary position. Not unfrequently do we find that an engineer, otherwise skilful, makes a bad witness before a parliamentary committee, or a bad adviser of a board of directors; from his want of business habits capitalists have no confidence in him, and his sphere of usefulness is by so much diminished. It is by facts like these that the man anxious to hold a respectable rank in his profession is urged to cultivate his mind in every respect, so as to bring to bear the greatest amount of knowledge and ability on the work in which he is engaged. Geological engineering particularly admits the application of these, and for this reason we call attention to it. Mining rests almost as much on geology as on engineering, the two however are closely connected together, and yet we find but few engineers who have devoted themselves to this branch. In Cornwall particularly, the direction of mining operations is almost exclusively left to the mining captains, though a preference would naturally be given to an educated man possessing the same degree of local information, well grounded in the principles of geology, mineralogy, metallurgy, and chemistry, competent to superintend the machinery and drainage operations, to make the assays, and to conduct all the proceedings in a business-like way. It is very true that from the class of mine captains, as well as from that of coal viewers, we have obtained some very eminent engineers—Trevithick, Stephenson, and Buddle, are names of men of first rate eminence—but it cannot be denied that generally the standard of education in the mining profession might be raised with advantage. It is too well known to those who have any connection with mining that from bad preliminary education, and want of superior special knowledge, great errors are committed, operations carried on in a heedless and wasteful manner, much money needlessly squandered, and jobbing of all kinds allowed, and it can scarcely be doubted that the resources of the mines are far from being made so available as they might. When, however, we find mines under the direction of men of high attainments, like the Taylors and Foxes, we find a state of affairs much more satisfactory, so that we are convinced the employment of well-educated engineers, having a professional reputation at stake, would prove of considerable benefit even in comparatively small operations. Here, by the bye, we would pause to point out a great benefit, which might be conferred by Mr. John Taylor, or some other spirited engineer or capitalist having the direction of large operations, and which would go far to supply the present want of mining schools. Let him appoint to the clerkship of one of his mines for two years some student who has distinguished himself in the preliminary studies of mining engineering, establishing a kind of mining scholarship or exhibition, which would give the holder bread and cheese and the opportunity of acquiring practical mining information on the spot. We have no doubt such appointments would be zealously contended for, and the proprietors would obtain a greater amount of skilled service for the ordinary salaries, as the opportunity of acquiring experience would be by the student looked upon as equivalent to a considerable premium. Mr. Taylor is Treasurer of University College, and might advantageously give such an advantage to the engineering class of that institution, in the same way that another treasurer attached to it, Sir Isaac Goldsmid, has so liberally and munificently secured an East India surgeoncy for the most proficient medical student. King's college has good friends enough, and we recommend this hint to Professor Ansted's attention, and we have little doubt something may be done, for the conductors of King's College evince great zeal in the securing the efficiency of its engineering class. We give the same hint to Durham University, which is most favourably situated for carrying it out.

If we find the want of educated mining engineers in our home establishments, where the remuneration is on a low scale, we feel it still more strongly in all our foreign operations. However well the Cornish mining captain may get on in his native county, with his small works and among his own people, he is totally incompetent and most mischievous in a foreign country, so that in Mexican or Brazilian appointments, competently, nay often lucratively, remunerated, we find a most miscellaneous selection. In some cases German mining engineers have been appointed, but they are by no means calculated to give satisfaction to English capitalists, so that, for the most part, educated English gentlemen, not brought up as engineers, have been preferred, and in one case an Italian refugee. In an isolated establishment in the new world it would, however, be of incontestable advantage to have on the spot the varied resources of a well-trained man of science able to turn the produce of the mine to the best account, and efficiently to extend the operations of the company, and at the same time to conduct the financial affairs in a proper manner. In Guanaxato, or Minas Geraes, there is no mechanical engineer at hand to invent new machinery, or adapt the old machinery to the workings in the best way, there is no geologist, no analyst, to be obtained at a short notice, all this should be done at the mine, but all this is unfortunately not done.

If we were to go over the field of mining operations in this country only, we should be able to show what a wide field there is for the young engineer, but we must restrict ourselves to the remarks we have already made. What may be done by skill is well shown by the case of George Stephenson and the Kilworth colliery.

Now with regard to another branch, the great attention which is now being paid to scientific agriculture particularly claims the notice of the engineer. Here his engineering and his geology both come into play with advantage. The survey of an estate calls forth the skill of the engineer to determine its soils and subsoils, the nature of its available fossil products, the superficial and subterranean supplies of water, the drainage, the sites for buildings, the available natural power, the machinery and millwork which may be applied, the state of the roads, their direction and the mode of permanently and cheaply repairing them, the capabilities of the streams for affording water conveyance—all these and many other points admit of the advantageous application of a very extensive range of study, in which geology enters as no inconsiderable portion. We have no doubt that when Mr. Josiah Parkes was appointed consulting engineer to the

Royal Agricultural Society, a great many agriculturists and a g eat many engineers considered the appointment as little better than a sinecure, perhaps nothing more than the giving to Mr. Parkes a sounding designation. We cannot say that we ourselves anticipated the exertions he has since made. Only to instance his last communication in the transactions of the Royal Agricultural Society will be sufficient to give an intimation of what may be done. He therein discusses the size of draining tiles, and from a careful investigation of the quantity of water falling and the quantity to be conveyed, he has been enabled to establish on a scientific and practical basis the necessity for greatly reducing the size of the tiles. The economical results accruing from this will be at once seen, the saving in material, labour and fuel in forming the tiles, a reduced cost to the landowner and farmer, a diminished ccst for cartage and for repairs. Thus a most important diminution is obtained in the cost of all large draining operations, a grand point, when we consider that the large outlay is the great obstacle to the extension of draining. Yet this is but an earnest of what engineering can do for agriculture; agriculture has, hitherto, been too much treated as a rule of thumb, petty chandler's shop pursuit, even when carried out on large farms, but the extension of farms admits the operations of the engineer with great advantage. The farmer is in truth a manufacturer, there is nothing mystic, nothing extra-economical in his pursuits, he is as much a manufacturer as the cotton or woollen manufacturer, and his operations must be conducted by machinery as good, as efficient, as cheap and as saving, and this, to a great degree, is yet to be done, although we have from Scotland a good deal of experience as to its advantage. Much ingenuity has been devoted to spades, and ploughs, cultivators, harrows, and thrashing machines, but the economical working of a farm as a whole, the proper application of power, and its adaptation to the resources of the locality, have been little studied, and here again the mechanical engineer will find wide scope. The possession of water power on the spot, and the power to transport to market a dressed article, instead of the material in its raw and rough state, may often make production profitable, which otherwise could not be undertaken without considerable loss.

Drainage is indeed a grand engineering operation, and with what advantage it can be followed as a pursuit Mr. Smith, of Deanston, has well shewn. It is evident, from the instance of Mr. Josiah Parkes' exertions just adduced, that draining cannot cheaply be carried out empirically, for either we run the hazard of wasting money by too great an expenditure of material, or we jeopardize our proceedings on the other hand by making insufficient provision. The ground must be well levelled, its nature examined with the eye of a geologist, so as to ascertain the causes of any extra supply of water and the means of preventing it, and also the most convenient natural outlet, whether by the usual water-courses, by means of one of the geological dikes which intersect the country, or perhaps even by an absorbent artesian well to reach some lower sandy stratum. While, on the one hand, the well-trained practitioner will be able successfully to deal with a difficult case, to relieve cheaply and efficiently a moss or submerged district, the blunderer may bore so as to get at more water, or expend much money without obtaining any adequate result. The artesian well places at the disposal of the engineer well trained in geology as complete a command over the drainage of the earth as it is possible to conceive, it enables him to select his water-course at any required depth, as the balloonist chooses his course, either by ascending or descending, among the various strata of the atmosphere. Not only can the engineer discharge below water which cannot be discharged above, but he can bring up, if need be, further supplies of water from the subterranean strata, and, a point of great importance, water of different properties. Whereas, we may have above water strongly impregnated with mineral substances injurious to vegetation, we may get rid of that and obtain a wholesome water from a lower stratum, or a water, perhaps, having some required chemical property, coming, it may be, from a calcareous formation, and holding lime in solution. By acquaintance with the laws governing the temperature of strata, and the progressive increase of temperature as we descend beneath the surface of the earth, we can procure water of a high temperature, which may be beneficially employed in cultivation. Here, again, it will be noticed how studies, speculative in their origin, are ultimately made to bear practical fruits. The ill-informed man, who thinks there is nothing but practice, and snaps his finger at all theory, forgetting that the two cannot be safely associated, might have smiled in derision at the long and serious discussion as to the temperature of wells, and the height of the thermometer in mines. We may here observe, however, that even with regard to the ventilation of mines the study is important to the practical man, though we have a better proof still. We will, however, call the attention of the mining engineer to another result accruing from philosophic investigation. It has been well ascertained[1] that the state of the atmosphere has a considerable influence on the causes of explosions in mines, the barometer having in cases of such accidents been observed to fall suddenly, while, in many cases, the discharge of hydrogen gas is found to be most intense and powerful while the wind blows from the S. W. and the barometer is low, but diminishes when the barometer is rising. The sudden change in the weight of the atmosphere, and consequent pressure of the gases, is, indeed, with scientific men, held to be a powerful predisposing cause to those fatal colliery catastrophes, of which one so serious has lately occurred. So far, too, as we are able to recollect these casualties have happened in particular months, and at any rate we think it incumbent on the superintendents of collieries to keep a close watch on the barometer, and in case of any sudden and serious fall we think it should be incumbent on the managers immediately to stop the workings for the day. At sea very great benefit has been found from the observation of sudden changes in the barometer in preparing for hurricanes, so that in well-conducted vessels it is the practice immediately on the change being ascertained to get in readiness for the coming storm. To return, however, to the practical results accruing from a higher temperature of air and water in the lower strata, we find, from Professor Ansted's work, (vol. ii. p. 528,) that advantage has sometimes been taken of the temperature of water from deep springs, conservatories have been warmed, cress-plots cultivated, and fishponds improved, particularly in Germany. At Erfurt, it is stated, the proprietor of a salad ground by availing himself of this means obtains a profit of not less than £12,000 per annum. The great Smith, the father of geology, who was as practical an engineer as he was a skilful man of science, was often called upon to apply his powers of command over subterranean springs and water-courses to important cases of draining. We shall leave Prof. Ansted to state this himself.

Mr. William Smith, who at the close of the last century had made himself much more accurately acquainted with the actual order of superposition of the Secondary strata in England than any person then living, was also one of the first to apply this knowledge to important practical purposes. About the year 1800 his reputation for "draining on new principles" was thoroughly established in the West of England, and on the occasion of numerous landslips taking place near Bath, he was employed to prevent, if possible, a recurrence of this mischief, which he effected by tunnelling into the hill on which the land was slipping, and intercepting the springs, and then providing a direct and convenient channel, by which the water could be discharged. In the year 1811 Mr. Smith was again employed to report on a subject of practical science connected with the drainage of strata. About that time numerous canals were being cut in different parts of the West of England, and these, crossing the oolitic hills, were found to be particulary liable to accidents of leakage, being cut through open jointed, and sometimes cavernous rocks, alternating with water-tight clays. In the passage across the former rocks, and more especially when the summit level of the canal occurs in them, the water escapes almost as fast as it enters, and all the skill of the engineer in puddling, and making an artificial bed, is sometimes exerted in vain, and cannot prevent great and ruinous loss. But the existence of open joints and caverns is by no means the only, nor, indeed, the greatest source of injury, for innumerable small faults or slides traverse the country and confuse the natural direction of the springs, rendering them short in their courses, and uncertain and temporary in their flow, weakening by their irregular pressure every defence that may be opposed to them, and causing leaks, which let through a portion of the water contained in that level of the canal.

The general remedy for all these evils was understood by Mr. Smith, and proposed by him for adoption. It is "the entire interception of all the springs which rise from a level above the canal and pass below it through natural fissures and cavities. This is a process requiring great skill and extensive experience; some of the springs for instance which it is most important to intercept come not to the surface at all in the ground above the canal, but flowing naturally below the surface through shaken or faulty ground, or along masses of displaced rock which extend in long ribs from the brows down into the vale, emerge or attempt to emerge in the banks of the canal; these no ordinary surface-draining will reach, and none but a draining engineer, well versed in the knowledge of strata, can successfully cope with such mysterious enemies. But Mr. Smith, confident in his great experience, not only proposed, by a general system of subterraneous excavation to intercept all these springs, and destroy their power to injure the canal, but further, to regulate and equalize their discharge, so as to render them a positive benefit. This he would have accomplished by penning up the water in particular natural areas, or pounds, which really exist between lines of fault in most districts, or between certain ridges of clay ('horses,') which interrupt the continuity of the rock, and divide the subterranean water-fields into limited districts, separately manageable for the advantage of man by the skilful adaptation of science."—Professor Phillips' Life of William Smith, p. 69.

In all those departments of engineering, which have to deal with

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1 Transactions of Nat. Hist. Soc. of Northumberland, vol. i. p. 185.

extensive tracts of country, and large earthworks, geology is most essential as a guide. The selection of the line of country, the choice of materials, the nature of substrata to be mined and cut through, the springs likely to be met with require geological skill to produce a good and safe plan, and the same knowledge is requisite in conducting subsequent operations, both for the engineer and contractor. Much of the waste of capital and subsequent litigation and in case of Ranger's contracts on the Great Western Railway was caused by want of knowledge as to the position of the Pennant stone and its probable hardness. Professor Ansted observes :—

In the case of a railroad, more than ordinary care and attention is often required to enable the engineer to decide how far he may safely, and with justice to his employers, contemplate the overcoming of natural difficulties in a country to be passed over, in order to escape from other difficulties of a different kind, arising from the local value of property, and the arrangements that have to be made with landowners. In this respect, an acquaintance with the principles of Geology cannot fail to be exceedingly useful, as suggesting resources, the existence of which could not otherwise be guessed at, or, at least, which could not be discovered without a minute local knowledge of the district. For, let us suppose two engineers, the one unacquainted with the order of superposition of the strata, and ignorant even of the fact of stratification at all, in its Geological sense, and the other a practical and well-informed student of Geology. And let us assume these two men to be required to construct a line of railroad from London to Dover. The mere engineer, having no knowledge of Geology, would only be aware, in a general way, that between London and the Weald of Kent, there was a range of chalk hills, (the North Downs,) but that afterwards the country was tolerably level, as far to the east as Folkstone. He would soon find that, with the exception of the Dart and the Mole, two rivers running into the Thames, the one at Dartford in Kent, and the other near Kingston in Surrey, there was no complete drainage across the hills, and therefore no continuous valley leading to the level country, and these two valleys would both be found ill adapted for the object in view. On further examination. partial valleys would, however, be discovered, and one of these, we may suppose, would be selected as the most convenient. The rest of the work to Folkstone would be calculated for as work of the ordinary kind, and cuttings and embankments would be made without any reference to the peculiar circumstances of the strata. Let us now see what would be the inquiries and conclusions of the Geological engineer under similar circumstances. The line of road by Croydon is sufficiently marked out by the physical geography of the district, and need not be again referred to. Our engineer, however, having settled these preliminaries, would consider that in the course of his work he must cut through a considerable portion of the lower part of the London Clay, which he would know beforehand to consist of sand and gravelly matter, mixed with some tenacious clay, and that he would then have to tunnel through the chalk, coming out upon the lower beds, which on examination he would find were considerably tilted towards the north. His line would thus carry him along the direction of a small disturbance transverse to that which had originally elevated the beds of chalk. Through part of this he would have to tunnel, and he would be aware that in a district like that extending along the line of the chalk hills there was little danger of meeting with hard beds, or with intruded igneous rock. The advantage of being thus able to predicate with considerable certainty as to the nature of the ground through which the road was to be cut, must be evident to every practical man, and we shall soon perceive how far such knowledge is immediately applicable. Besides this acquaintance with the condition of the chalk the Geological engineer in this case would remember that his cuttings and embankments would have to be made for the most part at right angles to the strike of the beds, but that in some cases the London Clay, having a different local dip, would be cut in a slant direction. Lastly, he would be aware that when he had crossed the chalk, and the other beds of the cretaceous group, he would come upon the Weald Clay, a bed dipping northwards, and which he would have to traverse in a westerly direction, and therefore directly on the line of strike. Now the beds of the London basin, consisting, as they generally do, of clay alternating with occasional sands, are exceedingly dangerous when deep cuttings or tunnels are made through them, which are not properly defended. And this is the case, because the rain, washing through and carrying away the sands where a section has been made, leaves the upper bed of clay barely balanced upon the lower, and with a slippery surface between them. The inevitable consequence of such a condition of things is, that after a short time the upper bed slips quietly down in the direction of its dip, falling upon and filling up the cutting that has been made through it. Accidents of this kind have happened too frequently not to be familiar to every engineer, and the cause is now to a certain extent generally understood; but nothing short of a knowledge of the structure of the country, or, in other words, of the principles of Geology, will enable any one effectually to avoid this danger, because it is one constantly recurring, and requiring different management, to a certain extent, for each individual case. The Geological engineer will know his danger, and will endeavour to provide against it beforehand. The mere empiricist who knows only the rule of practice on the occasion, will, perhaps, bring out at last the same, or nearly the same, result; but it will be by that most expensive and least creditable of all methods, a succession of failures.—It would be interesting and exceedingly instructive to consider, with respect to their bearing upon Geology, several of the great lines of rail-road in England and elsewhere. It would be found that all of them, without exception, have reference at least as much to the Geological as to the Geographical structure of the country, and that in each, the great works in cutting and tunnelling, if they were not originally constructed on those principle advocated in the text, have been since altered, or must shortly be altered, in consequence, or in certain anticipation, of accidents. By in the outline of the subject at present offered, such a detail would be clearly out of place.

This will serve to illustrate the course of investigation which the scientific engineer is bound to pursue who duly regards his own reputation and the interests of his employers. The treatment of slips, a difficulty with which railway working has made us acquainted is more geological than engineering, and as it is a subject which deeply interests professional men, and on which all experience is valuable, we shall bring before them Professor Ansted's observations. He says—

The only defences, indeed, in these cases seem to be, (1) Thorough surface drainage on the line of outcrop of each bed cut through; (2) A greater slope on the rise side of the bed than is necessary on the other or dip side; and (3), Careful attention from time to time to see that no tendency to a slip shows itself. The methods to be pursued with regard to clay cuttings, and the accidents that are incidental to them, belong as much to cuttings for ordinary roads and canals as railroads, and are applicable in many cases, when other beds than clay (such as courses of limestone) are separatad by partings, which on exposure to the atmosphere, or on suffering the drainage of water through them, become slippery, and cause the upper and lower beds to lose their coherence. Even in an embankment, if the successive layers of earth are not level, an accident not unfrequently happens from the same cause, the moisture penetrating the beds, and if not loosening them under ordinary circumstances of temperature, affecting them afterwards during severe frost, when the expansion of the freezing water produces effects that can hardly be calculated, until they are unhappily seen and felt. The advantage derived from a knowledge of Geology in engineering consists (it will now be understood) in teaching the engineer how to avoid danger, or if he must be exposed to it, how to provide a remedy from the beginning. It often happens that a tendency once produced in the beds to slip, cannot afterwards be stopped, although the first step towards the mischief might have been prevented by timely application of preventive measures. The slope, in such dangerous cuttings, should have some, and often a considerable reference to the dip of the bed, for however it may seem that the rain and other atmospheric agents must wash away the loose sand equally on both sides of the road, this is by no means the case in reality, and the washing will be far more rapid, and the tendency to slip down in large masses incomparably greater on the one side than on the other. On the one side, therefore, of such a cutting the judicious planting of grass will often be a sufficient defence even with a steep slope, while on the other, even a stout wall will be in sufficient to prevent a slip from the very first day of exposure.—The direction and the degree of exposure of the face of the cutting in such cases will also be important subjects of consideration. In our own country a south-west exposure is in most cases far more likely to be affected by atmospheric causes than any other; but this is not invariably the case, and may by local influences be less liable to be injured than any other.—There are, indeed, very few cases in which the considerations of geological structure and relative exposure ought not so to modify the calculations of the engineer as to induce him to make a greater slope on one side than on the other of every deep cutting.

Another department of engineering belongs decidedly to geology, the construction and improvement of harbours, and he must be a bungling practioner, who does not make himself well acquainted with the natural laws influencing the coast to be acted upon, and the operations of the sea upon it. One who goes to work without such knowledge and such care, too generally brings forth shingletraps as the result of his labours, and wastes the money of his employers in vain attempts to baffle nature, instead of bringing her operations to his aid. We have too often expressed ourselves as to the unsound, unsatisfactory and unscientific state of harbour engineering in the present day, to make further remarks in reference to it now.

In any kind of building operations, the engineer and architect will profit by his geological knowledge, he will take care not to erect an establishment where the strata may be liable to slip down, he will look well to his foundation, he will find what prospects he has of access to water, and what is the nature of the drainage, and before he proceeds to construct his building he will carefully examine the building stones, which may be available, and their relative durability, cheapness, colour and weight. As this subject is however now familiar to our readers, in consequence of the labours of the Parliamentary Commissioners, and the lectures of Mr. G. F. Richardson, we shall not dwell upon it longer.

We have already made some allusion to wellsinking, but before we dismiss it altogether we must make some few more remarks, as it is a subject daily becoming of more importance. The enquiries of Government and the Legislature into the state of towns have not only opened the way for extensive operations by the engineer in drainage and sewage, but they have established also the deficient supply of water to large populations. This is a want which must be remedied with regard to upwards of a hundred considerable towns, and the engineer will have to ascertain the means of supply, whether from surface springs in the neighbourhood, or from the subterranean strata. To determine these points satisfactorily mere local knowledge will not avail, but the engineer must have a due regard to geological laws. The dip of the strata, the probability of obtaining a continuous adequate supply from any source, and of securing it practically and economically require careful consideration. To obtain access to a polluted or inconsiderable supply, to the produce of limited superficial drainage, or the contents of some chance chasm is only of temporary benefit, and it will be the duty of those conducting the operations to take care that they are so conducted as to be of permanent advantage and capable of extension with the progressive wants of an increasing population. The phenomena of wells belong to geology, and there we must seek the explanation of the mode of supply and the means of reaching it, and also the most profitable plan of carrying out the operations. The urgent demand for public baths and washing places, which has extended from the provinces to the metropolis, and the means of providing them with water, now call for the consideration of the engineer. The practicability in a given locality of obtaining a large supply of water of a high temperature is an important feature in the establishment of large baths. To make them most useful, the water must be warmed, so that the machine and factory worker can resort to them on leaving his day's labour in winter and summer, and the cost of heating water artificially causes such an increase of price, particularly in southern towns, where coal is dear, as considerably to diminish the sphere of utility and the extent of the establishments. If we have the prospect as from the celebrated well of Grenelle, of obtaining half a million gallons of limpid water in 24 hours, at a temperature of 82° Fahrenheit, it is evident that we shall be justified in a considerable outlay. Many applications of wellwater will however suggest themselves to the intelligent engineer, and prompt his enterprise. Before leaving the subject however, we must call his notice to the use of absorbent artesian wells, advantageously used in Paris, but neglected here. Where we have noxious fluid discharges from chemical works and factories, the proprietors are often put to great inconvenience, and the neighbourhood also, to get rid of them, while a well carried down to some absorbing stratum would be in many cases a cheap and certain mode to get rid of the evil. In the drainage of towns too, while it will be desirable that refuse should if possible be applied to useful purposes as manure, yet it often happens that it cannot be done, and the absorbent well will then frequently come in as an available instrument.

The engineer who proposes to devote his energies to our colonial empire, has it in his power, by competent geological knowledge, greatly to promote his own interests, and those of the country in which he resides. The discovery of fuel, minerals and building stones, the choice of sites for towns, the supply of water to them, the construction of harbours, lie with him, and by his own activity he must make work for himself. The discovery of coal will require roads, trams, and railways, the opening out of mining operations will suggest a considerable application of water and steam power, the peopling of a district will demand roads, bridges, canals and other works of art. If he finds ironstone, coal and lime must be found to work it, and the establishment of every mining company will ensure to him a greater extent of professional practice. As he surveys the surface in his ordinary routine of duty, he must keep his eye constantly on the watch to detect any advantageous feature, his survey must be geological as well as superficial. The coal mines of Newcastle in New South Wales have led to a considerable extent of tramways, to gasworks, steamboats and steam factories, and railways must follow next. From this discovery alone a great extent of engineering employment has necessarily accrued, and so it must be wherever the resources of a country are developed by a scientific hand.

The geological map is an indispensable document to the engineer. Constantly called upon to examine the surface of the country, he requires the most accurate knowledge of its details, an acquaintance with its external features, its levels, and its artificial appendages is not enough, he must be further intimately versed in the position of its strata, its faults, dikes, and indications of disturbances. At the same time the engineer will do well carefully to note every geological fact, which comes under his observation, and if of the least interest to communicate it to the nearest geological institution, so that our knowledge of the country may become more extended, and the accessible sources of information improved until such time as the general ordnance geological survey is completed. We are happy to say that many engineers have distinguished themselves in this respect, and their labours give them particular opportunities for so doing. The series of geological railway sections now in progress of formation, and of which the portions executed are deposited in the Museum of Economic Geology, will be found of very great value for all subsequent works in the districts to which they relate, and we hope every facility will be given by engineers to the prosecution of this valuable undertaking.

Professor Ansted very strenuously urges the necessity for preserving records of all mining operations on the ground of humanity, as well as of profit, and we see that he has brought the subject before the British Association. The late Mr. Buddle, one of the greatest improvers of coal mining by the liberal application of science, skill and research, also strongly advocated the same measure, and as a public depositary has now been obtained in the Museum of Economic Geology, in Craig's Court, Charing Cross, we sincerely trust those engineers who have the means will take the trouble on all occasions of transmitting such information as is in their power. Neither is it requisite that such records should be limited to mining, but difficulties met with in tunnelling, in sinking a well, or ordinary operations of the kind, or anything illustrative of our strata will be thankfully received by the Curators, and will be open to the inspection of the public. Specimens of building stones and minerals should also be sent, and those engineers who have not visited the establishment should do so, to see what benefit they can derive from it, and how they can themselves add to its collections.

We have now brought our examination of Professor Ansted's works to a close, and we are not aware that it wants any recommendation after what we have already said. It is comprehensive, yet concise; clear, without being diffuse; accurate, without being tedious; abounding in illustration, yet without descending too far into minutiæ; it developes principles, and steers clear of speculation; it is indeed a work suited for the practical man, who desires to acquire a sound knowledge of geology in a compendious form, who has time only for what is useful and essential, and fears to lose his time on what is dubious and unprofitable. Confining itself to what is certain and established, it must long remain the most important text-book, while it will always preserve its value as an original and useful work. To compliment Mr. Ansted would be futile, to urge the purchase of his work hardly necessary, it must soon be in the hands of all students as it is already in those of his own class.

For those who are desirous of studying the fossil animal kingdom with more minuteness and to a greater extent, Mr. Van Voorst, the publisher of the work now before us, is also preparing from the hands of Professor Owen, one of the first men of the present day, a History of English Fossil Mammalia, a work, which as far as we have yet seen it, has greatly excited our interest and approval.

Ecclesiastical Architecture: Illustrations of Baptismal Fonts. London: Van Voorst, 1844.

We had promised ourselves that we would say something on the conclusion of Mr. Van Voorst's work, but yet what we can say we hardly see, except to repeat the encomiums with which we received the successive parts in the course of publication. The general remarks we might have made are so completely comprised in Mr. Paley's introductory essay, that we must repeat what he says or leave the matter alone, and that is what we think we must do, having already so often expressed our highly favourable opinion of the work. In recommending the work to our readers, we would make this remark—the subject of church fonts is not merely interesting to the antiquarian or to him who may have to supply such a piece of church decoration, but it is important to the architect generally, on account of fonts presenting authentic illustrations of style, details and decorations of the highest value. The number of Norman fonts in particular throws light upon a style of which we have the fewest relics, and the fonts of a later period, the decorated for instance, give us many ideas for ornaments of a domestic character no less than for various articles of church furniture. Indeed, without an acquaintance with such records, the architect can be but illqualified for designing in the pointed styles.

The volume contains a copious series of engravings, carefully and ably executed, while the work as a whole is a cheap and handsome one. The architect and the designer of ornament cannot do without such a manual in his library, and we hope the sale of the work will be such as to urge the publisher to bring forth a second and third series, for we have many highly interesting specimens yet remaining. We may observe, however, that the present work may be considered much more copious in reality than it is numerically, for many of the fonts described are types, frequently repeated in the same district and in various parts of the country with trifling variation, if with any at all.

Under the name of Instrumenta Ecclesiastica, another work on church furniture emanates from Mr. Van Voorst's establishment, edited by the Cambridge Camden Society, and he has also in progress a series of decorated windows, and a manual of Gothic mouldings, all important, necessary and useful works. We are glad to find such attention paid to the details of art, it is indicative of an improving constitution, for sticking bits of Gothic on the outside of a barn-church no more constitutes architecture than does a naked stereotype Ionic portico, on which the artistical merits of others rest. A style whether Greek or Gothic must be studied and treated catholically, and it is only when that is done we have either architects or architecture.

Weale's Quarterly Papers on Engineering. Part V. London: Weale.

The principal papers in the part are those descriptive of the Roof of the New Houses of Parliament, and of the Ironbridge over the Neva. There is also a translation of M. Arago's Report on the Atmospheric Railway, describing M. Hallette's system, and an account by Mr. Hughes, C.E., of the Bangor Slate Quarries. The plates are the chief features of interest in these papers, so as to leave us little room for comment or extract. In the account of the roofs we find the following remarks :—

Of the superiority of iron over wood in the construction of roofs for buildings, the architects of the present day are becoming fully convinced, and the splendid example now set before them by Charles Barry, Esq., should at least induce all who have hitherto been indifferent to the advantages of this material in the essential qualifications of lightness, strength, durability, and safety in cases of fire, to examine the subject with all the attention it deserves, and the result may be looked for in the more rapid progress of the substitution of iron for wood in constructing the principals of roofs, especially when of large span. Not to the roofs only, but to flooring joists or girders, the metal material is happily adaptable also, wherever resistance to fire, and great strength, with small section, are primary objects in their construction. Of these valuable properties, the architect of this edifice has wisely and very fully availed himself, and he has, moreover, been, by this selection, enabled to offer facilities for carrying into complete effect the most complicated details of construction in flues, &c., required for the proposed system of ventilation for the extensive pile of building under his care.

But beyond the use of iron in forming the principals of his roofs, Mr. Barry has ventured to a further step, of which those unacquainted with the experience that he is cognizant of might not fully understand the wisdom, but which is thoroughly approved by all practical and scientific persons who have examined the subject minutely. We refer to the coverings of the roofs with cast iron plates of a thin section, and galvanized by a process now admitted to present the best yet discovered means of protecting iron work exposed to the air and weather from their otherwise injurious effects.

Upon the many substantial advantages thus attained, we are induced to state briefly the impressions we have received from an attentive examination, we might say, most interesting study, of the roofs delineated and detailed in the eight accompanying plates. The cast iron plates being cast of sufficient size to span the distance between each adjoining pair of principals, dispense with the necessity for any kind of boarding whatever, thus saving not only a great expense, but also diminishing the chances of damage by fire, which would, by destroying this boarding, leave the slates without sufficient support, thus making the whole roof liable to be broken in by their derangement; or, in the case of lead covering, the fire from the boarding communicated to the lead, would speedily reduce it to a liquid state, and create the most disastrous or fatal consequences. Again the cast iron plates allow the formation of ornamental rolls on the exterior, and parallel with the rafters, at the same time having vertical joints beneath these rolls, which, together with the horizontal joints, are so contrived as to be perfectly impervious to the admission of water. The architect being thus enabled to communicate an architectural character to the very roof, which cannot fail to be highly esteemed when seen in connection with the striking features of the masonry below, when the edifice is completed. And these rolls, it must be remembered, which in slate covering would be impracticable, and in lead liable to considerable distortion and injury, are when formed in iron, and cast as parts of the plates themselves, not liable to injury by any ordinary means or circumstances, and will always retain their form, position, and imperviousness to wet and weather. To whatever purpose the spaces or rooms within the roofs may be applied,—and these spaces must, from the high pitch of the roofs, be very valuable for many purposes,—it is evident that uniformity of temperature will be highly desirable; and this will be attained, it is believed, to a much greater degree by an iron covering than by one of lead, slate, or any other material. The corners of each plate being firmly secured by screws and snugs to the rafters on which they lie, a greater degree of lateral strength and stiffness is attained than can be had with any other kind of covering: in fact, the whole roof, principals, and covering, become one piece of framework, well knit and secured together at all points by metal connexions, so that the longitudinal tie-rods, which are introduced at the intermediate points, are very much lighter than would otherwise have been advisable, and yet are abundantly sufficient for their purpose. Much greater facilities are likewise offered by this description of covering for the attachment of ornamental dormer windows, which the architect has introduced for the purpose of lighting the rooms within the roofs, and which could not in any other materia have been so neatly, durably, or safely constructed and attached to the covering. In point of durability merely, if lead be allowed a comparison with iron thus prepared and adopted, the latter must be pronounced the better material. As to weight, little or no difference can be stated; and regarding their comparative expense, it is believed, allowing fairly for all circumstances, the preference must be awarded to iron. Slate, of course, cannot sustain a comparison of durability, has little advantage in lightness, and not much in point of expense. But the many valuable peculiarities belonging to iron for the purposes required, and at some of which peculiarities we have above glanced, should be held thoroughly decisive as to its employment in the erection of an edifice of which not only the architect in the present age, but the nation for many centuries, should be justified in feeling proud.

In the account of the Great Iron Bridge for the Neva, it is said—

This bridge has seven arches, and bids fair to be a most elegant structure. It is to be erected as a permanent one across the river, at the best end of the town, near the official residences of the court and government.

SPAN AND RISE OF ARCHES, which are seven in number.

		ft.	ft.
2 side ones	.	span 107 each.	rise 7·25 each.
2 next „	. .	125 „	9·52 „
2 „ „	. .	143 „	12·17 „
1 centre	.	156 „	14·31 „

Total width between centre and centre of outside ribs, 66 feet 8 inches.

The total estimated weight of the seven arches, exclusive of the roadway and railing, is :—$6928\frac{3}{10}$ tons cast iron, and $342\frac{1}{10}$ tons wrought iron.

Exempla Ornamentorum. London: Bogue. Part I.

This is a new work on illuminated ornaments from the establishment of Mr. Jobbins, and which promises to be most useful, embracing in a cheap form richly illuminated designs from costly missals and ancient manuscripts, in a style of luxury unknown to the last century. These are capable of adaptation for title pages, borders, head and tail pieces, initial letters, monograms, and heraldic devices. By the architect employed in church architecture, or on Elizabethan buildings, the work will be found useful in connection with designs for stained windows, inscriptions, commandment tables, decorated ceilings, and other ornaments of similar character.

To those who know Mr. Jobbins's last work of this kind, the Polygraphia Curiosa, the Book of Initial Letters, no recommendation of its merits is necessary.

Instruction for the Use of the Seyssel Asphaltic Mastic "Claridge's Patent."

Among the many useful practical publications on the building art, this is one that deserves the notice of the profession and builders residing in the country, because it contains full instructions for using the asphalte or Seyssel rock, and every particular connected with its application, written so clear that an ordinary plasterer cannot but understand it. It contains drawings of the various utensils, and several wood engravings of the various applications of the material.

PROGRESS OF DECORATIVE ART.[1]

The intellectual supremacy of man appears in few things more conspicuous than in his appreciation of the sublime and beautiful, while in that mysterious sympathy which obtains between his moral perceptions and certain objects in the external world, we find, perhaps, one of the most striking evidences of his divine origin. He who walks through the secluded valley, listening with delighted ear to the murmuring of the silver streamlet, quickly becomes conscious of a pleasing affinity between its fairy music and the tenor of his own thoughts and feelings. He who in a proper spirit wanders amid the silence and solitude of the everlasting hills, and gazes from their hoary summits on the blue concave of heaven, or it may be on the green earth as it stretches out far, far beneath him, cannot fail to imbibe largely of the poetry of nature, and to feel a glowing consciousness of communion

[ ][1] The Laws of Harmonious Colouring adapted to Interior Decorations, &c., to which is now added an Attempt to Define Æsthetical Taste. Fifth Edition. London: W. S. Orr and Co. Edinburgh: Fraser and Co.

The Natural Principles and Analogy of the Harmony of Form.

Proportion, or the Geometric Principle of Beauty Analysed. By D. R. Hay, Decorative Painter to the Queen, Edinburgh. Wm. Blackwood and Sons, Eninburgh, and 22, Pall Mall, London.

with Him who is the author of sublimity, the essence of harmony, the spirit of all beauty.

We are not all, however, affected in the same degree by the same objects, neither are our minds always in a fitting state to receive pleasurable impressions. Association has, also, a powerful influence over our sympathies, and the contemplation of whatsoever has been familiar to us in infancy never fails to inspire us with delight.

Notwithstanding, however, that our minds are so variously constituted, and acted upon in such a variety of ways, there are, without doubt, certain fixed principles of beauty and harmony which command universal admiration; a desire of possession is a natural result of admiration, and where that may not be we have recourse to imitation. Hence, the wish to imitate the beauties of nature has originated the greater number of those delightful studies to which the energies of genius have been devoted. Beautiful forms and true thoughts have thus been handed down to us from remote times, and these Godlike creations, being based on nature and on virtue, still exercise an undiminished sway over our imaginations. Seeing then, to take two familiar examples, that the works of Homer, the poet, and of Phidias, the sculptor, have been the boast and glory of the world for thousands of years, may we not conclude that such productions are in strict accordance with certain fixed and leading principles; and is not this opinion strengthened by the following remark, with which the ingenious author of the works before us incites himself and others onward in the pursuit of the true and beautiful. "It seems almost certain," says Mr. Hay, "that the Grecians, at the period of their highest refinement, had a positive geometric principle of beauty, systematically developed and applied in all their works."

Several years ago, Mr. Hay, who has been throughout life a diligent and successful student of nature and art, published his "Laws of Harmonious Colouring," a work which rapidly passed through four editions, and which at once placed its author at the head of his own profession, and effected a complete revolution in internal decorations. For a considerable period previous to the appearance of Mr. Hay's work, house painting had sunk to a very low state, and the term of house painter was almost synonymous with that of "white-washer." Those in the profession who ought to have led and improved the public taste, either from a delusive idea of realising larger profits, or from a want of scientific knowledge, banished everything like colour from house painting, and as they could not arrange decided colours harmoniously, they had the tact to persuade their employers that there was no pure harmony excepting in cold neutral tints of quaker drab or colourless grey. In the same way, also, everything like pencilling was set aside; and while the most abominable and unmeaning compounds of bad drawing and crude colouring were permitted to cover our walls in the shape of paper hangings, the chaste and appropriate pencilled decoration, so prevalent during the last century, had almost entirely disappeared.

At this juncture Mr. Hay's work on colour made its appearance, and backed by the author's artistic talent it gave a new impulse to decorative art in Edinburgh, which has ever since been perceptibly improving. Patronized by a number of enlightened and wealthy employers, at the head of whom was the great Sir Walter Scott, Mr. Hay executed a number of ornamental designs remarkable for their masterly drawing and brilliant colouring, while those principles which he had evolved in his book were in many instances practically carried into operation under his own guidance. The arabesques of Raffaelle and the grotesques of Watteau shortly became fashionable, and although at first many imperfect imitations were produced, competition and appplication in a short time produced their usual results, until now the art of decorative house painting bids fair to rival, if not to surpass its ancient excellence.

No one who attentively peruses Mr. Hay's treatise on "The Laws of Harmonious Colouring" can be at any loss to account for the extensive popularity of that work, or the revolution which it has been the means of effecting in all matters connected with interior decorations. The author had at once gone to the source of all harmony in colour, and by means of a most ingenious and original experiment he was enabled to establish the truth of the theory that in the solar ray, as in the previous practice of the artist, "there are only three primary homogeneous colours.

Having thus established the first principles of harmonious colouring on a scientific basis, Mr. Hay, in his work, proceeds to give a practical exposition of the arrangements and proportions required to produce a harmonic effect in every kind of combination or composition, whether gay, gorgeous, or sombre. He shows how to avoid monotony and preserve repose in every supposable case, and in this way he invests the art of decorative house painting with a dignity to which formerly it had no pretension. He treats of the styles of colouring best adapted for every apartment, from the light cheerfulness of the drawing room to the solemn tone which ought to prevail in the library. He triumphantly proves that the strongest possible contrasting colours may be used in interior decorations, without disturbing that chaste simplicity always so desirable, and the soundness of Mr. Hay's views on this point must be universally admitted, when the celebrated architect Mr. Barry, in his report to the Royal Commissioners, recommends the use of positive colours in the decoration of the New Houses of Parliament.

Mr. Hay, in the fifth edition of his work on colour, has published an "Essay on Æsthetical Taste," which he defines to be the result of the operation of external nature upon the senses, and the effects of these again upon the mind, without being subjected to the reasoning or rather discursive faculty. "The accuracy of this kind of judgment," he says, "although instantaneous, is purely mathematical and dependant upon certain geometrical principles, which regulate all combination appreciable by the eye or the ear." As these geometrical principles, however, are more fully digested and illustrated in Mr. Hay's work on "Proportion," we shall now proceed to examine that volume, in the mean time recommending to the perusal of all lovers of art "The Laws of Harmonious Colouring."

In "The Laws of Harmonious Colouring," Mr. Hay casually alludes to an analogy supposed to exist between colour and sound, and in his work on proportion he seeks to prove the existence of a still more intimate analogy between sound and form. In attempting to establish this theory the author has puzzled and perplexed us to little purpose. The comparisons so frequently introduced between musical sound and geometric figures are exceedingly perplexing; and while the reader is convinced that "beauty depends on calculation and geometry, and that certain measures are beautiful either as simply considered or as related," he is far from being convinced that "the circle, the square, and the equilateral triangle, have any analogy to the tonic, the medient, and the dominant in the musical scale."

Mr. Hay in his treatise assumes that this analogy does exist, and he sets down the circle, the square, and the equilateral trangle as primaries, and compares these forms with the tonic, the medient, the dominant in music. Now there can be no possible analogy here. In the first place, each form, assumed as a primary, has a distinctive and positive character, independent of any relation it bears to the other primaries; the circle cannot be transposed into a square, nor the square into an equilateral triangle. Now the tonic, the medient, and the dominant are relative terms, used only in respect to a harmony—we can change their character at will, and convert the note which was the tonic into either the medient or dominant; the do, re, mi, fa, sol, la, si, are positive qualities in music, which cannot be changed, no combination of other notes can be substituted for any one of them—they are the primaries of sound, and the analogy to hold good must agree with them. No note in the gamut is of secondary quality. It matters not whether B flat or C natural be selected as the key note of a melody or harmony, that instant the leading note rules the composition, while the medient and the dominant arrange themselves in their proper places.

The analogy between colour and sound simply consists in the fact that in like manner as a primary colour is never seen alone, but is always surrounded with a combination of the other primaries, so in music, when a note is struck that note, or tonic, is always heard accompanied by the other two required to complete the harmony. Now we do not find that when the eye is fixed on a circle that that circle appears surrounded or accompanied by a square or an equilateral triangle, and such being the case, while we admire the ingenuity displayed by Mr. Hay in working out his theory, we are forced to come to the conclusion that the analogy has not been established. The primaries of sound, form and colour may have a few points of resemblance, but such general or accidental features of assimilation are to be found throughout all nature. An analogy, to be of any practical use to science or art, must be perfect, and the ingenious author of the work now under notice will, we think, perceive and readily acknowledge that his analogy is too remote and imperfect to be turned to any account. Having said this much, we now proceed to examine the book in its far more important capacity, as a thoroughly practical and most useful digest of the geometric principle of beauty.

The purpose of the work is to reduce to fixed principles what is called taste in the combination of forms, principles which were systematically developed, and applied in all their works of art, by the Greeks at the period of their highest refinement, but which were utterly lost when the other perfections of Grecian genius were overwhelmed in barbarism.

The author illustrates the object he has in view very forcibly, by making reference to celebrated works of painting and sculpture, some of which are famous for their perfect imitation of objects in nature, while others excel in composition, or in scientific combination of such natural objects as may be brought together in forming a subject, indepently of their individual merits. The former class of works are appreciated by the degree of deception produced, while the latter seem to be appreciated by an inherent feeling, responsive to certain mathematical principles of propriety and harmony existing in nature.

While these qualities constitute the excellence of works in painting and sculpture, the beauty of all architectural composition depends upon mathematical harmony alone, because in such there is no imitation; and it can scarcely be doubted that the five orders owe their origin, and the perfections of their proportions to some systematic mode of applying these principles practically in the art. In proportion, therefore, as we acquire certain fixed principles of our own, we shall be released from the servile necessity of continuing mere imitators of those ancients, with the philosophy of whose practice we are little acquainted, and who certainly did not work without principles themselves. These general views the author seeks to illustrate and explain: and in so doing, he has, in our opinion, been very successful. He has reduced to fixed principles what was formerly but considered dependant on some undefined waywardness of taste or fancy, and he has triumphantly established the fact that forms and figures are rendered pleasing to the sight by their geometrical quality of proportion.

Mr. Hay, as before remarked, assumes the square, the circle and the equilateral triangle as homogeneous figures, and after giving a clear and lucid description of the eye, with all its extraordinary parts and functions, he proceeds to remark, that "the effects of geometrical configuration on that organ are, in the first instance, regulated by the relation they bear to the conformation of that organ itself—hence the soft influence of those figures of the curved kind, and the acute and and more powerful effect of those whose outlines are composed of angles." On the mode of proportioning these elements of form in the combinations of various figures their effect upon the eye depends; when a proper mode is adopted geometric beauty is the result, while the adoption of an improper mode results in deformity. In further illustration of the effects of the three forms which Mr. Hay has assumed as primaries, and by way of justifying himself for giving them such a prominent position, he states that the circle is not only the most simple of the homogenous forms, but naturally so in reference to the organ by which it is perceived. The square is the next most consonant form to the eye, because its angles are less acute than the triangle, while the triangle, from its being composed of acute angles and oblique lines, exercises the most powerful influence on that organ. Now as there can be no proportion without variety, and as in Mr. Hay's primaries we have the source of endless variety, it is evident that the most perfect beauty must be the result of a justly proportional admixture of those forms. Nothing, amidst the many and most ingenious analogical illustrations which the book contains, is, we think, finer than the following observations on the similar effect which the primaries of sound and form have upon the eye. Analogy, therefore, does obtain most certainly here, and analogy of the most perfect kind.

"It is well known in chromatics that the primary colour blue exercises a softer influence upon the eye then either of the other two, red and yellow, and this no doubt occurs from its being the most allied to darkness, or black, of the three, and hence associating more intimately with the colour of the retina itself. The colour that stands next to it as a primary in the solar spectrum, is red, which consequently holds the situation that the triangle does in my series of forms, and this colour is well known to affect the eye more forcibly than the yellow, which in the natural series is furthest removed from the blue, so that the more acute effect of the triangle upon the eye, although holding a medial situation, is quite in accordance with the analogy of acoustics and chromatics." p. 18.

The author, for the purpose of rendering his analogy more complete, assigns to the oblong, the rhombus, the hexagon, and the dodecagon, the same parts in form as the secondaries in sound and colour; after which, he gives a very full explanation, illustrated by a number of diagrams, of the qualities of each of the geometrical figures referred to in the work, and shows that the three primaries, with their attendant secondaries, can be produced, within the range of ocular perception, in an endless variety of combination, and in various degrees of modification in regard to their proportions.

Mr. Hay then, for the purpose, as he says, of rendering more easily comprehensive, and to systematize the harmony of geometry, has a long chapter on the Geometry of Harmony. This portion of the work is also illustrated by a variety of tables and diagrams, and altogether contains a very simple and easily understood exposition of the laws of acoustics, and although, as we have already stated, the analogy sought to be established between sound and form is not satisfactorily proved, yet this chapter is of itself, abstractedly considered, altogether a masterly exposition of the geometry of harmony, while it forms a very fitting introduction to the study of "the harmony of geometry."

The author, in proceeding to develop this science in detail, divides the circle into 360 degrees, and endeavours to prove that in the division of these degrees by the harmonic ratios the principle of geometric beauty, or proportion, lies. In the first division, by two, the diameter of the circle, or horizontal line, the base of all geometrical figures, is produced. The second division by two, gives a radius perpendicular to the base, producing the right angles of 90°, and this, again, divided by two gives the angle of 45°, which is the first harmonic ratio; the next harmonic ratio is the angle of 60°, which is produced by the division of the quadrant into three.

Mr. Hay then goes on to show that rectangles only differ from one another in their proportions, that is the ratio that their length bears to their breadth, and this proportion is determined by one measurement, which is the diagonal. The oblong is simply a modification of the square, and this modification is regulated by the number of degrees in the angle of the diagonal, which when the oblong is placed vertically must exceed 45°, and when horizontally placed must be under that number. If, therefore, a series of these diagonals be produced by a harmonic division of the degrees that occur in a quadrant, that is, by 2, by 3, and by 5, the rectangles formed upon these must bear an harmonious relation to one another. Thus, the diagonal of 45° relates to the right angle as 1 to 2; the diagonal 60° as 2 to 3; the diagonal 72° as 4 to 5.

These diagonals form the groundwork on which Mr. Hay's theory of the harmony of form is based; and most admirable, so far as it can be judged of in its present stage of progress, is the structure of harmony which will ultimately be reared therefrom. These diagonals are the rules by which the building must be constructed, in every line from its basement to the summit of its pediment. Already has Mr. Hay laid the groundwork, in a series of beautifully proportioned rectangular figures, and whatever may be said about the analogy he has laboured to establish between sound and form, there can be but one understand as to his opinion of having been successful in discovering the harmonic divisions of a circle, when a series of figures of such perfect beauty, and in such perfect relative harmony is the result of such divison.

Mr. Hay after showing that the circle and the square seem to have a reciprocal effect upon one another, in regard to the harmonious mode of division, proceeds to illustrate, by a series of diagrams, that if a quadrant be placed upon any diameter of a circle and lines drawn through any of the harmonic divisions until they reach the circumference of the circle, and another line drawn from this perpendicular to the diameter or base, until it again meet the circumference, the repetition of these two lines from every similar division of the circumference will produce an harmonious arrangement. These diagrams which are composed of a succession of harmonic angles and various curves, and which display every variety of figure harmoniously arranged, are exceedingly ingenious and beautiful. In some the intersections of the straight lines in the circular mode of combination form various concentric polygons, which approach the figure of the circle so nearly that they at first sight deceive the eye, while the curve assumes the appearance of the straight line in those combinations that are angular. Again, when viewed laterally, obliquely or otherwise, these diagrams assume a variety of forms, all exquisitely beautiful, harmonious, and suggestive of an endless diversity of ornamental designs.

A very clear and forcible illustration of the mode in which the harmonic angles may be applied is afforded by the two last plates in the work. They are harmonic combinations of rectangles, divided into triangles agreeably to the Platonic system, and the strong lines show how they may be formed into solids or vacuities in architectural composition.

After a very able dissertation on the harmonic ratio of numbers, which is also illustrated by a number of diagrams, Mr. Hay concludes his treatise as follows:—"Thus have I endeavoured to analyse the geometric principle of beauty—proportion—by showing that it is regulated by the harmonic ratios of numbers. And by the application of those ratiso to a quadrant of the circle, I have shewn that an almost infinite series of rectangles may be produced, bearing to one another certain harmonious relations; and that, within each of those a series of six other distinctive characters of figures may be systematically and harmoniously generated. In short, that the beauty arising from the harmony of form may be on all occasions with certainty produced.

"But the application of this system to the various arts in which it will be useful, must form the subject of another treatise, as it would be premature to apply rules until their accuracy were acknowledged. I shall, however, in the mean time, add a few general rules which obviously arise out of this theory:—

"1st. Rectangles, when arranged in succession, either horizontally or vertically, should only differ from one another in one of their dimensions; so that, when vertically arranged either as solids or vacuities, their vertical sides must be in the same line; and when horizontally arranged, their horizontal lines must also be in the same line, their harmony being regulated by their diagonals alone.

"2nd. Triangles must on all occasions correspond to the rectangles with which they are associated—acutely when the rectangle is vertical, and obtusely when it is horizontal. As the harmonious proportion of every rectangle, when in a vertical or horizontal position, is determined by an oblique line, called its diagonal, so is the proportion of every regular isosceles triangle determined by a vertical line. This being in a positive position, it can have no change but in its lineal dimensions, which will be always as 1 to 2, or 2 to 3. When, therefore, triangles are employed in succession, their proportions must be in other respects the same; if they be not, they generate between them a discordant figure.

"Curvilinear figures, in like manner, must always correspond to the rectangles with which they are associated, and in succession their harmony will depend upon the ratio of their radii, therefore, they can only differ in size, annd not in degree of curvature; this difference can only be in the ratio of 1 to 2, or 2 to 3. The curve can never be greater than what may be inscribed by the rectangle with which it is associated, and can never harmoniously leave the rectangle, unless at the tangental point, or at right angles with it.

"As a circle may be described within any rectangle tangented to its longest sides, this peculiar curve may terminate any vertical rectangle."

In conclusion, we cordially recommend "Hay on Proportion" to all engaged in the ornamental arts designers for shawls, carpetings, paper hangings, mosaic work, stained glass, will find here an ample field for the exercise of their talents. To all such Mr. Hay's diagrams must, indeed, be most valuable in suggesting designs altogether new, all regulated by fixed principles, agreeable to those inherent in our nature, and which must of course always be productive of pleasure. To architects, we think, the work will be most acceptable. Those edifices which have been and continue to be most admired are those wherein the geometric proportion of beauty has been most closely adhered to. The finest of the ancient cathedrals in Britain and on the continent are remarkable for the geometrical knowledge developed in their general construction, as well as in their most minute details. The harmonic ratios of Mr. Hay appear to us altogether a new branch in this department of art. By following them closely the result is certain to be agreeable, and we cannot help indulging in a hope that, regulated by these principles, new architectural designs may yet gladden our eyes, not depending for our approbation on a slavish and close imitation of what has gone before, but exciting our admiration no less by their originality than by their beautiful symmetry. It has long and often been maintained that so much has been done in architeeture that there is no room for anything new; we have always maintained an opposite opinion, and are now more convinced than ever that there is no end to human invention. New schools of poetry, of painting, of every branch in art, science and literature, are daily arising, why should we, therefore, despair of seeing a new order of architecture?

We have now to return our best thanks to Mr. Hay for the pleasure which the perusal of his book has afforded us. He has entered into the examination of his subject with his whole heart and soul; he possesses a deep and penetrating intellect, and his best energies have been evidently devoted to the work he had in hand. He states his opinions firmly, although with the modesty which is always the characteristic of true genius; and if he has not been the first to discover that the ancients constructed all their great works on geometric principles, he is the first who has probed the matter to the bottom, and has thus been able to lay down exact rules, by which beauty can be produced and deformity for ever avoided.

B.

REJECTION OF BRITISH AND ENGLISH ANTIQUITIES BY THE BRITISH MUSEUM.

Sir,—Within the last month it has been pointed out, in more than one publication, how highly desirable it is that there should be, and how strangely perverse it is that there should *not* be, some collection of national art and antiquities in the British Museum. But, with one exception, none of the parties who urge the propriety and expediency of a gallery of the kind being formed in that building, seem to be at all aware that a proposition to that effect has actually been made to the trustees. Only in one instance have I seen your correspondent Mr. Lamb's spirited attempt to obtain for the public such a valuable addition to the contents of the Museum, spoken of with the commendation it deserves, and at the same time with severe but justly merited reproof of the conduct of the trustees in the affair. Those good, easy gentlemen were, it seems, quite taken by surprise—absolutely *flabbergasted*, at so very out-of-the-way an idea as that of introducing British antiquities within the walls of a British Museum, but retained only so much of their wits about them as to find out that they were "not prepared" to recommend the scheme to Her Majesty's government. "Not prepared" was, no doubt, the very literal truth, but it also evidently implied what it would not have done to utter in plain words, namely, that they did not mean to prepare themselves, or take any initiative steps at all in the matter; whereas, the reply should have been that although "not prepared" to pledge themselves to any thing further, the trustees were well disposed to give their serious consideration to what appeared to be an important and desirable object, and one likely to obtain the decided approbation of the public. Instead of returning an off-hand, frigid, decisive negative, tantamount to a supercilious rebuff, the trustees might, at any rate, have left the matter open for deliberation, and might have waited to see how far public opinion was at all in favour of what had been proposed.

Had that course been pursued, there would have been opportunity afforded the Institute to step in and add their testimony and influence in behalf of a project that they ought in fact to have originated—at least have taken up and promoted with alacrity and earnestness. But somehow or other there is a strange want of vigour and activity, to any really good purpose, in all such bodies; and their *vis inertiæ* and apathy appear to be even contagious, for even those individuals among them who are not deficient in zeal become in a manner paralyzed by the general torpidity. Hardly anything that would be of real benefit, either as putting down some abuse, or securing some improvement, is proposed without being met by the evasive and childish objection of its being difficult. But of what use are Institutes, Societies, Associations, with all their apparatus of councils, committees, secretaries, &c., if they cannot even attempt to take in hand difficulties which individuals cannot overcome? One thing there certainly is which persons gain by entering into associations, because they are thereby liberated from all individual responsibility and exertion, and they become one and all alike invulnerable to reproof, and utterly impenetrable to shame, as are the *big-wig* trustees of the British Museum!

Zero.

J. S. COTMAN.

Sir,—Knowing of no readier one, I resort to this mode of making inquiry respecting an artist whose works are well and widely known to architects and antiquaries. The name of the *late* John Sell Cotman is assuredly one of more than common note, nevertheless I have hitherto been unable to ascertain from what time that mortuary epithet is to be dated. I have been able to gain no nearer information than that he died some time last year; for, most strange to say, I can discover no mention whatever of that event in any obituary, or in any of those journals which are in the habit of giving necrological notices, however brief, of individuals of any note in literature and art.

For this marked silence, in regard to one who had been so long before the public as Cotman had, and who had distinguished himself by a peculiar yet masterly style of architectural drawing and engraving, I know not how to account, and were it possible to do so, I should take the report of his death to be a false one.

Thus completely baffled, my hope now is that the insertion of this letter in your Journal may elicit, from some one of your correspondents or readers, the information I have hitherto vainly endeavoured to obtain.

I remain, Sir, yours &c.,

E. D.

THE CAM-CAMS.

Sir,—In the *Morning Herald* of to-day is a letter from a "Quondam Member of the Cam-Cam Society," assigning as the reason for his withdrawal from it the discovery that, instead of promoting its original ostensible object, it is now all but openly declaring, what it had long been suspected of, an earnest endeavour to revive among us, and re-introduce into the church, some of the most puerile and grovelling superstitions—such as it might be supposed even Romanists themselves, at least intelligent and educated ones, would now be ashamed of. The Society's organ, *The Ecclesiologist*, is now vastly laudatory towards that ultra-Roman Catholic gentleman Mr. A. W. Pugin, whom it styles "the great master of Christian device," albeit the specimen of his talent which calls forth that eulogy, viz. the "new and beautiful seal" of the Camden Society, is by no means remarkable for either taste or ingenuity of design, or for aught so much as the conspicuous introduction of that symbol of Romanism —the "Mother of God and the Infant;" the very ostentatious adoption of which, under their own hand and seal as it were, is either exceedingly bold or exceedingly indiscreet, and sufficient to convict them either of both temerity and effrontery, or else of besotted stupidity.

I remain, &c.,

S. P.

AREAS OF CUTTINGS AND EMBANKMENTS.

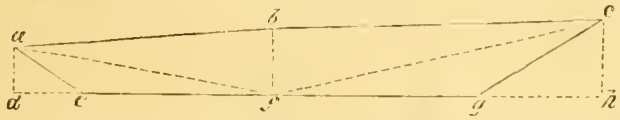
Sir,—In the August number of your excellent Journal there is an article, taken from the Journal of the Franklin Institute and written by me, on Short Methods of Calculating correctly the Sectional Areas of Excavations or Embankments, in copying the illustration of which an error has been made, which may cause difficulty in demonstrating the rules. In the Journal of the Institute the irregular pentagon is divided into four triangles, by dotted lines drawn from the point marked f to the points a and c, but in the copy the position of the lines is reversed, and they are incorrectly drawn as $b\ e$ and $b\ g$, which division of the figure is not applicable to the purpose intended.

Respectfully yours,

Philadelphia, U. S. of America, S. W. Roberts, C. E.
Sept. 11th, 1844.

We have given the diagram corrected together with the rule.

Multiply the extreme width of the excavation, or embankment, measured horizontally, by one-half of the depth at the centre; multiply the sum of the depths at the sides, by one-fourth of the base line, or bottom width *(e. g.)*—the sum of these products will be the sectional area required. Thus, in the following diagram the centre stake standing at b:

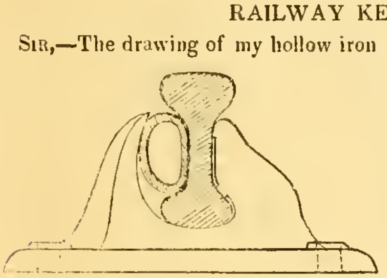


$$\left(dh \times \frac{bf}{2}\right)+\left(\overline{ad+ch} \times \frac{eg}{4}\right)= \text{Sectional Area of } a\ b\ c\ g\ f\ e.$$

The diagram in this position represents an excavation, by inverting it an embankment.

RAILWAY KEYS.

Sir,—The drawing of my hollow iron keys, which is given in your last number, is calculated to produce an erroneous impression as to one of the great advantages which they possess over modern keys. In your drawing you have shown the key as only fitting into the upper pin the of rail. In the enclosed sketch you will perceive that they fit into both the upper and lower fins, and this gives them a great advantage as joint keys, for the key being elastic the driving causes the contact with the rail to be very perfect, and the metal being hard no unevenness of the joint, or *canting* of the joint chair can take place, which is one of the great evils felt with wooden keys, for here the wood being comparatively soft and soon affected cy abrasion, also the hold of the key on the rail being subject to great variation and shrinking of the wood in wet and dry weather, the joint chairs become canted and the two ends of the rails out of level, which not only interposes with the comfort of travelling from the noise made in passing the joints, but produces unnecessary wear and tear in the engines and carriages, and increases the labour of repairing the road.



About two miles of the Midland Railway, that is four miles of single line, in the neighbourhood of Rugby, which has been laid with these keys, show a remarkable difference in the steadiness of the road and the quietness of the joints, as compared with the wood keys. It has been laid about six months, and the keys maintain their position and hold on the rail as firmly as the first day they were put in.

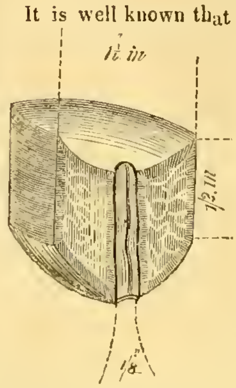
The hollow iron keys require rather more care and accuracy in laying the road than the wooden keys, but in other respects they are quite as easy to use, and drive readily into their places with the common keying hammer; however, I must not say too much in favour of my own invention; several engineers are now making trial of these keys, and we shall probably in a few months learn their opinion of them.

Your obedient servant,

W. H. Barlow.

EXPLOSION OF HARDENED STEEL.

By John M. Batchelder.



It is well known that dies, and all articles of solid steel, are very liable to become fractured at the edges, if made too hard, but an actual explosion, as detailed below, is, I presume, of rare occurrence. The annexed figure represents a fragment of a step for an upright shaft, made of round steel 1⅜th inch in diameter, with a hole ⅛th of an inch in diameter, passing through the centre.

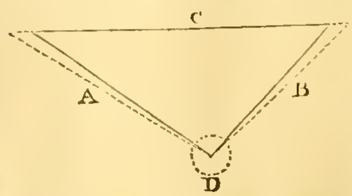
Twelve pieces were cut from the bar, and after being finished in the usual manner, were tempered separately, each being heated to a cherry-red heat, and plunged in water until perfectly cold: they were then laid aside, where the temperature was at sixty-five degrees. In about an hour, one of them burst into two parts, with a report as loud as that of a pistol; one of the pieces was thrown about twelve feet, the other struck the wall of the shop two or three feet distant. Of the whole number made, eight were broken at intervals of several days, but without any violent explosion. Examined with the microscope, the steel appears distinctly radiated, or fibrous, to the depth of a line from the external surface, while the inside is granular, but without the slightest appearance of flaw, or want of actual contact of the particles at the point ruptured, previous to the explosion. The specific gravity of the bar-steel in 7·825; that of the fractured pieces 7·850.

The cause of the fracture is, probably, the same as is observed in the glass toy called Prince Rupert's drops, made by pouring melted glass into cold water: the outside is suddenly contracted, while the particles in the interior, cooling more gradually, assume a different crystalline form, and burst asunder as soon as the cohesion of the external coating is destroyed.—*Franlkin Journal.*

A TRIANGULAR COMPENSATING PENDULUM.

The problem of a compensating pendulum, made of a single piece of metal, occupied my attention several years ago. the subject passed from my memory, but was recently revived by looking over some old memoranda—a copy of one of which is subjoined. Besides other objections, an impression that an instrument, like the one proposed, would be of too awkward a shape to be adopted in practice, induced me to lay the project aside. The principle is, however, applicable to other matters; if, therefore, nothing of the kind has been suggested, and the idea be deemed sufficiently novel to be worth recording, you will, perhaps, give it a place in the *Franklin Journal.*

Let the distance from C to D, be the required length of a pendulum, C being the point of suspension, and D, the oscillating body; it is required that the distance between them shall remain the same under all changes of temperature. Now, instead of directly connecting C, D, by a straight rod, (with the use of which the condition premised is in incompatible,) let a triangle be formed as in the figure, of a piece of iron, steel, or other wire, of a uniform thickness and density.



It is obvious an increase of heat will lengthen the sides, A, B, and tend to thrust D, further from C; but the side C, expanding at the same time, pushes the upper extremities of A, B, wider apart, as represented by the dotted lines,) and, consequently,—if the length of C, be properly proportioned to A, B,—D will remain at the same distance from C, as before. Again, suppose A, B, shortened by cold, the length of the pendulum is not effected, because the contraction of the side C, draws A, B, near together, and keeps D, where it was.

Hence it would seem that whatever variations of temperature may take place, such a pendulum, if correctly made, would be invariable. As the compensating property depends on the figure of the rod, no adjusting apparatus would be required. In simplicity, and other qualities, it surpasses the mercurial instrument of Graham, and the grid-iron of Harrison—that is, if the principle be found correct, and no mistakes in the inferences drawn from it. One striking defect, besides that of figure, is the want of stiffness, or rigidity, an important desideratum in a pendulum rod. The spring of the side C, might be fatal, To obviate this, in some measure, that side might be a flat bar, or the whole might be cut out of sheet metal, in which case the edges would oppose less resistance to the air. The position of the instrument, as shown in the figure, might be inverted—D, being made the point of suspension, and the weight placed at C.

Such is the memorandum referred to. If it be found of little worth, as regards the pendulum, it may, possibly, suggest, to some minds, more valuable speculation.—*New York, July* 5, 1844. T. E.—*Franklin Journal.*

ARCHITECTURAL AND ENGINEERING PREMIUMS.

The *Society of Arts have announced the following premiums*:—1. The Gold Medallion is offered to the candidate who shall produce the best original design for a town and county hall, containing the requisite accommodations for holding assizes, a large room for public meetings, and offices for magistrates' clerk, &c.; to be sent in on or before the third Tuesday in January, 1845. The expense of the building not to exceed 40,000*l*. The drawings to consist of two plans, one or more geometrical elevations, and two sections, drawn to a scale of a quarter of an inch to a foot; also a perspective view.

2. *Acton Premium.*—In the year 1837, a gift of 500*l*. was made to the society by Mrs. Hannah Acton, of Euston-square, for the purpose of enabling the society to offer an annual reward for the promotion of practical carpentry, applicable to civil, naval, and military architecture. In compliance with the terms of the above donation, the society offers a Gold Medallion for the best design for a roof of 100 feet span and 150 feet in length, with the walling necessary for its support. Each design to consist of a plan, and two sections, neatly outlined in Indian ink, and tinted, with a scale annexed; also a model of one bay, or larger portion (as the candidate shall see fit), should accompany the design. The model and drawings to be sent in on or before the third Tuesday in January, 1845; and to become the property of the society if the candidate be successful.

3. The Gold Medallion is offered for the best design for the hull-timbers of a steam-vessel of 1,000 tons burden. Such design to consist either of a model or of a plan, section, and other drawings sufficient to explain the same. The model or drawings to be sent in on or before the third Tuesday in January, 1845; and to become the property of the society if the candidate be successful.

4. For the best original design as a subject for modelling or carving, adapted to furniture or internal decoration, by an operative mechanic in either of these branches of art—the Silver Medal and Five Pounds.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Fourteenth Meeting, 1844.—*Held at York.*[1]

The Influence of Light on the Germination and Growth of Plants.—By Mr. R. Hunt.

The author postponed a full Report on this subject until he had been enabled by the experiments of another year to reconcile, if possible, some very anomalous results. Several experiments were described, all of which went to confirm the statement originally made by Mr. Hunt, that light prevented healthful germination, and was detrimental to the growth of the young plant. The author now gave the results of some experiments made with a view of determining the question of the production of the woody fibre. He finds that plants growing under the influence of light which has permeated blue and red media, contains more water than those which had been grown under the influence of rays which had permeated yellow and green absorptive media. On the contrary, the formation of woody fibre is greatest in the plants grown under the yellow and green relatively as follows:—

Those under the blue leaving 7·16 per cent. of woody fibre,
the red 7·25
the green 7·60
the yellow 7·69

Young plants in a healthly state were removed from the garden to the influence of the isolated rays. In all cases, the plants died under the yellow light in a few days; they slowly perished under the influence of the green, and only grew healthfully under the red and blue light.

Prof. Grove wished to make some inquiries relative to the supposed existence of a new principle in connexion with light, which was regarded by Mr. Hunt and others as the active chemical agent, to which was to be ascribed all the phenomena of photographic action, and the most genial influence on the growth of the young plant.—Mr. Hunt explained that the luminous calorific and chemical spectra were capable of producing extremely different effects. That the light coming from the sun was not at all equal in quantity to the heat; and that that element was much less than the amount of chemical power. He showed by diagrams, that the quantity of chemical power increased in the spectrum as the light diminished, and that when the light was at a maximum the chemical action was at a minimum. It was also stated, that by the use of absorbent media, light of great intensity could be obtained, which possessed scarcely any chemical power: and on the contrary, that this chemical principle of the solar beam could be obtained in the same way bu twith a very small amount of light.

On the Excavations of the Rocky Channels of Rivers, by the Recession of their Cataracts.

Mr. Featherstonhaugh drew attention to the manner in which extensive lacustrine and merecageous districts upon the continent of North America, have been drained and rendered fit habitations for man. During his researches in that part of the western hemisphere, he found evidences upon all the rivers whose valleys were bounded by lofty escarpments, that the gorge in which each river flowed had been cut out of the land by the recession of a cataract. The river Mississippi flowed in a valley of this character. From the Falls of St. Anthony to its mouth in the Gulf of Mexico, the distance was about 2,000 miles, during the first 1,200 of which these escarpments, varying from 200 to 450 feet in height, were everywhere found, divided from each other by a width varying from one to two and a half miles, the valley being during the greater part of this course thickly studded with well-wooded islands, amongst which the waters of the river flowed. Upon a level with the surface of these islands were extensive plains connected occasionally with lateral valleys coming through the escarpments, the soil of which was identically the same with that of the islands, being a light vegetable sandy soil much mixed up with decayed freshwater shells; showing that these soils were the old muddy bottom of the river, deposited when it occupied the whole breadth of the valley from escarpment to escarpment. These, and analogous appearances upon the courses of other American rivers, especially the immense lacustrine deposits separating Lake Erie from Lake Huron, seventy miles in breadth, were adduced as proofs of a great diminution of the quantity of fresh water once occupying the lakes, and the fluviatile courses of that continent: indeed, from the difference of level between a point on the Wisconsin River and the channel of the upper Fox River, over which boats now pass in time of great floods, the water communication betwixt the Mississippi and Lake Erie seems to have been uninterrupted. This portion of the paper was intended to show, that the quantity of water in the rivers in ancient times so far exceeded the quantity flowing in them at present, that the cataracts in the rivers must have been much more powerful, and that therefore the process of excavation of the rocky channels of rivers by the recession of their cataracts, must have been then effected in much shorter periods of time than at present. From all these considerations, and from the known fact that the Falls of St. Anthony had not receded more than twenty yards in the last 100 years, the author drew the deduction that the whole valley of the Mississippi, from the Falls of St. Anthony to the point where the escarpments terminate, had been excavated by the recession of that cataract, and that the excavation had proceeded at a much more rapid pace than it does in our times. The author next proceeded to explain the peculiar mechanical power which streams employ in forming their channels by the operation of cataracts, and divided it into two methods, the *molar* or grinding process, most common in mountainous countries constituted of primary rocks, and the *subtracting* or undermining power exercised upon strata of a softer quality. To illustrate the first of these methods, Mr. Featherstonhaugh exhibited a beautiful pictorial view of a remarkable cataract in the Cherokee country, called Ovnay Kay Amah, or White Water, which he visited in 1837, and which had not attracted the attention of any other traveller. This cataract was at a point several miles from the extreme edge of the mountain, and was upwards of 600 feet high, the water falling in various pitches and inclined planes from the top to the bottom. Wherever the water found a depression in the surface of the gneiss it lodged there, and on the first fortuitous pebble coming into cavity the work of destruction would begin, the current incessantly whirling about the pebble, and grinding the sides of the rock until a *pot-hole* was formed. These were there in great numbers, some of them four feet in diameter, and six feet deep. Where great numbers abounded, and parietes became at length weak, and giving way, all the pot holes would coalesce into one. This process being repeated in various portions of the rock, the cohesion of the mass became

[1] We are indebted for the reports to the local papers and partly to the 'Athenæum.'

diminished; and at the season of periodical floods, huge masses, weighing forty tons and upwards, would be precipitated to the bottom. This was the state of the great fragments at the bottom of the ravine, all of them bearing evidence of having been dislocated by the power of the water exercised upon the pot-holes. Such was the method by which this gorge, several miles long and about 600 feet in depth, had been ground out of this mountain of gneiss. At this locality were the evidences of the volume of the river having once been at least ten times larger than at present. A semi-circular ledge of gneiss, at the top, east of the stream, and 1,200 feet wide, was worn bare for a great distance, and down its perpendicular face was concave, as if the river had been projected over the top, and the screen of water in face of the concavity, and the concussion, and the moisture, had produced the usual effect, of peeling off the coats of the rock. It presented much such an appearance as the rock at the Horse-Shoe Fall at Niagara would do, if the water were to be so much diminished at that point as to abandon it, and to be projected only from the comparatively small fall of the Schlossa, on the American side of the river. For the other example of the *subtracting*, or undermining power exercised in the recession of cataracts, the Falls of Niagara were taken, of which a flat view was given, together with a section of the rocks. Mr. Featherstonhaugh had published a paper, in 1831, explaining the recession of this cataract. It is well known that the river Niagara flows upon a bed of limestone from which it projects itself, and that this rock is supported by a strong bed of friable shale upwards of seventy feet thick. The moisture arising from the screen of water, the current of wind behind it, and the concussion, loosen and remove the shale, and the superincumbent limestone, losing its support falls down. In this manner the cataract has receded at least six miles from the Queenston heights. Mr. Featherstonhaugh expressed an opinion that this operation of excavating long channels of rivers, as in the instance especially of the Mississippi, may be considered in the class of providential arrangements, since by it the lakes, swamps, and immense merecageous surfaces become drained, and rendered salubrious and productive habitations for man. There were many other interesting points brought forward in this paper, of which we have only room for this abstract.

Observations on Subterranean Temperature in Ireland.

In July 1843 thermometers were placed at the copper mines of Knockmatson Company, Waterford, which are worked to the depth of 774 feet. Of the four instruments employed, one was hung in the open air four feet from the surface; one hung freely in the gallery at the depth of 774 feet; one in the rock at the same depth; and one in the lode or metallic vein. The rock is indurated clay slate, the ore massive copper pyrites in quartz veinstone. The average of all the readings of these thermometers during eleven months was as follows:—

		Thermometer at the Depth of 774 feet.		
	At the Surface.	Air.	Rock.	Lode.
Average	50·026	57·176	57·369	57·915
Maximum		58·25	58·5	58·5
Minimum		56·	56·5	

Taking the average temperature in the rock as the mean at that depth, and allowing 100 feet for the depth to which the action of solar causes may extend, or to the line of no variation, there is an increase of 7·343 for the depth of 674 feet, equivalent to 1° in 91·82 feet, a rate of increase about one half as rapid as the rate deduced from a large number of observations in England, which gave an increase of 1° in 45 to 50 feet. Mr. Oldham also noticed the fact, that there was a gradual decrease in the actual temperature, during these observations: the average of the thermometer in the rock being 57·718 during the first half of the observation, and 57·004 during the latter half, being a decrease of ·674 during the eleven months, although more men were employed, and the works more extensive than at the commencement.

On the Causes of the Great Versailles Railway Accident.

By Mr. J. Gray resident engineer to the Hull and Selby Railway.

This paper commenced by observing that having seen the name of a near relative published as among one of the sufferers, he immediately set off for Paris, and that whilst there he endeavoured to possess himself of all the information which might in any way bear upon the occurrence. Having traced the order in which the train left Versailles for Paris, he proceeds to inquire into the cause of the fire which followed the overthrow of the train. This he attributes to the fact of the fire of one engine being scattered about and coming in contact with the carriages behind, and especially the combustible matter contained therein. He then goes on to describe the cause of the accident which he traces to the breakage of an axletree first at the one and afterwards at the other end. He says, from various facts and circumstances connected with the great accident of the 8th May, 1842, on the Paris and Versailles Railway, it was shown, step by step, that nothing but a failure in the front axle of the engine could have been the first cause of her right hand wheel slipping within the rail. Following this he gives a series of observations on the axle, with remarks and illustrations of the importance of uniform elasticity or vibration in the preservation of all articles subjected to sudden strains or percussive forces. He says, in conclusion, with good materials and proportions and the axles in a state of repose as received from the forge, or, in other words, perfectly free from the effects of cold swaging or hammer hardening, an axle in such a state, and of ample dimensions for its intended work, will, I have no doubt, most effectually resist fracture, for any period the wear of the journeys may enable it to run. But, if the dimensions be deficient, the iron will be taxed beyond its permanent cohesive power and elasticity; and, however slight the excess of exertion and fatigue may be, a gradual and inevitable dissolution of particles must result; but beyond this I have not met with anything, either in print, in observation, or in the course of experience, that would at all warrant my belief in iron necessarily changing its quality, or becoming crystallized by forces within the range of its permanent cohesive force and elasticity.

On Steam Navigation in America.—By Dr. Scoresby.

After alluding to steam navigation as having an important bearing upon the national prosperity and the development and employment of the national resources of America, equal to that of the steam engine upon the national wealth and commercial greatness of our own country, the author proceeded to notice the extent of navigable waters in North America, which he said, including the coast lines and the waters of the British possession, might be roughly estimated at 25,000 to 30,000 miles; for such was the vast extent even now traversed by steam-boats, partly coastways, but mainly inland in the United States alone, that the summing-up of the steam-boat routes given in a guide book not of the most modern date, made a total distance, omitting repetitions of the same track, of 13,444 miles. In enumerating the various waters, and particularly in reference to the Mississippi, he observed that none but steam-boats had any or little chance of making way, from the rapidity of the current, the average of which in the Mississippi was four miles an hour. The author went on to allude to the introduction of the steam-boat by Mr. Fulton, in 1807, and the rapid progress that had been made, and then directed the attention of the section to the peculiarities of some of the boats, namely, the general attention to elegance in the style of fitting up, the construction of the cabins on deck, and the application of the hull of the vessel entirely to cargo, the working of the rudder at the forepart of the vessel by means of communicating rods, the use of a distinct boiler and machinery to each paddle, &c. With regard to the speed he observed that it was much beyond that of our steam-boats, from the circumstance of the Americans adopting the high pressure principle, and that too to an extent at which the generality of Englishmen would be loth to trust themselves. Whilst our boats were worked at a pressure of 5 lb. to the square inch, they thought nothing of 100 lb. or 150 lb. pressure; and, in addition to loading the valve, the engineers had been known to sit upon it in order to gain increased speed. The most extraordinary performance of American steamers was effected by the "*J. M. White*," in the summer of this year. She made her way against an average current of from 3 to 4 miles an hour, from New Orleans to St. Louis, a distance of 1200 miles, in three days and 23 hours, remaining a day and a half at St. Louis, unloading and loading, and reached New Orleans again, having performed a distance of 2300 to 2400 miles in little more than nine days. The average speed, taking certain advantages and disadvantages, into consideration, would be 16 miles, or perhaps near 14 knots per hour. With regard to the dangerous character of the western boats (improved now, but far from safe,) the author observed that in 1834 an American paper stated that 1500 persons had lost their lives in American steam-boats, by the bursting of boilers, during three years, and that in two years, from 1832 to 1834, 67 steam-boats were lost or abandoned in the western waters.

A Micrometer.

Mr. Whitworth exhibited a machine for ascertaining *the diameter of metallic cylinders or gauges*, with an extreme degree of accuracy, amounting to the ten thousandth part of an inch. The gauges or cylinders are to be used as standards of size, where practicable, instead of the two-feet rule. The truth of the machine depends upon the perfect accuracy of the screw. The object to be measured is passed by the hand between two surfaces, which are actuated by the screw, and a difference indicated by one division of a wheel, on the screw, amounting to the ten thousandth part of an inch, is distinctly sensible to the hand. This occasioned considerable surprise, that a difference in size so extremely minute should (by touch) be distinguished. The thickness of a hair was taken, and found to be 0019 decimal parts of an inch, and the thickness of a piece of tissue paper 0017 decimal parts of an inch.

Grenier Mobile, or Moveable Granary for Preserving Corn.

Professor Byrne explained the nature of this invention, it was the result of the ingenuity of the French, and they were introduced here in order that the intelligence of the English, if they thought them practicable, might be brought to bear upon them in the way of improvement. The machine consists of a cylinder, divided into compartments, which will hold 800 quarters of corn. It is made of zinc or galvanised iron, and turns round like a barrel, so that the grain is thus turned over by one man daily. The advantages are that the corn gets gradually dried, may be preserved for a longer period, bad corn is improved, grain generally comes out heavier than when it went in, and it is not bruised and wasted by being turned over with the shovel. With regard to the increase (?) in weight, it was stated at 6¾ lb. in 110 cwt. The cost of the machine is about 1*l*. a quarter.—Mr. Bermingham supposed that a person expended 100*l*. on one of these machines, which would hold 100 quarters of grain; the interest of the 100*l*. would be, say 5 or 6 per cent., and he thought no farmer would say he lost less than that by rats and other vermin, which would be obviated by the use of this machine.

On Heating by Steam.

Mr. W. West read an account of some experiments on heating by steam. Having reason to believe that water heated by steam did not reach the boiling temperature, even when the steam escaped in abundance, and the water was violently agitated, Mr. West made a number of experiments to ascertain the fact. In one of these experiments, the water only reached 205°, in another 190°, and in another 207°. Steam from water in the same apparatus which was used throughout was then passed through water; but with an addition of the receiving vessel, of a second, or false bottom, pierced with numerous small holes. It was then easy to maintain a temperature of 212°, with the same means of producing steam, and apparently a similar, or rather a smaller quantity,

On the Resistance of Railway Trains.—By Mr. Scott Russell.

The paper detailed a number of experiments on the Sheffield and Manchester Railway. For the purpose of these experiments it is necessary that the railway should present long and very steep gradients, and no where else, were these advantages presented in greater abundance than on the Sheffield and Manchester railway. The experiments were as follow:—

1. Trains of carriages, empty, were put in motion at the summit of an inclined plane, at about 30 miles an hour, and were allowed to descend freely.
2. Trains of carriages, loaded, were tried in the same way.
3. The engine and tender were treated in the same way, being put to a velocity of between 30 and 40 miles per hour, and allowed to descend freely the whole length of the inclined plane without any train attached.
4. The engine and tender, with a train attached, were propelled to the top of the inclined plane, and then allowed to descend freely by gravity.

By these means the following results were obtained:—

1. The resistance to railway carriages at slow velocities does not exceed 8 lb. per ton.
2. The resistance to a light railway train of six carriages, at 23·6 miles an hour, was 19 lb. per ton.
3. The resistance to a loaded train of six carriages, at 30 miles per hour, was 19 lb. per ton.
4. The resistance to a light train of six carriages, at 28 miles an hour, was 22 lb. per ton.
5. The resistance to a loaded train of six carriages, at 36 miles an hour, was 22 lb. per ton.
6. The resistance to a six wheeled engine and tender, at 23·6 miles an hour, was 19 lb. per ton.
7. The resistance to a six wheeled engine and tender, at 28·3 miles an hour, was 22 lb. per ton.
8. The resistance to a train composed of six light carriages, with engine and tender, at 32 miles an hour, was 22 lb. per ton.
9. The resistance to a train composed of nine loaded carriages, with engine and tender, at 36 miles an hour, was 22 lb. per ton.

From these experiments Mr. Russell drew several deductions, one of which was that a train, when coupled with the engine, met with less resistance than when put in action singly. He observed that the subject was at this time of considerable importance, inasmuch as the system adopted for laying down the gradients of new lines was of necessity regulated chiefly by the opinion of the engineer on the question of resistance. How much mechanical force is required to move a given weight of train, along a given gradient, at a given speed, was a question of which the solution was essential to sound engineering, but the profession had long felt that they were not in possession of sufficient practical data to determine this question.

In answer to a question from Dr. Green, Mr. Russell said that a large portion of the resistance no doubt was due to the atmosphere, but still, allowing for that, there remained a wonderful increase over the above supposed resistance of about 8 lb. per ton, and the object of these experiments was to learn from what cause that increase arose.

Mr. Roberts hoped, in future experiments, the size of the wheels would be taken into consideration. Both he and Mr. Fairbairn were of opinion that if the wheels were made more cylindrical they would give a more comfortable action to the carriages.

On the Great Fountain at Chatsworth, erected by the Duke of Devonshire.—By Mr. Paxton.

This fountain is supplied with water from a reservoir which covers eight acres of land, and which receives the waters from the moors. A hundred thousand yards of earth have been cut away for this reservoir, and 2621 feet of piping, having 298 joints, have been constructed for conveying the water. The fall of the pipe is 381 feet, and the height which the water attains from the fountain, (or which it is expected to attain when the whole work shall have been brought into full operation,) is 280 feet, or, as the chairman observed, about 60 feet beyond the highest point of York Minster. The description of this fountain was given as applicable to the study of hydrostatics, showing the friction of water upon pipes and the impediment to its free course by friction against the air. One gentleman observed, with reference to the force of water thus emitted that the sensation produced by putting a finger in the pipe was just like that which would be experienced by putting a finger into the flame of a candle.

Report on a Hydrogen Furnace for Vitrification, and other Applications of Heat in the Laboratory.—By the Rev. W. V. Harcourt.

At the request of the British Association Mr. Harcourt had undertaken some years since to make experiments on vitrification. Dr. Faraday, in his experiments on glass, had the greatest difficulty in procuring perfectly homogeneous masses, arising in most cases from the almost impossibility of procuring a regulated heat in the ordinary furnaces. Mr. Harcourt, impressed with the advantages which might be gained for optical purposes, by procuring glasses formed by other salts and bases, instituted some experiments with a view of ascertaining this point. It was considered, that if a tribasic phosphate formed a glass, and the bibasic phosphate formed a glass, we should have, in all probability, glasses having different optical properties. Finding difficulty in proceeding with these experiments, at the heat given by ordinary furnaces, and the risk to which the platina crucibles were exposed, he was induced to try the effects of hydrogen burning in common air. Dr. Dalton was consulted on the construction of the first hydrogen furnaces, and he suggested the difficulty which was found to arise in practice—that hydrogen gas burning, through small orifices, with great pressure, would blow itself out. This difficulty was, however, overcome in the management of the apparatus brought before the Section. This apparatus consisted of an iron tube, in which the gas was generated by the addition of 15 ounces of zinc to three-quarters of a pint of oil of vitriol and ten pints and a half of water. The gas produced was found to be in ten minutes under a pressure of 21 atmospheres, in sixteen minutes and a half under a pressure of 25 atmospheres, and in eighteen minutes under a pressure of 26 atmospheres. The gas was conducted into another cylinder, and from thence to the jets, over which was suspended a platina crucible. The gas being ignited at these jets, maintained, with the above charge, the platina crucible at a white heat for twenty minutes. Gems had been fused by the heat thus generated. Several kinds of jets were used, as it might be necessary to surround the crucible with heat, or only to apply the heat to the bottom of it. Experiments with this apparatus have been made upon the phosphates of antimony, zinc, barytes, and cadmium. The results have not been, however, quite satisfactory. In some the striæ interfered with the transparency of the glass formed; and in the case of the monobasic phosphate of zinc, it was found that, to whatever heat the compound may have been exposed, the glass thus formed was deliquescent. The reading of this Report was accompanied by some experiments with the hydrogen furnace in question, for the purpose of showing the intense heat which could be produced.

Dr. Faraday bore testimony to the advantages of this arrangement. He had found in all his experiments on glass, in which the elements were chemically combined, that crystallization took place. He regarded all common glass as examples of solution, rather than of chemical combination. Borate of lead and silicate of lead, if fused in small quantities, so that they cooled quickly, were transparent, but if fused in masses, which required a longer time, they were in a crystalline condition.—Mr. Harcourt remarked, that in the monobasic phosphate of zinc, which was transparent when vitrified, the quantity of acid was probably exceedingly small, but this glass was striated.—Dr. Faraday said, that some of the purest specimens of American ice show similar striæ, although it was in a state of exceeding purity, yielding the purest of all water when liquefied.—Some remarks were then made by Mr. Pearsall, on the action of hydrogen on platina. An experiment was named by Mr. Harcourt, in which a platina tube was destroyed by an attempt to fuse ultramarine in it. Prof. Liebig stated, that platina was soon fused if exposed to a charcoal fire, from the action of the silicon contained in the charcoal.

Tidal Observations.

The Astronomer Royal gave a verbal account of the results of tide observations on the coast of Ireland. For the purpose of these observations stations had been established at different places on the coast, and the observations had been continued two months, namely, from the 22d of June to the 25th of August. There were four critical periods daily in the tides, namely, high water twice, and low water the same, one of which, at least, must occur in the night, and it was necessary that these periods should be watched. They were requisite, in order that proper allowance might be made for the diurnal tides, because, at some of the stations, the forenoon tide was higher than the afternoon, and again on the contrary. The plan, therefore, was that about an hour before high water the observer began to watch the water every five minutes, and watched it at those intervals until it had decidedly taken a turn the other way. The same process was continued at the time of low water, and the observations were continued at night in the same way. The result was that it was found the tide along the S. and S.W. coasts was simultaneous, and along the west and north and north-east, it was the same, but at the south-east there was a difference of six hours. At Portadown, there was scarcely any tide at all, or the tides flowed so frequently that it had been impossible to make an observation. It was a remarkable fact that the water washing to the north of Ireland was a foot higher than on the south coast. There were several other remarkable facts which the Astronomer-Royal detailed, to which he gave philosophical explanations, and his observations were of that highly interesting character as to demand for them the applause of the section.

Mr. Scott Russell made his final report "On the Tides of the East Coast of Scotland." He said he had little more to add to the report which he had submitted to the last meeting. He recommended that observations of this sort should be made at the highest and lowest point of the tide, and should be kept perfectly continuous, which might be done by employing two sets of observers, one for the night time, and the other for the day. He mentioned a self-registering tide gauge which had been invented by a gentlemen at Port Glasgow, and which gave the heights in the most simple and accurate manner.

Mr. Russell also made some remarks upon "The Nature of Sound Waves," which were principally details of experiments in which he has been engaged.

A paper was then produced, written by the Rev. — O'Brien, "On the propagation of Waves in a resisted medium, with a new explanation of the dispersion and absorption of light, and other optical phenomena." The communication was read, and its contents verbally described by J. J. Sylvester, Esq.

On Specific Heat.—By J. P. Joule.—After examining the law of Dulong and Petit, that the specific heat of simple bodies is inversely proportional to their atomic weights, the author proceeded to detail the attempts made by Haycraft, De la Rive, and Mercet, to discover the specific heats of gases and liquids. The observarions of Newmann and Regnault on the specific heats of simple and compound bodies were next examined. Mr. Joule then exhibited to the Section a table, in which the theoretical specific heats of a variety of bodies impartially selected were calculated, on the hypothesis, that the capacity for heat of a simple atom remains the same in whatever chemical combination it enters. On the whole, the coincidence between the theoretical and experimental results was such as would induce a belief that the law of Dulong and Petit, with regard to simple atoms, is capable of a greater degree of generalization than chemists have hitherto been inclined to admit.

On the Alteration that takes place in Iron by being exposed to long-continued Vibration. By Mr. W. Lucas.—At Cork, this subject was brought forward, and certain specimens of iron exhibited, in order to show the effects produced upon the iron by being exposed to a certain degree of concussion or vibration during the process of swaging, and again restored to its original state by being annealed, in accordance with the results detailed by Mr. Nasmyth, at Manchester, in 1842; in addition to these, also were exhibited specimens of portions of the same iron that had been exposed to the concussion of a large till hammer, working at the rate of about 350 strokes per minute, which occasioned the bars of iron to break short off at the point of bearing in the course of twenty-four hours; there was also shown a portion of one of the hammer shafts, the texture of which had evidently been altered, probably by the long-continued and repeated concussions to which it had been exposed, for instead of breaking with the peculiar splintery fracture common to wood, it broke with a peculiar short fracture, and this, I am informed, is a common occurrence. In continuance of these experiments upon the effects of concussion or vibration, Mr. Lucas laid before the section the results of some further experiments.

EARL OF ROSSE'S REFLECTING TELESCOPE.

The Earl of Rosse commenced by stating, that the Council having intimated their opinion that some account of the experiments in which he had been engaged on the Reflecting Telescope would not be altogether devoid of interest, he would endeavour to describe, as briefly as possible, the manner in which he had attempted to accomplish the object in view, and the principal results obtained. Two objects required to be kept in view: first, to give the telescope sufficient aperture to secure a sufficiency of light; secondly, to increase to a sufficient extent the magnifying power. On these depended what might be called the optical power of the instrument, but particularly upon the former. For instance, the large telescope, of which a model stood before them, to be used effectually, must have a magnifying power of 300 times. Now, another instrument, very inferior in size, might have a much higher power, but, from the vast quantity of light which it collected into the image, objects in it became distinct which could not be at all seen by those of inferior aperture. The next question he had to determine was, whether he should attempt refractors or reflectors. Just at that time very large and very fine discs of the proper glass had been produced upon the Continent, and a strong hope was entertained of bringing the refracting telescope to a degree of perfection which had been hitherto rather hoped for than attained. But, upon a calm balancing of all the difficulties which opposed their construction, he determined to attempt the improvement of the Newtonian reflector, and that notwithstanding it was well known that an error of form of the reflector produced an error in the image more than five times as great as the same error in the refractor would produce. It was to the steps by which he attained this object that he was now about to direct the attention of the Section.

"Having concluded that upon the whole there was a better prospect of obtaining by reflection, rather than by refraction, the power which would be required for making any effectual progress in the re-examination of the nebulæ, the first experiments were undertaken, in the hope of obviating the difficulties which had previously prevented the application of the brilliant alloy which may be formed of tin and copper in proper proportions to the construction of large instruments. The manner in which the difficulty had been met, was, by adding an excessive proportion of copper to the alloy, but the mirror was no longer susceptible of a durable polish, and, when used, its powers declined rapidly. It appeared to me, therefore, to be an object so important to obtain a reflecting surface which would reflect the greatest quantity of light, and retain that property little diminished for a length of time, that numerous experiments were undertaken and perseveringly carried on. After a number of failures the difficulties appeared to be so great that I constructed three specula, where the basis of the mirror was an alloy of zinc and copper in the proportion of 1 zinc to 2·74 copper, which expands with changes of temperature in the same proportion as speculum metal. This was subsequently plated with speculum metal, in pieces of such size as we were enabled to cast sound. These specula were very light and stiff, and their performance upon the whole satisfactory; but they were affected by diffraction at the joinings of the plates; and although very brilliant and durable, defining all objects well under high powers, except very large stars, still as the effect of diffraction was then perceptible they could not be considered as perfect instruments. In the course of the experiments carried on while these three specula were in progress, it was ascertained that the difficulty of casting large discs of brilliant speculum metal arose from the unequal contraction of the material, which in the first instance, produced imperfections in the castings, and often, subsequently, their total destruction; and it appeared evident, that, if the fluid mass could be cooled throughout with perfect regularity, so that at every instant every portion should be of the same temperature, there would be no unequal contraction in the progress towards solidification, nor, subsequently, in the transition from a red heat to the temperature of the atmosphere. Although it was obvious that the process could not be managed so that the exact condition required should be fulfilled, still, by abstracting heat uniformly from one surface (the lower one), the temperature of the mass would be kept uniform in one direction, that is, horizontally; while in the vertical direction, it would vary in some degree as the distance from the cooling surface. These conditions being satisfied, we should likewise have a mass which would be free from flaws, and, when cool, would be free from sensible strain; nothing could be easier than to accomplish this, approximately, in practice; it would be only necessary to make one surface of the mould (the lower one) of iron of a good conducting material, while the remainder was of dry sand. On trial, this plan was perfectly successful; there was, however, a new, though not a very serious defect, which was immediately apparent—the speculum metal was cooled so rapidly that air-bubbles remained entangled between it and the iron surface; but the remedy immediately suggested itself, by making the iron surface porous, so as to suffer the air to escape; in fact, by forming it of plates of iron placed vertically side by side, the defect was altogether removed. It only then remained to secure the speculum from cooling unequally, and for that purpose it was sufficient to place it in an oven raised to a very low red heat, and there to leave it till cold, from one to three or four weeks, or perhaps longer, according to its size.

"*The alloy* which I consider the best, differs but little from that employed by Mr. Edwards: I omit the brass and arsenic, employing merely tin and copper in the atomic proportions, namely, one atom of tin to four atoms of copper, or, by weight, 58·9 to 126·4. As it was obviously impossible to cast large specula in earthen crucibles, the reverberatory furnace was tried; but the tin oxidized so rapidly, that the proportions in the alloy were uncertain; and after some abortive trials with cast-iron crucibles, it was found, that when the crucible is cast with the mouth up it is free from the minute pores through which the speculum metal would otherwise exude; and therefore such crucibles fully answered the purpose. It was very obvious that the published processes for grinding and polishing specula, being in a great measure dependent on manual dexterity, were uncertain, and not well suited to large specula; accordingly, at an early period of these experiments, in 1827; a machine was contrived for the purpose, which has subsequently been improved, and by means of it a close approximation to the parabolic figure can be obtained with certainty; as it has been described in the Philosophical Transactions for 1840, it is unnecessary to do more than to point out the principle on which it acts. The speculum is made to revolve very slowly, while the polishing tool is drawn backwards and forwards by one eccentric or crank, and from side to side, slowly, by another. The polishing tool is connected with the eccentries by a ring, which fits it loosely, so as to permit it to revolve, deriving its rotatory motion from the speculum, but revolving much more slowly. It is counterpoised, so that it may be made sufficiently tiff, and yet press slightly on the speculum; the pressure being about one pound for every circular superficial foot. The motions of this machine are relatively so adjusted that the focal length of the speculum during the polishing process, or towards the lateral end of it, shall be gradually becoming slightly longer, and the figure will depend in a great measure upon the rapidity with which this increase in the focal length takes place. It will be evident that a surface, spherical originally, will cease to be so, if, while subjected to the action of the polisher, it is in a continual state of transition from a shorter to a longer focus; in fact, during no instant of time will it be actually spherical, but some curve, differing a little from the sphere, and which may be made to approach the parabola, provided it be possible in practice to give effect to certain conditions. An immense number of experiments, where the results were carefully registered, eventually established an empirical formula, which affords at present very good practical results, and may hereafter, perhaps, be considerbly improved. In fact, when the stroke of the first eccentric is one-third the diameter of the speculum, and that of the second eccentric is such as to produce a lateral motion of the bar which moves the polisher, measured on the edge of the tank, equal to ·27, the diameter of the speculum, or referred to the centre of the polisher, of 1·7, the figure will be nearly parabolic. The velocity and direction of the motions which produce the necessary friction being adjusted in due proportion by the arrangements of the machine, and the temperature of the speculum being kept uniform by the water in which it is immersed, there remains still other conditions, which are essential to the production of the required result. The process of polishing differs very essentially from that of grinding: in the latter, the powder employed runs loose between two hard surfaces, and may produce scratches possibly equal in depth to the size of the particles: in the polishing process the case is very different; there the particles of the powder lodge in the comparatively soft material of which the surface of the polishing tool is formed, and as the portions projecting may bear a very small proportion to the size of the particles themselves, the scratches necessarily will be diminished in the same proportion. The particles are forced thus to imbed themselves, in consequence of the extreme accuracy of contact between the surface of the polisher and the speculum. But as soon as this accurate contact ceases, the polishing process becomes but fine grinding. It is absolutely necessary, therefore, to secure this accuracy of contact during the whole process. If the surface of a polisher, of considerable dimensions, is covered with a thin coat of pitch, of sufficient hardness to polish a true surface, however accurately it may fit the speculum, it will very soon cease to do so, and the operation will fail. The reason is this, that particles of the polishing powder and abraded matter will collect in one place more than another, and as the pitch is not elastic, close contact throughout the surfaces will cease. By employing a coat of pitch, thicker in proportion as the diameter of the speculum is greater, there will be room for lateral expansion, and the prominence can therefore subside, and accurate contact still continue; however, accuracy of figure is thus, to a considerable extent, sacrificed. By thoroughly grooving a surface of pitch, provision may be made for lateral expansion contiguous to the spot where the undue collection of polishing powder may have taken place. But, in practice such grooves are inconvenient, being constantly liable to fill up: this evil is entirely obviated by grooving the polisher itself, and the smaller the portions of continuous surface, the thinner may be the stratum of pitch.

"There is another condition, which is also important, that the pitchy surface should be so hard as not to yield and abrade the softer portions of the metal faster than the harder. When the pitchy surface is unduly soft, this defect is carried so far that even the structure of the metal is made apparent. Whilst, therefore, it is essential that the surface in contact with the speculum should be as hard as possible, consistent with its retaining the polishing powder, it is proper that there should be a yielding where necessary, or contact would not be preserved. Both conditions can be satisfied by forming the surface of two layers of resinous matter of different degrees of hardness; the first may be of common pitch, adjusted to the proper consistence by the addition of spirits of turpentine, or rosin; and the other I prefer making of rosin, spirits of turpentine, and wheat flour, as hard as possible, consistent with its holding the polishing powder. The thickness of each layer need not be more than one-fortieth of an inch, provided no portion of continuous surface exceeds half an inch in diameter, the hard resinous compound, after it has been thoroughly fused, can be reduced to powder, and thus easily applied to the polisher, and incorporated with the subjacent layer, by instantaneous exposure to flame. A speculum of three feet diameter thus polished, has resolved several of the nebulæ, and in a considerable proportion of the others has shown new stars, or some other new feature."

In conclusion, Lord Rosse exhibited drawings of the nebulæ, as figured by Herschel, and also as they appeared in the telescope constructed by his Lordship.

Fig. 88 of Herschel, or 2 Messier, and 21 h. 25 m. δ—1° 34′ south, many of the stars into which it is reduced by his telescope, are as large as those of the first magnitude to the naked eye.

Fig. 81, Herschel, the bright nebula near ζ Tauri, figured by Herschel as perfectly elliptic and resolvable, but no stars seen, is seen in the telescope, with three feet aperture, as a rather oval cluster of stars, with projecting filaments of stars; some of these filaments extending considerably, so as to give something of the idea of a scorpion.

Fig. 29 of Herschel. The ring nebula of Lyra, shows in the three feet telescope, seven stars, one triple. It is an annular closter, with fringes, and the nebulous-looking centre in patches.

Fig. 45 of Herschel, a planetary nebula, is also seen as an annular closter.

Fig. 26 of Herschel, the "Dumbell Nebula," is seen as an irregular cluster, or rather two in juxta-position and nothing of the exact elliptic termination of Herschel's figure.

AMERICAN PATENTS.

(From the American Journal of the Franklin Institute.)

IMPROVED REVERBERATORY AND PUDDLING FURNACES.

Specification of a Patent for "*an improved reverberatory furnace for converting mineral, or ore, into wrought-iron at the first operation.*" Granted to Simeon Broadmeadow, of Manayunk, Pennsylvania, and assigned to Wm. Green, jun., of Woodbridge, New Jersey.—January 20, 1844.

The new and improved reverberatory furnace is for the purpose of directly converting mineral, or ores of iron, into wrought-iron, at the first operation, by the process of puddling, using either anthracite, bituminous coal, or other fuel, for that purpose; which furnace is also used for the puddling of pig-iron, or of iron in other states, which is to be submitted to that process, and likewise for the melting, or heating, of metals for various purposes.

The improvement consists in the so constructing it as that the hearth of the furnace shall be heated both on its under and upper sides. For this purpose a fire chamber is constructed, in which the fuel rests upon grate bars directly under the hearth of the puddling furnace, there being an ash pit under said grate bars, such fire chamber and ash pit being in the ordinary form. The direct heat of the burning fuel which is contained in the fire chamber, is, consequently, made to operate on the under side of the hearth, and the heated air and flame ascend through a flue space at the rear end of the fire chamber, then along the puddling compartment, to the front of the furnace, and thence back along a flue over the roof thereof leading to the chimney, which is to be elevated in the ordinary manner to create a sufficient draught.]

Fig. 1, Fig. 2.

Scale, one-eighth of an inch to a foot.

In the accompanying drawing, fig. 1, is a front elevation of the furnace; the masonry which encloses it, and the chimney being omitted for the purpose of showing the outline of the interior. Fig. 2, is a vertical section through the middle of the furnace from front to back. A, is the ash pit; B the fire chamber; C, the hearth of the puddling furnace B, into which the heated air and flame pass through the flue space E, and operate upon the material within the furnace in the usual manner; F, is the roof of said furnace; the hearth and roof should be formed of suitable fire stone; G, is a flue above the roof stone, leading to the chimney H: I, represents a front door to the puddling furnace, but the main working door is to be made at the side, as seen at I', this being its usual place; J, is the door of the fire chamber for supplying fuel; K, is a basin at the front of the hearth, and L, a tap hole for the removal of slag, &c.: as it is desirable to keep the hearth at this part well heated, the fire chamber is sometimes so constructed as to allow it to project a foot, more, or less, in front of the furnace, by which means this end is effectually accomplished. The lower part of the basin may be strengthened by giving the hearth stone the form shown by the dotted lines *a, a*; M, is the grate, and N, level of the ground.

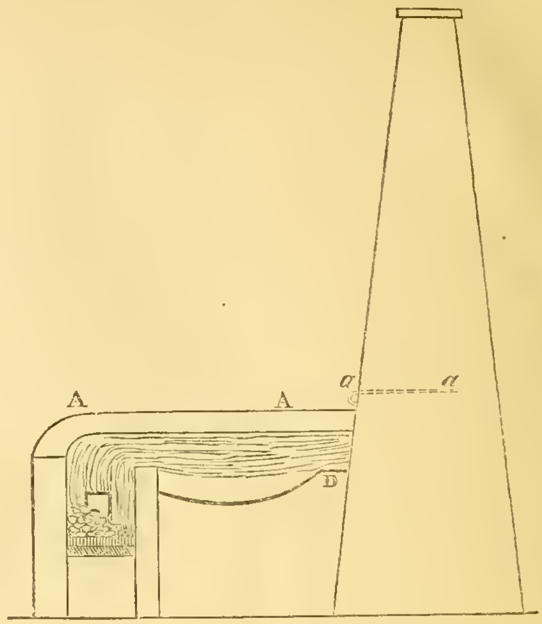
When this furnace is used for the purpose of converting mineral into wrought-iron directly from the ore, said ore is to be finely pulverized, and thrown upon the hearth, which must be heated to whiteness; in about half an hour the mineral will be fused, and it is then to be treated in the same manner as when pudling pig-iron; by this means the sulphur and other volatile matter contained in the ore will be driven off, and the ore will be subjected to the full action of the heated air. Most kinds of ore may be treated in this way without the addition of any flux, or of carbonaceous matter; but where the ore is refractory, and does not fuse readily, from containing an excess of oxygen, a small portion of charcoal may be added thereto. When the ore is too fusible, owing to its containing an excess of carbon, I add the scales of iron, or some analogous substance, such as the highly oxidized ores, as is sometimes done in the puddling of pig-iron. No rule can be given for this, but the judgment of every competent iron master will supply all the information that is necessary. Most commonly, as before remarked, the metal will be brought into nature without any such addition to the iron. When the mineral, or pig metal, has been thus heated until it approaches the melting point, the fire is to be slackened, until it is reduced nearly to a red heat; in this state the ore, or the metal, is to be worked with a scraper and paddle until the mineral, or metal, shall have become, as the technical phrase is, sufficiently *dry*. At this period the heat is to be raised, and, when the welding of the mineral, or metal, commences, it is to be balled into suitable sizes, either for the hammer, or the rollers.

The claim is for the constructing and using of a reverberatory furnace that is heated by means of a fire chamber, situated below its hearth, or floor, and from which the flame and heated air are conducted over its top, so as to heat it as well below as above; the respective parts of the said furnace being combined, arranged, and operating, as represented and described.

Specification for a patent for "*manufacturing malleable iron directly from the ore, in a puddling furnace.*" Granted to Simeon Broadmeadow, of the city of New York.—May 30, 1844.

The improvement is the process for manufacturing iron, by means of which malleable iron is obtained directly from the ore, by treating the same in a puddling furnace.

The form given to the furnace, is somewhat different from that usually given to the pudling furnace, as will be seen by reference to the accompanying drawing, which represents it as having one of its side walls removed for the purpose of showing the form of the interior. A A, is the arch, or roof, which, instead of curving down as it approaches the chimney, rises regularly from that part which is above the fire chamber, as it approaches the stock, which it may do at an elevation, say of about ten degrees; it may, however pass horizontally, or even be slightly depressed, without materially interfering with its action; the object of giving to it this form is to prevent its taking the character of a reverberatory, as the reflecting of the flame and heat so as to cause them to reverberate, or impinge, upon the ore, converts the large portion of it into slag, instead of reducing it into malleable iron. The inventor elevates the hearth of the furnace at its near end, and prefers to do this to an extent greater than that of the elevation of the roof; this elevation is shown at D. The object thereof is to contract the throat, or opening, from the furnace into the flue, so as to make it much less than in the ordinary reverberatory, which is usually about two feet, or two feet six inches, whilst he reduces its height, between the floor and the roof, to about one foot. In the lower part of the chimney, as at *a, a*, where a sliding register, or damper, is placed, which can be closed at pleasure, so as to retain and regulate the heat; such regulation being essential to the success of the process. In a furnace, so constructed, the mineral and the metal obtained therefrom, will be sufficiently heated to produce the intended effect; but the form of the furnace may, as above indicated, be varied to a considerable extent without materially interfering with its use; and there have probably been puddling, or other furnaces constructed, which, under due management, might answer the purpose equally well with that described. No claim is made to the particular form of the furnace which is described, but only to indicate the main conditions necessary to the success of the process.



In this process of reducing the mineral to the metallic state, the inventor does not use any of the earthy, or other fluxes which are employed in the smelting of iron, nor does he, of necessity, mix therewith any carbonaceous matter, as has been uniformly done in the attempts heretofore made to manufacture malleable iron directly from the ore. The most notable of these is the process for which letters patent were obtained in England by W. N. Clay, dated on the 31st of March, 1841. In that patent a claim is made to "the mode of manufacturing wrought, or malleable, iron in reverberatory furnaces from iron ore, by combining therewith twenty-eight per cent., or upwards, of carbonaceous matter." In this present process, on the contrary, the ores of iron are employed alone, by mixing together, in due proportions, such ores as, by their chemical composition, are calculated to react upon each other when duly heated, and to bring the metal contained in each of them into the malleable state, the inventor takes any of the ores which are known as oxides of iron, which he reduces to coarse powder, and with this he mixes a due proportion of the ore known as a carburet of iron, also in powder; this mixture he puts into his puddling furnace, and by means of anthracite, or other fuel, subjects it to the proper degree of heat for effecting the reduction. The mass so placed in the furnace, he does not stir, but leaves at rest, until he finds that it is brought into a state in which it is prepared for balling, which condition is produced in consequence of the union of the carbon of the carburet with the oxygen of the oxide, and the consequent production of particles of iron in the malleable state.

When charcoal or other carbonaceous matter is mixed with the ore which is to be reduced, the carbon will begin to combine with the iron in the oxide which is to be reduced, before the oxygen of said oxide is so far disengaged as to be ready to combine with it, and the metal will become highly charged with carbon, and the whole contents, will, consequently, be converted into a fluid mass, and this may occur notwithstanding the utmost care on the part of the operator; a very slight deviation in making the mixture, or in the heat to which it is subjected, converting the materials into slag. But when this mixture consists entirely, or nearly so, of the ores to be reduced, as above described, there may be a considerable variation in the temperature without deteriorating the mass, the carbon of the carburet, and the oxygen of the oxide, being given out simultaneously, and these, by their affinity, combining with each other, the iron of both the ores will be left in the metallic state, requiring only to be balled up.—It will be manifest to any one acquainted with the nature of ores, that in mixing them no proportionate quantities can be designated, as scarcely any two ores will be found to be identical in composition; but the proportionate quantities may be learnt from analysis, or will readily be ascertained by experiment in the hands of a competent iron master.—Although the addition of carbonaceous matter is not necessary in this process of reduction, the inventor does not interdict its use, as it is manifest that a deficient proportion of carburet might find its compensation in such addition, but this would be only a variation of, and not a departure from, the principle upon which he proceeds. When the iron is ready for balling, the slag is to be removed, and the balling is to be effected in the ordinary way; the working and feeding doors, the tap hole, and the general appendages of furnaces for this purpose being such as are well known.

The inventor claims as new the effecting of such reduction by mixing in due proportion the ores known as oxides, and as carburets of iron, and by exposing them to a proper temperature in a puddling furnace, without the addition of any of the ordinary fluxes, or the necessary admixture of carbonau co s matter therewith.

Specification of a patent for "*an improvement in the manufacturing of steel.*" Granted to Simeon Broadmeadow, of the city of New York.—May 25, 1844

The improvement is in the construction of the furnace for converting iron into steel by cementation, and in the process of manufacturing such steel.

In the ordinary mode of constructing the converting furnace, the bars of iron, after being piled in the coffer, or oven, in combination with carbonaceous matter, to the proper height, are covered with a stratum of fire clay and sand, or some analogous substance, which has to be renewed every time the oven is charged. The inventor's improvement in the structure consists in the using of a permanent roof of fire stone, or fire brick, in place of the temporary covering heretofore employed; he also uses a sliding shutter, which is placed in front of the furnace, so that it may be brought down as required for a purpose to be presently made known. This improvement in the manufacturing of the steel, after the process of cementation has been completed, consists in the taking of the bars first from the upper part of the convertory, whilst they are at the highest temperature to which they are to be brought, and subjecting them immediately to the action of tilting, or of rolling, without the necessity of re-heating. To do this, a part of the upper layer of bricks which enclose the converting oven is first removed, so as to enable him to draw out the upper bars, and as the bars are successively operated upon, the bricks are further removed, until the whole contents of the convertory have been tilted, or rolled. As this process goes on, the sliding shutter is brought down so as to enclose the part from which the bricks have been removed. By this procedure several advantages are attained, in the process of manufacturing steel. Under that hitherto followed, the whole charge has been allowed to cool down before removing the steel from the convertory, and this necessarily resulted in great loss of time: the bars after being removed had to be re-heated, in order to their being tilted, or rolled; by this re-heating time was consumed, and the steel actually injured, it being a well established fact, that every time steel is highly heated, it is deteriorated. The steel manufactured by the improved process, has proved to be very superior to that made from the same iron in the ordinary way; it has, in this particular, exceeded the anticipated benefit.

In the accompanying drawing, fig. 1, is a front view of the converting furnace, the temporary brick work which is used to enclose the coffer, or oven, and likewise those that enclose the flues A, A, the arch B, and the chimney stack C, being removed. D, is the roof of fire stone, or fire clay, which extends over the whole top of the coffer, or oven E. Fig. 2, shows the top of this roof in plan, being a horizontal section of the furnace, in the line X, X, of fig. 1; D, is the roof stone, and A, A, the flues leading from the fire chamber into the arch, as usual.

Fig. 1.

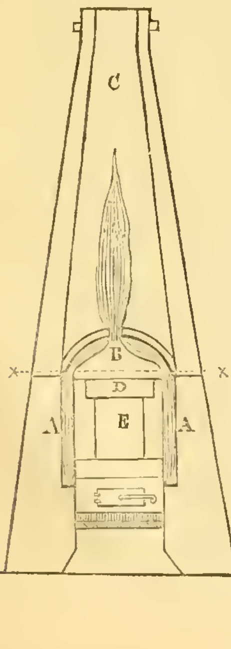
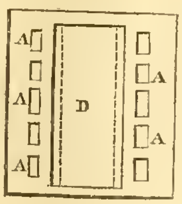


Fig. 2.



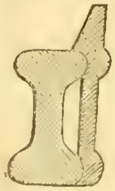
The inventor claims as new, the improvement of taking the steel from the oven in its heated state, and subjecting it to the action of rollers, or of the tilt-hammer, without the necessity of reheating the bars, by which improvement the said manufacture is greatly facilitated, and the quality of the steel much improved.

REGISTER OF NEW PATENTS.

(Under this head we propose giving abstracts of the specifications of all the most important patents as they are enrolled. If any additional information be required as to any patent, the same may be obtained by applying to Mr. LAXTON at the Office of this JOURNAL.)

RAILWAY RAILS AND WHEELS.

Andre Dronot de Charlieu, of the Sablionière Hotel, Leicester Square, Middlesex, gensleman, for "*Improvements in rails for railways and in wheels for locomotive carriages.*" (Communication.)—Granted March 20; Enrolled September 20, 1844.

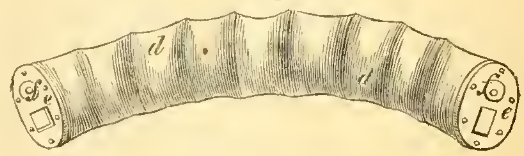


This invention consists in manufacturing the rails with an angular projecting flange at one edge or side of the rail, to prevent the carriages from running off. The rail may be so made that the flange shall form a portion of it, and therefore be inseparable from it, or the same may be made distinct and bolted to it. Another improvement consists in covering rails of wood or other material with flat plates of metal in such manner that the wheels of the carriage shall press upon such parts, whereby the rails may be made much thinner than those heretofore constructed. The improvements in wheels for locomotive carriages consists, in making them without a flange as such will not be required when rails of the above description are employed. The annexed wood engraving shows a section of one of the rails with a loose flange wheels may be bolted to the side of the rail; the drawing of the specification shows several forms of rails, in some of which the flange forms a portion of the rail, and which flange the patentee prefers to be at an angle of 105 degrees, but does not confine himself to that angle, and concludes by saying, I would have it understood that I am aware that rails have been constructed with a flange, but in such case the flange was at a right angle to the rail or nearly so, I do not therefore claim the so constructing rails with flanges, but what I claim is the constructing rails with flanges when the flange is at an angle to the rail at not less than 93 degrees, whether such flange is fixed or bolted to the rail, and also the application of metal bands to wood or other rails. And lastly, the dispensing with flanges on the wheels of locomotive carriages. It evidently appears from the above that the inventor claims the making or application of a rail, having a projecting flange of not less than 93 degrees, (as much more as you like), rails having been constructed with a projecting flange at right angles to the rail, that is to say, 90 degrees, *or nearly so*, consequently the angles from 90° to 92° 59′, are not included in this patent, and a rail having a projecting flange of 92° 59′, may be made and employed without infringing on the same, presuming the patent to be good.

LIFE PRESERVER.

Charles William Spicer, of Portman Square, Middlesex, Esq., for "*an invention called a nautilus or portable life preserver and swimming belt.*"—Granted March 28; Enrolled September 28, 1844.

Fig. 1.



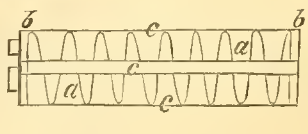
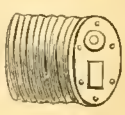


Fig. 3.



ig. 2.

The annexed drawing shows the nautilus or life preserver in two positions. Fig. 1, being in an inflated state ready for use, and fig. 2, in a portable state. The following is a description of the apparatus and its mode of construction; *a, a,* fig. 3, is a spiral spring attached at each end to ring *b*; *c, c, c,* are four pieces of tape which are fastened to the rings *b,b*, and also to the springs their object being to prevent the apparatus extending beyond a certain length; *d, d*, fig. 1, is an elastic covering of india-rubber fabric, which is drawn over the spiral spring and doubled down at the ends, and then passed over or upon the projecting pins or screws seen in fig. 3; *e, e*, are plates having an opening *f*, provided with a valve which opens inward, and is actuated by a spring in such manner as to press it against the plate, this plate being screwed or rivetted against the rings as seen at figs. 1 and 2, firmly secures the india-rubber fabric or outer covering *d, d*. Supposing the apparatus to be in a portable or closed state, as at fig. 2; then in order to inflate it with air ready for use, it is only necessary to take the nautilus and by pressing with the fore finger of each hand, open the valves *f, f*, then by drawing out or extending the apparatus, the nautilus will become inflated with air, which is prevented from escaping by the spring valves *f, f*; *i, i*, is a spring clasp for fastening the nautilus or life preserver and swimming belt, round the body of the wearer.

MOSAIC WORK.

John Robert Dicksee, of Old Compton Street, Soho, Square, Middlesex, artist, for "*improvements in the manufacture of mosaics.*"—Granted March 30; Enrolled September 30, 1844.

The material employed by the inventor for producing mosaic work is principally opaque glass, but he also employs transparent glass, the mosaic pieces may be made of any size or colour, or of any combination of colours, the same (according to this invention) being produced by casting, moulding, or pressing, and in order to produce the larger pieces of mosaic work, the inventor takes two smooth plates of metal, in one of which there is a hole or holes of the required size and form for the mosaic piece to be produced, this hole or holes are to be made a little taper or somewhat wider on one side of the plate than the other, this plate is then laid upon the smooth metal plate with the widest side of the holes downward or next to the smooth plate, the hole in the upper plate is then filled with glass in a fused state, either opaque or transparent; and the same is pressed by means of a screw or lever and plunger, the object of pressing of glass in the manner described, is that a smooth and polished face is produced which may form the upper part of the mosaic work; by this process of moulding a great variety of pieces may be produced. For moulding smaller pieces of mosaic work, the inventor proposes to have plates as above described, one of which is to have a number of holes formed through it of a size and form intended for the pieces of mosaic work to be produced, these plates are then to be clamped together, and a quantity of glass in a fused state placed at one end, the plates together with the fused glass is then passed between a pair of rollers which will press the glass into the holes of the plate, the glass being afterwards taken out and annealed in the ordinary manner.

When joining a number of pieces of mosaic work together, the inventor proceeds by stretching a piece of calico tightly upon a slate or slab, the surface of the calico is then to be rubbed over with wax or gum, for the purpose of holding the pieces of mosaic work together which are to be arranged, with their faces downward, according to the pattern or design intended, the several pieces forming the design are then fixed together by applying a cement over the whole, the inventor prefers that known as patent Portland cement.

From reading the specification it appears that the principal object of the invention is the casting, moulding or pressing the pieces of mosaic work, and also the application of opaque glass in successive pieces placed side by side, or alternate, and in combination with transparent or coloured glass.

SHEAVES AND BLOCKS FOR SHIPPING.

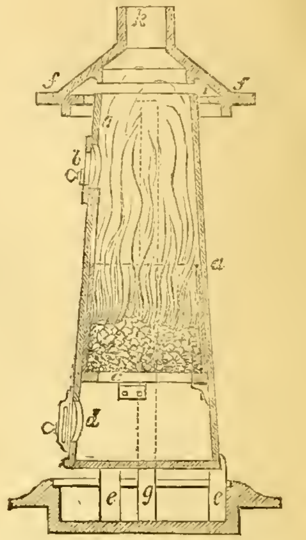
Geore William Lenox and John Jones, of Billiter Square, in the city of London, merchants, for "*Improvements in the manufacture of Sheaves and Shells for blocks, and of Bolt rings or Washers, for the purpose of shipwrights and engineers.*"—Granted April 10; Enrolled October 10, 1844.

This invention consists in manufacturing shells and sheaves for blocks, and also bolt rings or washers for engineering purposes of malleable cast iron, which is to be afterwards annealed. In carrying out this invention, the patentees cast the sheaves and shells for blocks in the ordinary manner of casting articles of malleable cast iron, without confining themselves to the peculiar form or shape of the block or sheave, which may be varied without departing from the nature of the invention, which is the manufacture of the articles above described of malleable cast iron, and afterwards annealing the same. The specification describes the sheaves as being cast hollow, and that the shells are very light and of great strength, and that very durable articles may be produced by malleable cast iron afterwards annealed, and which may be effected by placing the blocks and washers into an annealing oven and surrounding them with Cumberland or Lancashire iron ore, and then subjecting them to a red heat, as is well understood by those who are in the habit of manufacturing articles of malleable cast iron. The patentees claim the manufacturing sheaves and shells of blocks and also bolt rings or washers for shipwrights and engineers, of malleable cast iron.

IMPROVEMENTS IN STOVES.

Frederick Brown, of Luton, Bedfordshire, ironmonger, for "*Improvements in stoves.*"—Granted April 10; Enrolled October 10, 1844.

The object of this invention is to construct a stove which will be less liable to accident, and also much cleaner than those of ordinary construction. The accompanying figure which, is a sectional elevation, shows the interior and peculiar construction of this improved stove: *a a* is what the inventor terms the fire pail, and is provided with a door, *b*, for supplying the stove with fuel, coke broken into small pieces being that which is intended to be consumed in this description of stove; *c* shows one of the grate bars, and *d* an opening through which the ashes are to be removed, this opening is provided with a door constructed with a ventilator for regulating the supply of air to the fire; the apparatus above described is supported by three pillars, two only of which are seen in the drawing, and marked *e*; *f* is a conical top supported by two pillars, *g*, one of which is shown in dotted lines; this conical top is entirely separate and distinct from the fire pail, and forms an annular space between the top of the fire pail and the projecting rib *i* of the conical top, so as to allow of a current of air passing through such space, which has the double effect of preventing any accident accruing from the pipes becoming over-heated, and also the thorough ventilation of the room in which the stove is placed; the products arising from combustion pass off through the aperture *k* into the pipe. Another advantage is stated to be, that the fire pail *a* can be removed for cleaning out the ashes and laying a fresh fire, thus avoiding the dust which would unavoidably arise from such operation.



IMPROVEMENTS IN ENGINES AND TRACTION ON CANALS.

John Aitken, of Surrey Square, Surrey, gentleman, for "*improvements in water machines or engines and steam engines, and the mode of traction on or in canals or other waters.*"—Granted April 10; Enrolled October 10, 1844.

The first improvement set forth in this specification has reference to a peculiar mode of working dredging machines: this the inventor proposes to effect by means of undershot water wheels, which wheels are to be attached to the side of the barge or boat containing the dredging machinery, and worked by the flow of the tide; the inventor not confining himself to any peculiar mode of constructing or transmitting motion from the water wheels to the dredging machinery, which latter may be of the ordinary construction. The second improvement relates to a mode of raising stone or other heavy bodies by means of a vacuum produced by displacing water: this apparatus consists of a tank divided by a plate into two compartments, upon this plate is fixed a cylinder provided with a piston and piston rod, similar to an ordinary steam engine cylinder, the piston rod being connected by some convenient arrangement to a crane, this cylinder is provided with a valve or slide, and also with eduction and induction ports, the induction ports communicate with the water placed in the lower part of the tank, the eduction ways communicate with the lower part of the tank only, the object of this arrangement being that as the water is raised from the lower part of the tank, which is effected by means of a pump, a partial vacuum will be formed in the cylinder on the upper or underside of the piston depending upon the position of the same. Suppose for instance the plate to be at the top of the cylinder, then by pumping out the water from the lower compartment of the tank a vacuum will be formed in the lower part of the cylinder, and the water from the tank will be forced by the pressure of the atmosphere into the upper part, or top side of the piston, which will cause the same to descend, the slides or valve is then moved and a similar action takes place with regards to the up stroke of the piston. The third improvement relates to certain improvements in condensing steam engines, and consists in the application of a cylinder having a piston and piston rod, this cylinder is to be of such dimensions as to contain as much water as will condense the steam flowing from the steam cylinder to the condenser, "and the piston rod of such cylinder is to be in connection with the steam," to assist in giving motion thereto, this cylinder is to be provided with a slide valve and induction and eduction ways, the induction way being so constructed as to open into a tank containing water, which is to surround the cylinder, the eduction way being made to communicate with the condenser, so that the water contained in the cylinder may be thrown in any suitable manner into the condenser, for condensing the steam that comes from the steam cylinder. The operation of this new combination of parts is stated as follows: supposing the piston of the additional cylinder to be descending the eduction part will be open to the condenser, and the induction port will be open to the tank to receive the water which will be forced in by the atmosphere, and will force down the piston owing to the vacuum in the condenser, by this arrangement the pressure of air in the additional cylinder will aid the steam in the cylinder in giving motion to the beam of the engine.

The fourth improvement relates to a mode of traction on canals by means of a partial vacuum produced by the displacement of water, this the inventor proposes to effect by means of an apparatus similar to that described in last month's journal, in which will be seen a tranverse section of a pipe having a longitudinal opening or slit on the top side, which is to be provided in the same manner with a valve suitably prepared for withstanding the action of the water. This pipe which is to be placed at the bottom of the canal, is provided with a piston and a projecting arm, the same as is now practised with regard to atmospheric transit, the latter being attached by any convenient means to the boat, thus by removing the water from the pipe in advance of the piston, a partial vacuum will be formed therein, and the piston will be forced along by the pressure of water and air on the back side of the piston. The mode of discharging the pipe of water is by means of pumps, or where the supply of water is great and the situation admits, by means of a branch outlet of not less than 32 or 33 feet long.

The fifth and last part of these improvements relates to a mode of loading and unloading ships and other vessels of their cargo by means of the tide. This the inventor proposes to effect by means of an undershot water wheel, mounted upon a raft, which can be floated to the ships side, and the power of the water wheel applied to give motion to suitable machinery or apparatus for unloading or loading vessels.

IMPROVEMENTS IN SHIP BUILDING.

James Kennedy, of the firm of Bury, Curtis & Kennedy, of Liverpool, engineer, and Thomas Vernon, of the same place, iron ship builder, *for "certain improvements in the building or construction of iron and other vessels for navigation on water.*—Granted April 15, 1844; Enrolled October 15, 1844.

Iron ship building is daily becoming an object of the greatest importance, it having recently been adopted by Government; it is therefore necessary that ship builders and engineers should turn their immediate attention to the construction of vessels in the strongest manner with as small a weight as possible. Heretofore iron vessels have generally been constructed with angle iron, usually employed for the ribs of vessels, and also by uniting one or two pieces of this angle iron with a plain bar of iron, and sometimes with rolled iron of a T form; both these systems it is well known are not so strong as a bar of iron, having ribs or flanges on both the top and bottom edge, which from experiment has been found to be the most economical manner of constructing girders in buildings, and also railway bars; but hitherto this form has never been introduced for ship building: simple as it may appear, it is an improvement in ship building of the greatest importance, in the construction of vessels either of iron or wood and iron.

The patentees claim the introduction of iron rolled in one piece having a flange on one edge projecting on one or both sides, and a rib or flange on the other edge projecting on one or both sides, for the purpose of strengthening the iron to be used for the beams of decks and bulk heads, and for the ribs or frames of the sides of vessels. They also claim the introduction of rolled iron, with a rib or flange on one edge projecting on one or both sides, and a piece of angle iron rivetted on to the other edge on one or both sides, or instead of angle iron, a piece of T iron; the patentees describe in their specification thirteen forms of beams, ribs or frames, and also claim the use of any of the different forms of beams or frames for keelsons.

The drawings annexed to the specification show, among others, the form of four different sizes of beams and frames or ribs now being used by Messrs. Vernon & Co. of Liverpool, in the construction of some large iron vessels they are building.

BRICK MAKING MACHINE.

William Hodgson, of No. 42, King street, Kingston-upon-Hull, Agent, for "*A machine for making and compressing bricks, small paviors, floor bricks, flat tiles, ornamental bricks, &c., at one operation.*"—Granted April 17; Enrolled October 17, 1844.

This invention relates to certain arrangements of machinery or apparatus for making or moulding and compressing bricks, tiles, &c.; that part of the invention which relates to the making or moulding bricks, consists in having a mould constructed in such a manner that all its sides shall fall down so that the brick can be removed. The sides and ends of this mould are covered with moleskin, which is turned over the upper edge and fastened thereto by means of brass beading or plates and screws; this mould when in use is placed within an outer mould, which during the making of the brick keeps the sides of the inner mould in a vertical position. The outer mould here spoken of is fixed upon a table, on the underside of which there are two or more treadles to suit the convenience of the workmen when on different sides of the table; these treadles communicate with a vertical spindle, the upper end of which passes through the table and is attached to the inner mould having the moveable sides; the object of this arrangement being that when a brick has been formed in the inner mould, in the usual way of making bricks, such mould is raised from the outer one by placing the foot upon some of the treadles, the sides of the mould at the same time falling down admits of the brick being removed by means of a pallet board in the ordinary manner. Upon the same table and near the machine just described is fixed the compressing apparatus, which forms the second part of the invention and consists of a mould having its two sides attached to the bottom part by means of hinges, the ends of the mould being movable and capable of approaching each other; this mould is made to drop within another similar to that just described, and over the mould is a pressing box having inclined ends, which come in contact with the movable ends. This pressing box can be raised or lowered upon an arrangement of levers, the parts being so arranged that when the pressing box is lowered for the purpose of compressing a brick, the underside of such box comes first in contact with the upper face of the brick, the inclined ends of the pressing box coming at or near the same time into contact with the movable ends of the mould cause the same to approach each other, and thereby compress the brick which is contained in the mould. The inventor claims the arrangement of making bricks by means of a mould having falling sides and ends, and also the arrangement for making and compressing bricks, paviors, and tiles by a mould with falling sides and moveable ends, as above described.

BRINE EXTRACTORS.

Sir,—I shall feel extremely obliged if you can inform me what is the most approved method of extracting the brine from tubular boilers.

I understand that vessels with tubular boilers have been fitted so as to keep constantly blowing off without the use of brine pumps. If you can give me any information concerning the arrangements employed for effecting this I shall feel deeply indebted, and remain,

Your constant reader,

R. Richardson.

Manchester, Sept. 18, 1844.

There are three ways in which saturated water, or brine, may be, and is extracted from tubular and other boilers.

1stly. By the common method of blowing off at stated periods, by means of pipes and cocks connecting with the bottom of the boilers, and which is, perhaps, the most effective system, although attended with considerable trouble and loss of heat, as well as the possibility of *neglect*.

2ndly. By *brine* pumps, refrigerators, and other apparatus, such as loaded valves, cocks and pipes, an excessively complicated affair, and we understand very irregular in their action, unless *each* boiler has its separate pump, pipes, cocks, &c., otherwise the varying pressure in the boilers, arising from unequal evaporation, irregular firing, or other causes, produces a greater efflux of water from one boiler than from its neighbours, and so is uncertain in its action. Consequently, this apparatus becomes very expensive and requires considerable attention in its working.

3rdly. The brine may be ejected by the pressure of the steam only; for it must be evident that with brine pumps, a *loaded* valve on the suction of the pump, is required to *overcome this pressure*. Various schemes have been used to effect this object, among others, a simple valve connected to the boiler and opened by a tappet fixed to the main or paddle shaft, allowing a certain portion of the saturated mixture to escape during each stroke, the exact quantity being regulated by a screw. This scheme is open to one objection only; that the engine may be stopped in such a position that the *valve is raised*, and thus placing the boiler in jeopardy. If any plan can be devised by which this may be obviated, and the regular action of the valve be ensured, we are disposed to think favourably of this latter device.—Editor.

THE NEW METROPOLITAN BUILDING ACT.

The Committee of Magistrates for Middlesex appointed to examine and take into consideration various matters to them referred connected with the new act. made their report on the 17th inst. to a Court of Magistrates, when it was ordered to be adopted. The following extracts relate to the appointment of surveyors, &c.

"That there shall be no immediate interference in the subsisting districts, until any alterations occur by removal or death, when the following alterations are to take place. To divide into two districts the following parishes, viz., Islington, St. Marylebone, Paddington, and St. Pancras. To separate the parish of St. Sepulchre Without from Islington, and add it to the district of Saffron-hill Liberty, St. Clement Danes, St. Mary-le-Strand, and the Savoy. And—to separate the parish of Shadwell from Spitalfields and Mile-End New Town, and add it to the district of St. Catherine's, Wapping, Ratcliff, and Limehouse. That the proposed new districts, viz. Fulham, Hammersmith, Kensington, Hampstead, Hornsey, Tottenham, Stoke Newington, and Bromley, should form distinct districts, excepting Kensington, which is to form two, to be divided into north and south districts by the Great Western road.

"That the election of all the surveyors for the new districts shall take place on 28th Nov., being the county day of the Middlesex Session.

"That no district surveyor shall be directly or indirectly concerned in building in any department, nor shall deal in any building materials, nor act as surveyor or agent of any estate within his district."

Dover Harbour.—In these days of improvements in all directions and of all manners and kinds, the ancient town of Dover is not entirely backward in the march of amendment. Not content with restoring the fine old church of St. Mary at a very large cost, and adorning the town and neighbourhood with new buildings of all classes, Dover will soon possess a vastly increased and improved harbour. It was, indeed, at one time contemplated to make it a harbour of refuge, and it is well known that the Duke of Wellington (who, as Governor of the Cinque Ports, has at different times taken so active a part in matters connected with the welfare and advancement of the town) has ever been in favour of such a desirable object being effected. The work, however, would be of so expensive a nature that nothing short of national means could hardly hope to accomplish it. His Grace is understood to have remarked, "We will improve the existing harbour; but such a work as that must be done by the nation." Yet, it appears, it is not likely Dover will be converted into a harbour of refuge: but the town commissioners, it is declared, are determined to do all in their power to render the harbour as useful and perfect as possible. It is well known that at present it is not very good, yet it can now accommodate ships of 500 tons. It is chiefly used for sailing and steam packets to and from France. Immense sums have been expended upon this haven, from the period of Henry VIII.; but it is so imperfectly formed at the present time that a vessel coming in with a direct south wind would be driven against the walls, as there is neither room to turn nor for the ship gradually to expend her force before reaching the extremity of the docks. The harbour has been undergoing repairs of various descriptions almost constantly for many years, but, early in this summer, an extensive improvement and enlargement was decided upon and commenced that is well calculated to remedy many of the most important objections now existing. Thus "the poor haven, such as it is" (rather derogatively termed in an old description thereof), is likely to be materially raised in the rank and utility of harbours upon the southern coast of England. It is to be so extended by another wing, as it were, being added, that a vessel may enter in full sail, and have room to turn and come gradually to its stoppage, an object that cannot now be attained. A large piece of land to the east of the existing harbour and between it and the parade has been purchased for the purpose of enlarging the docks, and gates are to be added. Upon the land so appropriated stood, until quite recently, building yards, houses, &c. There also remains as yet upon the site (although they will be removed in the course of the speedily-approaching alterations) a battery containing several cannon, and buildings that have been used as a magazine, guard-house, &c. A great portion of the space to be converted to the enlargement of the harbour is now in an advanced stage of excavation, and some parts are already being walled in. It was originally intended to have wooden walls for this addition to the haven, but a wiser, though more immediately expensive plan has been adopted, and stone is to be used instead of the former more perishable material. "Wooden walls" have for many ages proved good defences for old England; but a harbour intended to endure requires something more substantial. Some notion of the important nature of these works may be formed when it is mentioned that no less a sum than 100,000*l.* is proposed to be laid out upon them, in addition to the large amounts that have been spent upon the docks during the last few years. The time which has been specified for the alterations to be completed is three years; but, extending regard to the extent of the improvements, and the difficulties that are so often met with in like undertakings, it seems more than probable that they may not be finished until a somewhat longer period has elapsed. The effect, even now, is advantageous, as it gives more room in some portions of the harbour; but eventually it cannot fail to be most important to Dover, in advancing in no slight degree its prosperity as well as utility.—*Times.*

STEAM NAVIGATION.

"THE PRINCE OF WALES" STEAMER.

Many erroneous statements have been made in disparagement of the "Prince of Wales," on the score of the want of sufficient strength when she first began to run. We have the satisfaction now to say that at the termination of a long season, and after taking the dry harbour at Margate whenever necessary, she is as perfectly free from any symptoms of weakness by change of form. &c., as it is possible for any vessel to be, and which, considering her great length, 180 feet between the perpendiculars, is, we think, a remarkable fact, and another indication of the superiority of iron over wood posssessing *the additional lightness that it does*, but this can only be when the mechanical construction is judiciously and carefully done, and the work well put together. The machinery is also as perfect as on the first day of the season, and the vessel has not been stopped an hour for repairs, another proof of the strength of the vessel, as we have frequently known wooden vessels strain so seriously by entering Margate harbour, as to destroy very soon the cement joints between the cylinders and condensers, and thus seriously deteriorate the power of the engines.

The Peninsular and Oriental Steam Company.—This Company, for the purpose of carrying out their new line to China, have given orders for three first class iron steam vessels of 1100 tons, two of them to be built by Mr. Wigram, of the late firm of Wigram and Green, of Blackwall, and the other by Messrs. Vernon and Co., of Liverpool. These large ships being ordered by a company so well and carefulry managed are, we think, decisive as to the opinion in favour of the superiority of iron over wood, particularly when we see Mr. Wigram, one of the oldest and largest ship builders in wood, has now turned his attention to building with iron. The three vessels are each to have a pair of engines of the collective power of 450 horses, to be constructed by the eminent firm of Messrs. Miller, Ravenhill, and Co., of Blackwall.

"The Wonder," an iron steam-boat built by Messrs. Ditchburn and Mair, the successful builders of iron vessels, for running between Southampton and Havre, made a trial trip down the river Thames on the 27th September last; her length is 160 feet, breadth of beam 22 feet, depth of hold 12 feet 9 inches, draught when light 5 feet 6 inches, when loaded 6 feet 6 inches. She is fitted with 3 engines on the atmospheric principle by Messrs. Seaward and Capel, of the Canal Iron-woaks, Blackwall; each engine has an open topped cylinder 53 inches diameter with a 3 ft. 6 in. stroke, they work on the direct action principle; the lower end of the piston rods move on a joint attached to the top of the piston, and the other end is connected to the crank of the paddle wheel shaft, the 3 cranks being placed at different angles, so that when one piston is at the top of the cylinder, another is at the bottom, and the third about the middle; the three cylinders exhaust their steam into one condenser. with one air pump. The engines during the trial made 38 and 39 strokes per minute, the paddle wheels are 19 feet diameter to the extremity of the float boards, and are on the self-feathering principle, being a modification of Morgan's paddle wheel; the nominal power of the three engines, at a velocity of 220 feet per minute, is equal to 150 horses, but the real effective power is nearer double, as proved by the great velocity of the vessel. She ran the mile distance in 4 minutes 17 seconds against tide, being a velocity equal to 14 miles per hour, the tide running at the time about $2\frac{1}{2}$ miles per hour. The boiler is of the tubular principle, with five furnaces, and is only 7 ft. 6 in. long; it is furnished with a brine apparatus for constantly drawing off a certain quantity of water, this water is pressed by the force of the steam throug a pipe dipping down to near the bottom of the boiler, and coming out in the front near the top, where it is furnished with a cock to regulate the emission of the water, this pipe passes along the front of the boiler then alongside of the engine-room to a cistern in which the water runs and is allowed to overflow to the outside of the vessel. The water for supplying the boiler is taken from the hot well, and forced by the feed-pump through a pipe which passes backwards and forwards 2 or 3 times in the brine cistern just described and thence into the boiler, by this process the boilers are supplied with water nearly at a boiling temperature. There are several other ingenious contrivances adopted by Messrs. Seaward and Capel for working the valves, &c.

The "Trident" Iron Steam-Ship.—Messrs. Boulton and Watt are the contractors for supplying this iron steam-frigate, building by Messrs. Ditchburn and Mair, at Blackwall, with a pair of oscillating engines, of 350 h. p.—the price to be given for which is 16,750*l.*, and they are required to be ready about Christmas.

Steam-Engines of Irish Manufacture.—The first trial of the new engines of the 'Shannon' has proved most satisfactory. These engines are upwards of 200 h. p., and are the largest ever made in Ireland, having been just completed at the iron works of Messrs. Perry and Co., Ringsend. On the experimental trip they went off in admirable style, when the distance from Kingstown Harbour to the Kish Light was accomplished in forty-five minutes, and back in the same time; there is no question but that when everything is finally adjusted in working, their performance will be equal to any ever built in England or Scotland.—'Irish paper.'

Her Majesty's Steam Ship Rattler.—This fine steam frigate, after having made a great variety of experiments with the different propellers that have been projected by Mr. Smith, Mr. Woodcroft, Mr. Blaxland, Mr. Steinman, Mr. Sunderland, and other persons, in order to ascertain their comparative merits, lately made her final trial in the river. The screw that has been found to produce the highest rate of speed with the smallest consumption of power is that of Mr. F. T. Smith, known as the inventor and adapter of the Archimedean screw. The Admiralty have in consequence determined to send the Rattler to sea, fitted with a propeller in accordance with the suggestions of that gentleman. The last trial was made partly with the view of ascertaining the precise rate of the ship in steaming in smooth water with Mr. F. P. Smith's propeller, and partly to determine its effect as compared with what had been done with other propellers that have been recommended to the notice of the Admiralty. On this occasion the average of 12 trials at the measured distance in Long-reach showed a speed of 9·9 knots, or 11½ statute miles, an hour, which rate of speed, considered in comparison with the small amount of power, viz., 200 h. p., the amount of power of the engine of the Rattler in relation with her tonnage, 888 tons, ranks her performance higher in the history of steam navigation, than the performance of any vessel of her class, either in the service of Her Majesty or in the commercial steam navy of the empire. It should be mentioned that the Rattler was built in every respect as a sister ship to Her Majesty's steam ship the Prometheus, with this difference, that the Prometheus has paddle-wheels. The Prometheus on her trial at the measured distance reached only to the rate of 8⅔ knots an hour. The Rattler has already got her masts on board; she is rigged with a foremast like a frigate or sloop, her middle and mizenmasts are rigged as schooner masts, her gun carriages are also on board, and she is ordered to be equipped for sea as speedily as possible; and in consequence of the complete success which has attended the application of the screws to her, several others, we believe six, iron ships of a large class are forthwith to be constructed on the same principle. The trials were made under the superintendence of Mr. Lloyd, chief engineer of Woolwich Dockyard, and Captain Smith, R.N., of the Royal Dockyard.—'Times.'

LARGE STEAM-BOAT.—A magnificent steam-boat has just been completed in America, called the 'Empire;' she is 260 feet in length, engine 600 h. p., and measures 1220 tons—being 200 tons larger than any other fresh water steam-ship in the world! The main cabin is probably without equal, being 211 feet long, lighted the entire length through painted glass under the roof, and so arranged that it can be divided by folding doors into three apartments, and fitted up in the most splendid style.

THE WATER LILY STEAMER.—This vessel is of iron, 170 tons burthen, built by Messrs. Ditchburn and Mair, and fitted with engines by Messrs. Maudslays and Field, she is propelled by a screw, 8 ft. diameter and 16 ft. pitch, placed at the stern between two rudders, as patented by Mr. Joseph Maudslay, and reported in our Journal for January last, p. 37. It is reported that at an experimental trip, made on the 19th inst., she realized a speed of nearly 13 miles an hour, but the report does not say whether this is a mean velocity, or a velocity obtained with or against the tide, nor does it give the power of the engines.

WHERRIES AND OTHER BOATS PROPELLED BY THE SCREW.—The experiments made by Mr. James Aust, with his wherry, upon the river Usk, have proved the superiority of the screw principle, set in operation by manual labour, to that of rowing or sculling with oars. Mr. Aust entertains no doubt that he shall construct a boat capable of being propelled by manual labour alone, on any river, at 12 or 15, or even 20 miles an hour! He considers that life-boats may be constructed upon this principle, and capable of being sent out, when other boats could not live.—'Cambrian.'

THE "GREAT BRITAIN" STEAM-SHIP.—BRISTOL, Oct. 26.—This noble vessel is at length released from her protracted confinement in our float. The necessary alterations in the upper lock leading from Cumberland Basin into the float having been made, she was yesterday evening, between 6 and 7 o'clock, removed from her moorings on the Sea-banks, and proceeded majestically down the floating harbour to the entrance of the lock, where she remained for the night, and this morning at 7 o'clock she was brought safely through the lock into Cumberland Basin, where she will remain for a few days to have the screw affixed, &c. It is then intended that she shall make one or two trial trips after which she will proceed to London.—'Times.'

LAUNCH OF A WAR STEAMER.—On the 15th instant the Gladiator, a splendid steam boat, was launched from Her Majesty's Dockyard, Woolwich, in the presence of about 1000 persons. She is of 1,190 tons' burden, is bored for 20 guns, and will carry a complement of 175 men. She is built after the model of the Sampson, which was launched on the 1st instant from the same yard, and is less in length by 11 feet than that ship. Her dimensions are as follows:—Length between perpendiculars, 203 feet 6 inches; keel for tonnage, 178 feet 5 inches; extreme breadth, 37 feet 6 inches; tonnage breadth, 37 feet; moulded breadth, 36 feet 4 inches.

LOCOMOTIVE ENGINE POWER IN THE UNITED STATES.—Perceiving several notices in your Journal respecting the powers of English engines, the following facts may not prove uninteresting:—A train from Schenectady to Troy brought over, with one locomotive, 1250 passengers in nineteen cars. If the average weight of each passenger was 120 lbs., and that of each car four tons, the whole weight would be 151 tons. The weight was carried over an ascent of about forty feet to the mile for a portion of the distance. This is, I believe, one of the heaviest loads ever drawn up such an inclination by a single locomotive. The locomotive used was from the manufactory of Messrs. Baldwin, Whitney, and Co., of Philadelphia.—'Mining Journal.'

TRIAL OF A NEW LOCOMOTIVE ENGINE.—A new locomotive engine, the 'Liver,' built on an improved principle by Mr. Thos. Pearson, of the Liver Foundry, Liverpool (and to be employed in the transit of coals from Wigan to Preston and Lancaster), was tested with thirty-one loaded wagons, averaging six tons each (including wagons), up the incline from Wigan to the Boar's Head, and with thirty-five wagons up Coppal incline, of 1 in 100, which she performed with the utmost apparent ease at the low pressure of 70 lb, to the inch.—'Liverpool Mercury.'

COMPRESSED AIR ENGINE.—M. Andraud has performed with his locomotive, charged with a vessel full of compressed air, 3400 metres (about 2 miles), going and returning. At starting the pressure of compressed air was 7½ atmospheres only—at his destination, the pressure was only three atmospheres; therefore, there had only been expended 4½ atmospheres. But M. Andraud proposes to employ more considerable vessels, at a much greater pressure—viz., vessels from eight to ten cubic metres (340 cubic feet), having a pressure of from 25 to 30 atmospheres (450 lb. !), so as to be able to run over four leagues without having occasion to refill the vessel.—'Moniteur Industriel.'

NEW LOCOMOTIVE ENGINE.—Mr. Kearsley (late superintendent of the locomotives on the Midland Counties Railway), has just had constructed under his immediate direction, by Messrs. Hick and Son, and put upon that line an engine which took fifty-five loaded wagons up an incline of ·002, or ten and a half feet in a mile, at twenty-seven miles an hour; it has 15-inch cylinders, 2-feet stroke, and 4 feet 8 inches driving wheels, and works at 75 lb. pressure. The engine is of simple description, the general form being much similar to the Midland Counties engines (Bury's appearance and plan), but longer, so as to admit of six wheels between the fire-box and smoke-box (Stephenson's patent). The boiler is 13 feet 6 inches long, a round fire-box, with 112 iron tubes. The wheels are entirely of wrought-iron, welded throughout, the form of Bury's cottered wheel, having round arms, running diagonally from the nave to the tyre, and welded to both. The framing is twenty-two feet long of wrought-iron, and welded solid, with the plummer blocks on it, and with peculiarly strong fixings for the cylinders, which are attached to the framing alone. The working gear, as well as the reversing gear, are all carried on one piece of forged work, or bracket, or hanger, running transversely from frame to frame, and having all the bearings forged solid on it.

FRENCH RAILWAYS.—Contracts for thirty-four locomotives, with their tenders, were awarded at the office of the Minister of Public Works, in three lots; the first was ceeded to M. Cavé, at 44,800 f., the second to M. Alette, at 47,000 f., and the third to Messrs. Derosne and Caille, at 49,000 f., per locomotive, with its appurtenances. A contract for 608,000 iron bolts was awarded to Messrs. Labreur and Grefix, at 487f. 45c. a ton.—'Galignani.'

MISCELLANEA.

THE ROYAL EXCHANGE was opened with regal honours on Monday the 28th ult.; we purposely abstain, in the present month's Journal, offering any remarks on the new structure, that we may be able to devote some attention to the interior when divested of the temporary fittings and scaffolding; next month we propose giving a full account of its architectural character.

THE NEW BUILDING ACT.—The *London Gazette* of the 4th Sept., contains the following notice:—"The Commissioners of Her Majesty's Woods and Forests have just issued a notice that they have appointed Sir Robert Smirke, James Pennethorne, Esq., and Thomas Cubitt, Esq., to constitute with the official referees a Board for the examination of persons who may present themselves for the purpose of obtaining certificates of qualification for the office of District Surveyor within the limits of the New Metropolitan Building Act. All communications for the said examiners are to be addresaed to the Registrar of Metropolitan Buildings, at his office, No. 3, Trafalgar-square."

The *Asphalte* is now receiving a new application. The uses of this material are now no longer confined to pavements and footways, they extend to the very pipes underground. It is now employed for protecting the long metallic pipes which run underneath the streets of Paris, from the effects of oxidation. These pipes being covered over with damp earth, become in a very short time so coroded as to be almost completely eaten away by the rust. Hence they frequently burst, causing the water to overflow, and interrupting its circulation, thereby occasioning much expence for repeated repairs, to say nothing of the great inconvenience attending them. All this will be obviated by the new system, which consists in coating the metallic pipes with with a layer of asphalte, one or two centimetres thick. The asphalte being impervious, oxidation can hardly take place. The better to secure this advantage, zinc is substituted for the cast metal, as being less subject to oxidation, and the pipes are screwed together instead of being adjusted end to end. This improvement will effect a great saving in the cost of keeping the water pipes in repair. Révue de Paris.

AN EXTRAORDINARY NEW LEVELLING INSTRUMENT.—"A highly ingenious and most scientific instrument for levelling," says a contemporary journal, "has been invented recently by Mr. Emslie, civil engineer; the opinion of several competent persons is greatly in its favour. The objects to be gained by its use, we are informed, are increased accuracy, with the capability of operating with it even in the dark, mist, or rain, or "through thick cover, high walls, or buildings," &c.! these advantages will be considered by the profession undoubtedly of great value, and meet with corresponding support. The plan is about being registered, after which full particulars will be laid before the public through our columns."

ANTIQUITIES.—We learn from a paragraph in the Foreign Quarterly that extensive researches are now going on at Khorsabad, in the immediate vicinity of the ancient Nineveh, under the direction of M. Botta, assisted by Eugène Flandin, an artist sent out by the French government, for the purpose of making drawings of whatever may be discovered. Hitherto, however, discovery does not promise much that is likely to prove of intrinsic interest to art,—certainly not to architecture, unless abundant fragments of brick and marble, literally mere 'rubbish,' can be considered so. The only remains of building, in an intelligible shape, yet found, is a structure having two doors, uniformly adorned with bas-relief, representing a colossal bull with a human head, and a human figure with an eagle's head and wings. These doors are fifteen feet in height, and open into a hall 120 feet long. The only wall which is yet cleared from rubbish (that on the south side), is covered with a series of bas-reliefs, representing battles, explained by inscriptions. Of what quality or styles these sculptures are is not said, but we suspect very uncouth and barbarous, in very extravagant and ultra-pagan taste. Nevertheless, it must be confessed, to be both curious and interesting to find in that remote region a personification of ourselves; there being no doubt that the colossal bull with a human head is if not the genuine 'John Bull'—his ancestor and prototype. Perhaps that member of the Bull family will now be carried away captive to Paris, to captivate if it can the French, and console them for having suffered us to get the start of them in securing those valuable treasures the Lycian Marbles. Still we would now gladly give them all in exchange for the Bull gentleman, who would feel himself so comfortably at home in the British Museum. As to the Foreign Quarterly itself, we are sorry to perceive that it has now entirely changed its original character, as indicated by its taste, that it now bestows scarcely any notice on continental literature, properly so called, but takes up English publications for revising, and deals in such articles as "French Aggressions in the Pacific," and the "Military Power of Russia."

METAL FURNACE FOR HEATING SHOT.—Messrs. Smithard and Addison, of Guernsey, have invented a plan for heating shot to a red heat, by placing sixty 12-pounders into a square cast metal furnace, nearly similar in appearance to a stove. The invention was lately tried at Woolwich, when the shot were admitted six each, at ten different entries, five above each other, and, after the furnace was heated, which occupied 1½ hour in the first instance, the heat became so great that the shot were heated red hot in twenty minutes, and afterwards in less than a quarter of an hour. The invention appears far superior to the rough grating hitherto used, and it does not consume much fuel. It appears to be formed in such a manner that in a time of peace it would answer the purpose admirably of heating store or barrack-rooms, and only requires some modifications to regulate the draught according to the state of the wind, to render it highly useful for many purposes.

We learn from Parma that the theatre of the ancient city has just been discovered at a considerable depth in the earth, and in a remarkable state of preservation. The Government has ordered researches to be made, and has purchased several houses which stand in the way of the operation.—'Galignani's Messenger.'

BETHLEHEM HOSPITAL.—Works of considerable magnitude are now in progress at this hospital, they are from the design, and are being executed under the direction of Mr. Smirke, architect, and consist of two new wings, containing wards for convalescent patients, a new chapel, and a range of workshops. The wings are about 80 feet long, and comprise 12 rooms for male, and the like number for female patients, in which they are to be employed variously, according to the nature and circumstances of their cases. The chapel, which was rendered necessary by the increase in the number of patients, is in the centre of the building over the portico, and is to be surmounted by a new dome, now in course of erection. This dome will be about 150 feet high, and on its summit will be an octagonal cupola terminating in a copper vane. The workshops form a quadrangle of considerable extent, and comprise nine large rooms, all 'en suite,' varying in size from about 21 feet square to 35 feet square; they will consist of shops, where the patients can be employed under proper masters in the trades of plumbing, painting, masonry, &c. It is in contemplation to erect a similar range of workshops connected with the criminal wing, which is under the control of the Secretary of State. The dome already referred to will be by far the largest structure of the kind in England, with the exception of St. Paul's; it is built of Portland stone and brick, covered with copper. The base is octagonal, and consists of an order of Corinthian pilasters coupled with a range of windows between them, forming the clerestory of the chapel; and over the entablature are ornamental lunettes, by which the ventilation of the chapel is effected.

EVAPORATION OF WATER UNDER ELECTRICAL INSULATION.—M. Rowles suspended two similar capsules of 8½ inches diameter by silk strings over a stove. In each vessel 8½ ounces of water were poured; one of the vessels communicated with the earth by a copper wire. At the end of twenty-four hours, 2 oz. 279 grs. had evaporated from the insulated capsule, and 3 oz. 144 grs. from the other, making a difference of 345 grs. in favour of the capsule in communication with the earth. The same result was obtained with the heat of the sun.

An Iron Life-Boat.—About twelve months ago a subscription was raised at Havre, for the construction of an iron life-boat, by M. Lahure; this boat, being finished, was a short time ago submitted to trial in the presence of a committee appointed for the purpose, who declared it to be perfect, and, consequently, it is now placed at the port for service, in case of need; it is built of cast-iron sheets, is 26 ft. 3 in. in length, and 5 ft. 3 in. in breadth. The reservoir of air is divided into three compartments, perfectly distinct from each other, so that any accident happening to one of them, would not destroy its buoyancy, self acting valves let in and out such quantities of air as may be required to preserve its equilibrium, according to the weight with which it may be charged, and, by means of a water-proof cloth, so arranged as not to confine the motions of the rowers, excludes the possibility of its being swamped by shipping water.

Plating Steel by a Solution of Silver.—"This solution, remarkable for its intensely sweet taste, is readily obtained by dissolving recently precipitated chloride of silver in a solution of hypo-sulphite of soda, and though the steel may be plated, as stated above, by immersion in the solution, it will be found more advantageous in practice to use a paste, formed by moistening a little whitening with the solution, with which the surface to be plated should be rubbed over." It appears that whilst in some instances the silver deposited "presents a perfectly uniform and adhering surface," in other cases its precipitation "is attended with a roughening of the surface" of the steel—an objection which the writer anticipates will be overcome, as the process receives more general attention. Should this anticipation be realised, the discovery will be found of no less utility in its application to the arts than of present interest as a new fact in metallurgical science.—'The Pharmaceutical Journal.

Gigantic Scheme.—We have heard that the practicability of connecting the opposite shores of the Mersey by a stupendous chain bridge is under consideration. It is said, that by the formation of a viaduct, on the principle of an inclined plane, on arches, commencing at the top of James-street, to the margin of the river, a sufficient elevation may be obtained. A similar erection on the Woodside bank of the river would, of course, be requisite. Our active and enterprising Cheshire neighbours would, no doubt, readily assist in promoting a project so magnificent. Such a work would throw all other suspension bridges into the shade, and be a world's wonder. Of its practicability no doubt, we believe, is entertained, and it will be allowed that the enterprise is worthy the combined energies of Liverpool and Birkenhead.—'Liverpool Albion.'

Injurious Effects of Lead.—At the Academie des Sciences, Paris, a paper by M. Chevreul was read, "on the injurious effect, in a commercial point of view, of the presence of lead in certain preparations used in manufactures. He states that he was some time since consulted as to the cause of a brown tint which made its appearance in some white shawls which, in the finishing process, had been submitted to the action of steam. On examination, he found that the parts thus stained were only those which had received a preparation of glue, and on analyzing some of the same glue, he found that it contained oxide of lead, and a small quantity of oxide of copper. This glue was prepared in the neighbourhood of Lille, and it was ascertained that a quantity of white lead had been added to it.

Steam Engine Chimneys Superseded.—Dr. Arnott has recently adapted an air-pump to supply a draught to furnaces, that will supersede the necessity of funnels in steam-boats, and of the costly chimneys which now demand so great an outlay in the erection of engine houses. This pump, when worked by a weight of 1 cwt., furnishes a draught equal to 100 cubic feet of air in a minute, in an uncompressed state. A slight transfer of power from any engine, would thus suffice to create a strong draught, which can be so directed as to cause the consumption of the smoke.

Church Bells.—The *Irish Ecclesiastical Journal* informs the clergy that they can substitute cast-steel bars for the ordinary church bells with very considerable advantage, as regards both tone and cheapness. Any clergyman can procure for 30s. a bar of cast steel, producing a better tone than the ordinary small church bells, which cost from 4*l.* to 6*l.*

Aberystwith.—On the 26th ult. the ceremony of laying the foundation stone of a new County Hall was performed here, in consequence of the present one being too small for the transaction of public business. The cost for erection, &c., will be about £3000. Architect, Mr. W. R. Coultart.

Nasmyth's Patent Steam Hammer.—One has lately commenced operations at Devonport Dockyard.

German Association of Architects and Engineers.—The Germans are carrying out associations, or periodical meetings of men of science, even more extensively than ourselves, and they have as perhaps our readers are aware from our columns, an Association of Architects and Engineers, which this year met at Prague, being its second meeting. Some long remarks have appeared in the 'Algemeine Zeitung' in reference to it, from which it appears, that as last year no practical papers have been produced, and only a meagre assortment of theoretical papers on architecture or antiquities. Not a paper was read on practical constructions, as railways, or on machinery. This account might be thought to belong to establishments nearer home.

Westminster Bridge.—This bridge was closed on Monday the 14th ult. for the purpose of lowering the roadway of the centre of the bridge; this desirable object has been accomplished, and the steepest inclination of 1 in 14 reduced to 1 in 25, which will render the ascent easier than Blackfriars Bridge. This alteration has been done in the incredible short period of a fortnight, the bridge being again opened on Monday the 28th ult. The lowering of the footpaths is deferred until the new parapets are ready, together with the widening of the bridge, when this is done the view of the New Houses of Parliament will be greatly improved: we hope there will be no delay in proceeding with so desirable an object.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM SEPTEMBER 26, TO OCTOBER 23, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

Edward Coke Wilmot, of Haddenham, Bucks, for "Improved apparatus for warming beds, persons, carriages, and rooms."Sealed September 26, 1144.

James Malam, of Huntingdon, gas engineer, for "certain Improvements in purifying coal gas, and increasing its illuminating power, and preventing the circulation of it being impeded by frost.—September 26.

Edwin Edward Cassel of Millwall, Poplar, merchant, for "a material or combination of material suitable for paving, piping, roofing, and most other purposes to which wood and iron are applicable."—September 26.

Thomas Clark, of Wolverhampton, ironfounder, for "an Improved domestic convenience.—September 26.

Sir George Steuart Mackenzie, of Coul, county of Ross, baronet, for "an Improvement or improvements in the manufacture of paper, and particularly for the purposes of writing and copying writings, and machinery for effecting the same, also the manufacture of a fluid or fluids to be used with the improved paper in the manner of ink."—September 26.

John Berkeley Cotter, of Dublin, gentleman, for "Improvements in the preparation and manufacture of woven fabrics, or tissues applicable to various useful purposes."—September 26.

Alexander Turnbull, of Russell-square, doctor of medicine, for "a new mode or method of more expeditiously and effectually tanning hides and skins, and of extracting and separating the catechuic acid from the tannic acid in the catechue or terra japonica used in tanning."—September 26.

Alexander Ramuz, of Frith Street, Soho, cabinet-maker, for "Improvements in sofas, wardrobes, ottomans, bedsteads, and other apparatus for reclining or sleeping on, and in the construction of dining and billiard tables. (Being a communication.)—September 27.

James Carter, of Delabole, Cornwall, gentleman, for "Improvements in cutting slate for roofing, and other purposes."—September 27.

William Henry Ritchie, of Lincoln's-inn, gentleman, for "Improvements in carding engines." (Being a communication.)—September 27.

John Harcourt Quincey, of Old-street, gentleman, for "Improvements in the manufacture of blinds and shutters."—September 27.

Samuel Cunliffe Lister, of Manningham, worsted spinner, for "Improvements in preparing and combing wool."—September 27.

William Thomas, of Cheapside, merchant, for "Improvements in looms." (Being a communication.)—October 3.

Samuel Pritchett, of Charlbury, Oxford, glove-maker, for "certain Improvements in cutting and making up gloves."—October 3.

Albert Daniel Hindley, of Berner's-street, Oxford-street, carpet manufacturer, for "Improvements in the manufacture of carpets, and other piled fabrics."—October 3.

William Newton, of Chancery-lane, civil engineer, for "Improvements in machinery for letter-press printing." (Being a communication.)—October 3.

Obed Mitchell Coleman, of Fitzroy-square, gentleman, for "Improvements in piano-fortes."—October 10.

William Henry Ritchie, of Lincoln's-inn, gentleman, for "Improvements in obtaining copper from ores." (Being a communication.)—October 10.

John Bower Brown, of Sheffield, merchant, for "Improvements in combining cast-steel with iron, and in the construction of carriage springs."—October 10.

Joseph Eugene Chabert, of Chancery-lane, gentleman, for "Improvements in preparing materials to be used in making picture and other frames, and for architectural, and other purposes."—October 10.

Henry Oliver Robinson, of Old Jewry, engineer, for "certain Improvements in steam machinery and apparatus for the manufacture and refining of sugar."—October 10.

George Hurwood, of Ipswich,engineer, for "Improvements in apparatus for moving and fastening windows."—October 14.

John Smith, of Salford, weaver, for "certain Improvements in the manufacture of fabrics suitable for ornament or dress." (Being a communication.)—October 14.

Adolphe Nicole, of Dean-street, Soho, watchmaker, for "Improvements in watches and chronometers."—October 14.

Sir Graham Eden Hamond, baronet, K.C.B., of Norton Lodge, Yarmouth, for "Improvements in the mode of fastening on and reefing paddle-wheels, float-boards, or paddles." (Being a communication.)—October 14.

William Clarke, of Nottingham, lace-manufacturer, for "certain Improvements in machinery for manufacturing ornamental bobbin net or twist, lace, or other fabrics."—October 14.

Peter Borrie, of Princes-square, St. George's in the East, civil engineer, for "certain Improvements in the machinery for the manufacture of sugar."—Octoper 17.

Arthur Parsey, of Spur-street, Leicester-square, Artist, for "Improvements in obtaining motive power."—October 17.

Edouard Guigues, of Peckham, gentlemen, for "Improvements in printing on leather and skins."—October 17.

Paul Chappe, of Manchester, spinner, for "certain Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous substances."—October 17.

Alexander Wright, of Hales-place South Lambeth, engineer, for "certain Improved apparatus for measuring gas, water, or other fluids, and in the means of manufacturing the same."—October 17.

Frederick Herbert Maberly, of Stowmarket, clerk, Stephen Geary, of Hamilton-place, New-road, architect, and Joseph Croucher, of James-street, Buckingham-gate, gentleman, for "certain Improvements in the construction and arrangement of machinery or apparatus for clearing, cleansing, watering, breaking up, and raking, of streets, roads, lands, and other ways."—October 17.

John Grieve, of Portobello, Scotland, engineer, for "certain Improvements in the production and use of steam, applicable to steam-engines."—October 17.

James Nasmyth, of Patricroft, Lancaster, engineer, and Charles May, of Ipswich, engineer, for "Improvements in working atmospheric railways, and in machinery for constructing the apparatus employed therein."—October 22.

John Henry Rehe, of Moscow-road; surgeon, for "Improvements in the manufacture of starch and farinaceous food."—October 22.

Frederick Ransome, of Ipswich, caster, for "Improvements in the manufacture of artificial stone for grinding and other purposes."—October 22.

George Osmond, of London-street, Tottenham-court-road, cabinet maker, for "Improvements in fastenings for doors, drawers, window-sashes, and dining-tables, and in apparatus for suspending looking-glasses, and other articles."—October 22.

James Napier, of Hoxton, dyer, for "Improvements in treating mineral waters to obtain products therefrom and for separating metals from other matters."—October 22.

Moses Poole, of the Patent-office, London, gentleman, for "Improvements in machinery for emptying privies and cesspools." (Being a communication.)—October 22.

Henry Carbines, of Hayle, Cornwall, brazier, for "certain Improvements in fusees, cartridges, and other like explosive instruments."—October 24.

POWER OF WATER WHEELS.

"Aquarius" has not given sufficient data for the calculation which he requires. The power of overshot wheels depends not only on the width of the bucket but also on their capacity, form, or number. Some buckets are formed so as to retain the water during a greater part of their revolution than others. Also, cæteris paribus, the slower the velocity maintained in the wheel by the amount of work done by it, the greater the force of the water. The "theoretical" duty of an overshot wheel is the whole weight of water multiplied by the velocity of the stream. The "actual" duty appears from Smeaton's Experiments to bear to the theoretical the proportion 2:3; in overshot wheels the proportion is about 2:5. All practical deductions from the theory of hydrodynamics are very difficult, owing to the present inadequate knowledge of the theory itself; but the following rule for calculating the effect of overshot wheels, taken from the Encyclopædia Britannica, may be considered tolerably accurate. Multiply $\frac{4}{5}$ of the number of buckets by 6·456, and this product by the number of gallons in each bucket. The result gives the number of pounds acting on the circumference of the water wheel. In breast-wheels, however, the current of water generally acts as well as the weight: and the force of the stream must therefore be ascertained. As all these calculations are experimental, Aquarius, if anxious on the subject, will get a much more satisfactory result, if he can make a direct experiment on his own wheels, of the weight which each will lift by means of a rope coiled round the wheels themselves. The machinery should, to make the experiment accurate, be disconnected, as far as practicable, from the water wheels; and he will be doing a service to practical science by communicating the result.

NEW SCHOOL BUILDINGS FOR QUEEN ELIZABETH'S HOSPITAL, BRISTOL.

Architects, Messrs. Foster and Son, of Bristol.

(With an Engraving, Plate XVI.)

This charity was established under an Act of Parliament passed in the 39th year of Elizabeth, the said act having been obtained by the trustees of the will of John Carr, gentleman, of the city of Bristol, who at his death left the principal part of his property for the founding and endowment of this charity. The object of the institution, as set forth in the said will, was "for the bringiog up of poor children and orphans in such order, manner, and form, aud with such foundation, ordinances, laws and government as the hospital of Christ Church, nigh St. Bartholomew's hospital, in London," From this time down to the present century this charity has been enriched by gifts and bequests from many of the principal merchants and inhabitants of Bristol, among whom the names of Edward Colston, Lady Mary Ramsey, James Gollop, Samuel Hartnell, William Bird, Thomas Farmer, Richard Hughes, and Samuel Gist stand conspicuous.

The building originally purchased for the purposes of this charity was the commodious premises near College Green, now occupied by the Grammar School, which latter was formerly held in St. Bartholomew's Hospital, situate in one of the low parts of the city. By an Act of Parliament, obtained in the 9th year of George III., these two buildings were exchanged the one for the other, and since that period Queen Elizabeth's Hospital has been carried on in the last mentioned building. Until the late changes in reference to the public charities, 40 boys only were clothed and educated with the funds of this charity, but since that period the numbers have been increased to 100, the greatest number that can possibly be accommodated in the present building, but the funds being amply sufficient to provide for a much larger number, by the permission of the Court of Chancery a very eligible site for new buildings has been purchased, and cootracts entered into for the erection of a noble and commodious edifice suitable for the reception of 200 boys.

The site selected for the building is a sloping field of about 4 acres situate on the side of Brandon Hill, it is rather a commanding one and extremely salubrious, and the premises will form a connecting link between the fashionable suburb of Clifton and the ancient portion of the borough.

The basement story of the building will be raised about 28 feet above the level of the road, and will be approached by a broad flight of 40 steps opposite the centre of the building, with a carriage drive on either side all communicating with a terrace extending the entire length of the main building. A noble staircase, with pauelled freestone balustrade or parapet, leads from the entrance hall to the centre of the principal floor, where it has the master's apartments behind it, commanding the play grounds; the school room, class rooms, teachers' sitting rooms, library and lavatory on the right hand, and the dining room, the baths, &c. on the left hand. This floor is on a level with the play ground, which is divided into two terraces, the first of which 400 feet long and 90 feet broad, and is provided with two spacious arcades for the accommodation of the boys in wet weather. At an elevation of 16 feet above this is a second terrace 320 feet long and 70 feet broad; these terraces will have a smooth gravelled surface, and will be provided with a fives court, and in the arcades will be gymnasia and other means of recreation; above the terraces will be a private garden for the master, which will command a view of the entire grounds. On the next story are three large dormitories which are overlooked by the bedrooms of the ushers; and on the third story in the centre of the building are the sick and convalescent wards with the necessary appendages. Large iron tanks are provided in the angular turrets in case of fire. The basement story contains the matron's apartments and store rooms in the centre, on the left hand the offices connected with the culinary department with an apparatus for raising the provisions to the dining room, and on the right a large wardrobe or dressing room.

The dimensions of the principal apartments are as under:—

	ft.		ft.		ft.		ft.	
Entrance hall..	36	by	26	Bath room	55	by	19	
Dining room ..	85		32	Two dormitories	85		32	each.
School room ..	70		32	One ditto......	60		26	
Lavatory	55		19	Dressing room..	85		32	

The walls are to be built with a species of sandstone, raised upon the site, with Bath stone dressings, which will produce a pleasing contrast with the warmer tint of the other stone. The ceilings of the principal rooms are divided into panels by moulded cast iron bearers, serving as girders and binders for the floors above.

Contracts have been entered into by the trustees, under the sanction of the court, for the erection and completion of the building for the sum of £13,912 18s. The masons are Messrs. Willcox and Sons; the carpenter Mr. R. Hamlen; the slater, plasterer and painter Mr. Henry Lee, all of Bristol; and the contracts are to be completed in the autumn of 1846.

[The wing on the right hand side of the building is not shown in the engraving for want of room, it is however the same as the one on the left hand side, with the exception of the door and small windows in the basements story, which are omitted.]

CANDIDUS'S NOTE-BOOK.
FASCICULUS LX.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. My reply to Dr. Fulton ought to be one of thanks; not because he has convinced me by his arguments any more than I have convinced him by mine, but for the compliment he is pleased to pay me,—so high a one as far as it goes that I might be well content with deserving the quantum of praise he allows me, being under no great apprehension that most others will consider me not sufficiently "correct," or too latitudinarian in taste for vindicating in a derivative style, where windows, not columns must be the essential features, a practice which he condemns as both unauthorized by and incompatible with original Grecian architecture and its principles.—I cannot, however, let the Doctor off without clearing myself from the charge of an inconsistency into which he fancies I have fallen. I certainly spoke "with very decided approval" of the houses in Maddox Street, where there are no pediments to any of the windows. What then?—I have never said either in this Note Book, or any where else, that a pediment is an essential and indispensable part of the dressing to a window,—one that ought never to be omitted but employed alike on every occasion and under all circumstances. Were such the case, it would follow that all the windows in a façade should have pediments without any distinction in that respect. As well might the Doctor have remarked that the windows in question have neither columns nor pilasters, and that I have therefore rather inconsistently expressed my approbation of what evidently falls far short of that degree of decoration which I am disposed to allow of for windows. Far greater inconsistency would it be in me to maintain that there should be but one uniform model for doors and windows, and that the same character as to embellishment ought to be preserved in every design. For my own part, I could wish to see architects avail them far more frequently and more freely than they now do, of the resources both in regard to composition and detail which such features afford them; and also see them abandon *stereotype* and treat detail generally with more artistic feeling, adapting it to the particular design and occasion; whereas at present many of their compositions look no better than architectural *centos*,—as if, in order to escape the charge of being wholesale plagiarists, they had merely committed a series of petty larcenies, pilfering one feature from one design, filching another from a second, and so on, till the ensemble so produced looks very much like Miss Edgeworth's "Miss Tracey," "a perfect monster formed of every creature's best: Lady Kilrush's feathers, Mrs. Moore's wig, Mrs. O'Connor's gown, Mrs. Leighton's sleeves, and all the necklaces of all the Miss Ormsbys."

II. If Dr. Fulton be scandalized at pediments to windows in a style which does not profess allegiance to Grecian precedent and taste, he ought to be almost equally scandalized at windows being introduced at all where the severity of the Greek temple style is both ostentatiously and pedantically affected for the ensemble. As soon as we begin to introduce windows the purity and genuine character of that style are forfeited. There is but one alternative, either to abandon the idea of applying that style in its classical severity, and to modify it accordingly, if windows there must be; or to arrange the plan so that there shall be no occasion for windows on that side of the building which is to be *à l'antique*, but make what is externally the front, a screen façade coming at the rear of those principal apartments within which must be lighted by side windows. At any rate if windows there must be in a façade professedly classical, they ought to be as few as possible, and as they cannot be got rid of, to be rendered noble and ornamental features, as is the case with the doorways of ancient temples. Were that done, beauty of design and richness of effect might reconcile us to such departure from the too obstinate severity of our prototypes, whereas as now treated in our modern ultra-classical, yet at the best only pseudo-Greek buildings, the windows are left to show themselves hardly better than so many holes in the wall, having for the most part little other architectural dressing than a scanty bordering of flat architrave, no matter of how decorative character the order—which ought to regulate all the rest—may be, or how highly wrought in its enrichments. Between the most florid and the very plainest Ionic no distinction is made as far as windows are concerned, it being thought, it seems, that those which will serve for the one, will serve equally well for the other; or as to the matter of that, for all orders alike. Such at least appears to be, if not avowedly his doctrine, the principle—the idea of harmony and unity, and of due consistency of character, manifested in the works of one great modern *classic*,—who has been content to go on all his life with just one idea. That he should have done so is, perhaps, not very strange, because it may fairly be questioned if he could possibly muster up a second one; yet strange it certainly is that his employers should be content with the humdrum things he has supplied them with.

III. *Ecce iterum!*—Dr. Fulton fancies that I am prejudiced in favour of Palladio and his school. Next, I suppose, somebody will say of me,—who have shown myself to be

Nullius addictus jurare in verba magistri,

that I am too bigotted an admirer of Vitruvius. I cannot just now point out to the Doctor the precise passages where in the course of what now amounts to Sixty Fasciculi, I have expressed my opinion of Palladio, but it certainly has not been one of admiration and respect. I therefore fancy in my turn that the Doctor's acquaintance with my Note-Book is not of very long standing, and if so, there is probably some amusement and edification still in store for him:—so very far indeed am I from entertaining any affection for Palladio's own works, or from being able to discover in any of them that refined taste which is so liberally attributed to him by Italian critics and ciceroni, and by those who write or speak after them, that I consider them to be for the most part stamped by meagreness, littleness, and dryness of manner, and to abound to such degree with sins against ordinary good taste, that there is hardly a solecism or a deformity for which authority—if authority can avail aught in such cases—might not be produced from his designs and buildings. Even his admirers do not seem to speak from self-conviction or from their own perception of his merits: they extol him, it is true, by wholesale in those safely vague generalities which amount to nothing more than the mere assertion of praise; but as soon as you begin to ask them for more explicit criticism, and to enter a little into the "*why*" and "*how*," and the *pros* and *cons* of the matter, or set about cross-questioning them at all, they turn a deaf ear upon you, or else cut you short by saying that Palladio has always been held to be one of the greatest masters in his art, and that if you are not of that opinion, your opinion is contrary to that of all the rest of the world.

IV. Few architects appear to have much *storge* or natural affection for their productions, or any of that sensitiveness in regard to them which induced Queen Elizabeth to prohibit spurious counterfeits of her fair features and person by unskilful "limners;"—or else we should have more publications supplying authentic representations of modern buildings, whereas of late years, a work of the kind has become almost a rarity—in this country at least, nothing of the kind having appeared for a long while except Barry's Illustrations of his Travellers' Clubhouse, and the two separate works on Windsor Castle, neither of which, by the bye, explain the interior of that edifice. One plausible excuse for architects not bringing out authentic delineations of their own buildings, is that such kind of publicity is not needed: there are the buildings themselves for people to judge of. Very true; but they forget that they cannot prevent others from putting forth to the world vile misrepresentations and caricatures of them, called "views,"—which, wherever they go—and many of them, undoubtedly find their way abroad,—are calculated to make the most unfavourable impression. Besides which, it frequently happens that by being published original designs become faithful and valuable—at least interesting records of structures that have either been destroyed by fire, or have else been so greatly altered as to present quite a different character from their first one. There can be little doubt that the publication of their "Entwürfe" or "Designs," tended, not indeed to establish, but certainly to widely extend the fame of Schinkel and Klenze, and as little doubt can there be that many who would else not have thought of doing so, have been in consequence induced to visit Berlin and Munich for the express purpose of beholding the structures themselves.—Why does not Barry begin at once to edit the drawings of the New Palace of Westminster?—first of those portions that are already executed, and then in like manner of others at intervals, whereby the progress of their publication would nearly keep pace with that of the edifice, and both be completed together. Whereas if the one—which it is to be presumed will be undertaken some time or other—is not to be commenced until after the other shall have been terminated, it will be a far more laborious task than if it were executed as here suggested.

V. The Royal Exchange gives us a foretaste of that general splendour of decoration which we look forward to for the Palace of Westminster; therefore, although in all probability it would never have been thought of—or if thought of, scouted as extravagant, had it not been for what is contemplated for the other edifice, it has got the start of the latter in point of time. In truth, the new Exchange seems to be the commencement of a new era in our public buildings; at least so, it is to be hoped, it will prove, and that we shall not now revert to, or any longer tolerate that bald and beggarly style of so-called simplicity and purity which has heretofore prevailed from the commencement of the century, and whose parsimoniousness has, after all, conduced nothing to economy,—quite the contrary, if it be true, as has been stated, that notwithstanding its richness of decoration, the Exchange has not cost more than half what the Post Office did. Nevertheless it may be called a wicked building, inasmuch as it puts wicked thoughts into one's head, making one wish many other public buildings we are now heartily ashamed of, were to meet the same fate as the old Exchange did, in order that they might rise from their ashes "transformed, transfigurated" like the new one.

VI. Seldom has any one obtained credit for superior critical acumen more cheaply than Horace Walpole. His remarks are often lively and epigrammatic enough, yet seldom amount to more than brief *dicta* unsupported by any show of arguments. No wonder, therefore, that he has been styled by some a flippant critic: the wonder is that those who consider him such should sometimes adopt his bare *ipse-dixits*, without attempting to show the justice of them. Nevertheless this is done by Gwilt, who approvingly quotes Walpole's sneer at Hawksmoor's church of St. George's, Bloomsbury, whose steeple it pleases him to term a masterpiece of absurdity. Gwilt, indeed, allows that there are considerable merits in other parts of the building, yet without specifying one of them; while as to the steeple, he too, leaves us quite at a loss to understand whether apart from the "absurdity" of a statue being placed on the summit of it, it possesses any merit in its general design as a campanile. Consequently, instead of at all *confirming* Walpole's opinion, he merely repeats, just as any one else who had no opinion of his own to offer—as any of those self-constituted critics, reviewers, and amateurs might do, upon whom Gwilt affects to look down with so much contempt and scorn. But "masterpiece of absurdity!" wherefore so, most critical Horace, or most critical Joseph? Does the absurdity consist in placing a statue upon the very summit of a lofty structure, where it chiefly serves as an ornamental finish or pinnacle to it, little more than the general shape of the figure being distinguishable? If so, precisely the same sort of absurdity attaches to all statues similarly placed,—whether on the top of a monumental column, or on the apex of a dome by way of substitute for a lantern—of which there are instances, or placed as terminations to gothic pinnacles, let alone spires. Or does the particular absurdity here consist in the statue's representing a modern king instead of an ancient saint? That, however, need scandalize no one—at least not when considering the matter merely architecturally: the figure may just as well pass for the one personage as for the other, at such a distance; so that this masterpiece of absurdity is at least reduced to a minimum. However unfavourable may be the traditional criticism given in books, since Walpole's time, I never yet met with an architect who has not confessed that there is something no less masterly than original in the general composition and effect of that campanile. It has a look of solidity and lightness combined, without any of that appearance of being a Romanized or Italianized version of a Gothic spire, as is the case with those of Wren.

Fall of a Stalk at St. Rollox.—On Friday, Nov. 1, in the afternoon, a little past three o'clock, the stalk, 240 feet in height, situated at the corner of the works at St. Rollox, immediately adjoining the Glasgow and Garnkirk Railway, gave way at the foundation, and in an instant not one brick was left above another. This stalk, we understand, was only finished a few weeks ago, and about the same time it was discovered that its base was not secure. Means were accordingly taken to insure its stability, by propping and otherwise, and little fear was entertained but that it would stand a while, when on Friday, as has been stated, it fell with a most tremendous crash. Its descent was almost perpendicular, and it therefore occasioned little additional damage, for although a portion of the bricks fell within the Railway depôt, and upon the rails, no further accident was the result. Several men who were working close by the stalk heard it cracking a few seconds before it fell, and, fortunately, having quickly left its vicinity, escaped. The wind was blowing very fresh at the time, and the stalk fell in the same direction; but had its foundation been anything like secure, it would not have affected the stability of the structure.—*Caledonian Mercury.*

THE ART BLISTER.

No. I.

The George Jones and Martin Shee principle of election in the Academy has, I am happy to see, been shelved for the present. Two artists have been elected, both creditable, both talented, yet the sculptor of infinitely a sounder taste than the painter.

Every man must have observed of late years, since the German school revived, a strong tendency to introduce into British Art the wild childishness of the leaders of that eminent renovation. Munich is so much nearer than Rome, that young men have continually swept through Paris to Munich, and returning during Autumn through Germany to London again, brought back more vicious taste than they carried out, and certainly in their practice proved they believed rigidity was beauty—distraction of effect, simplicity—flatness, angelic—and gold grounds and glaring colours the *ne plus ultra* of elevated thought.

To keep what is acknowledged to be good, and add what is defective ought to be the basis of all reforms, politically, religiously, poetically, or pictorially;—but will it ever be so, or has it ever been so? In all reforms men go to excess, and therefore a Royal Academy ought to be very cautious in sanctioning any men who give evidence, or have given it, of being bitten by a false taste.

The Academy has one talented man of this species already, who has done more to ruin the art, and the youth in it, than any one who ever took the lead in the most corrupt times of corrupt art; to elect another to help him is to add to the danger instead of stemming it, and to whatever lamentable condition the art may shortly sink, the Academy will be in a great measure answerable for the effect produced on the public taste, by the puffing and the prominence with which they obtruded his productions, at the expense of their own repute, their own sagacity, and their own decided conviction they were doing wrong, or ever enquiring with themselves, what would Reynolds have thought?

The painter they have now selected is an accomplished and amiable man, but of the same taste as the other alluded to; compelled to resign his situation as Master of the School of Design, which he had not sense to conduct, and which he nearly ruined, his powerful friends, of whom he is the pet, procured him to be elected as Member of the Council which controls the Master, though he had given evidence he was totally unfit to be the Master himself; and after having misled all the students he directed in London, he was dispatched to inspect the country schools, because he had proved he was totally unfit to conduct the London one! Ignorant of fresco, in reality, from the evidence he gave before the Committee, he is one of the selected to decorate the Lords, and lastly, the Academy has given its sanction to this tissue of absurdities, by preferring him to better men on their list. To get out of so many scrapes, with such tact, shews great diplomatic skill, and let the Academy beware they have no occasion to repent their decision hereafter. At any rate, however, any men are preferable to incompetent men, for let the Academy be assured, that it is a great mistake to elect inferior men, under the notion they will become useful as tools for the dirty work of the institution; there should be no dirty work, the official situations should be all rendered worthy men of genius, by the yearly income, and not fit only for fools as a refuge from destitution; the consequence given to mediocrity by many of their elections has been fatal to the dignity of genius in the body, from the impulse they have given to the most incompetent out of it.

Let the Academy remember, what disgrace, what turmoil, what loss of character, ensued from the admission of Farrington and his clique. They very nearly destroyed the art, they kept it in one perpetual contest of intrigue, and violence, and recrimination, and insult, till at last the interest of the students, the honour of the sovereign, the advance of design, were utterly sunk in the squabbling and vulgarity of a benefit club, to the disgrace of all breeding and taste.

I know it is difficult always to keep 40 men in a right direction; influences will be used, and put in practice totally inconsistent with the known interests of the institution; but the quicksands always to keep in view are men of *intriguing mediocrity*, creatures whose very want of fame or of power leave them leisure, first to make themselves useful, and then necessary, till at last, the members of genius, for the sake of relieving themselves of the trouble of a duty, resign their liberties to those whose only chance of distinction and importance at all is the trouble they are always ready to take off the shoulders of their superiors.

No man can deny that sometimes men of mediocre talents in art can be useful to a body, for instance Martin Shee, he came in when mediocrity was in full bloom, and he has kept it blooming ever since, and really he can be justly called "the distinguished head of all the mediocrity in Europe;" but such gifts of Nature are rare, and let the Academy not risk diluting the body by any future experiments of the like nature, for out of the thousands of painters throughout Europe of the exact calibre of the worthy President, not two perhaps have his fluency of speech, to conceal poverty of thinking, or his activity in common business, to make amends for his wretchedness in Art. Perhaps Shee is unique as an example of a man being placed at the head of a profession on the principle of being the most incompetent man in it.

Never had any country such a crop of reigning mediocrity, as since the elevation of Sir Martin; and yet his whole life is one continued illustration of opposite principles. An upholder of the dignity due to authority for its own sake, now, to the very marrow, he once wrote a tragedy so finely radical in rebellion against its power that the Lord Chamberlain forbad its coming out. Formerly maintaining that Genius all over Europe had preceded Academies, and that none had appeared since, he is now ready to die in asserting that no Genius can ever come without them! Swelling with ambition, and yet cursed with impotence; hating the genius he can never equal, yet thirsting for the distinction he feels is its inherent right; cunning, designing, talkative, and intriguing; never more deeply plotting than when most artlessly affecting to be open; frank, to conceal an intrigue; bustling, to bewilder suspicion; eloquent, when he wants to distract, and humane and compassionate for those he detests, when pity may lead to contempt for their condition; by flattering the vanity, pandering to the weaknesses, and soothing the appetites of the herd he despises, he elevated himself and elevated them, and in baffling the Genius who opposed him (Wilkie), bestowed a boon on all those who cursed his great talents, feared his private worth, and abhorred, with the grovelling baseness of degraded spirits, his illustrious and immortal name.

The most popular man in the Art is the President, because in him the mediocrity of the Art is represented; and every man who aspires to immortality by daubing for an Art-Union patron, when no other can be had, feels his breast swell with delight as he remembers the inherent tact of Sir Martin for snubbing genius by tickling impotence, and making every fool at a fund dinner believe he may one day be as great as himself! The immediate danger to British Art, however, is the tendency to Germanism by the introduction of fresco, we have three men of talent that way most fiercely inclined; because fresco is to be chosen, the patrons seem to believe it is contrary to sound taste to carry the beauties of the school into that species of decoration, as if the defects hitherto endured were not an accidental omission, but an inherent concomitant of the material and the style; as if clearness, touch, execution, tone, colour, softness, were not to be attempted, but banished; as if, because light is more required than shadow in decoration, the light must be crude and the shadow black. This ridiculous absurdity has got into the heads of every member of the Royal Commission, and, being agreeable to German theory, the eminent Secretary is too delicate to explain to the Prince what ought to be, must be, and will be the doctrine of British decoration.

We will not have and endure the lime illuminations of Munich walls; in all the graces of colour, light and shadow, impasta, execution, and simplicity of expression without imbecility of look, we are the masters of the Germans, and will remain so; what the British are defective in can be added; what they have, if they lose, they will never regain; and I call on every eminent British artist, and every budding student, to resolve, in the contest next year and the one the year after, to keep, in all their attempts in oil, fresco, or cartoons, the great beauties of British Art, whilst they add knowledge of construction and correctness of form without hardness, light and shadow without sootiness, colour without gaudiness, and touch of the brush without being brassy or brittle.

For the honour of Old England let them beat down the bastard theories of foreign travel—

> "I'd have our English Mounseers know,
> A man may yet be wise and never see the Louvre."

TIMON.

RAILWAY TUNNELLING.—At a meeting of persons interested in the South Wales Railway, at Cardiff, on Friday, Mr. Brunel stated, that the Box Tunnel of the Great Western Railway cost 100*l*. per yard; the White Ball Tunnel on the Exeter Railway, cost but 53*l*.; the Cheltenham Tunnel, in connexion with the Great Western Railway, was estimated at 136*l*. per yard—it cost but 34*l*. per yard; and to show the reduction in this department alone, he mentioned, that within the last three weeks he had contracted for tunnelling at 28*l*. per yard.

SIR JOSHUA REYNOLDS.

Sir,—An intelligent correspondent, Wilhelm de Winterton, has asserted, page 378 of your last number, "that contrary to the allegation of the person who professes to hold, in Sir Joshua's own writing, a diary of practice, very ingeniously woven out of scraps and patches by some keen observer of his habits, *he kept no journal*, and declared in the hearing of Sir Martin Shee and others still living 'I'd give a thousand guineas if I knew how I painted this and that, &c.'"

So, because chattering people assert they heard Sir Joshua say he would give a thousand guineas if he knew how he painted some particular picture or two, of which he had evidently kept no memorandum, *therefore* Sir Joshua never kept any journal at all, and *therefore* the journal he did keep in his own hand of the vehicles of the great proportion of his pictures, *now* in the possession of his relations, cannot be *his* journal, because it *may be* written in scraps from his conversation by other people!! Very likely certainly, and very beautiful Logic. On reading this delicious deduction, I wrote Mrs. Gwatkin, at Plymouth, Sir Joshua's niece and descendant, and who is in possession of Sir Joshua's private papers, stating to her what had been asserted, and requesting to know if Sir Joshua did or did not keep memoranda of his daily practice, as I had in my possession extracts from such memoranda, copied by Sir W. Beechy from the original book, but yet, before replying to your correspondent, I wished her confirmation, as I had never seen the original book myself, though the extracts I possessed bore evidence of being genuine in every sense of the word.

By this morning's post, Mrs. Gwatkin has actually enclosed me a leaf of *the* book in Sir Joshua's hand-writing, to make what use of I please, saying:—

"*Plymouth, Nov.* 11, 1844.

"Dear Sir,—I am sorry it has not been in my power to give you an earlier answer to your note, and hope the document I send you will be satisfactory in putting an end to the falsehood you mention; *I have cut it out of the book* to which I imagine you allude.

* * * * * * *

"You will be so good as to return the leaf when it has answered your purpose.

"I am, dear Sir, yours, &c.,

"B. R. Haydon, Esq." "Theophila Gwatkin."

There never was such an interesting document made public for the art, and we are indebted to Wilhelm for mooting the question, which has produced so satisfactory a refutation of the chatterers, who concluded what they heard on a *particular* occasion was a principle to be applied to *all* occasions.

Faithful Copy of a Leaf from Sir Joshua's Secret Memoranda Book of Daily Practice, now in the Possession of his Niece.

"Prima—Umbra et (latin) Biacca—Poco de olio—

"Seconda—

(Then he has written)—

" My own Portrait—Asphaltum, Minio, Giallo e turchino (Prussian blue) per lo campo.

"Umbra Verm. and Biacca, thick, occasionally thined[1] with turpentine.

"Primato | Nero, Cinabro, Minio, e Azurro. Thick.

"Lord Henry and Lady Charlotte Spencer, first, olio e poi colori con cera senza olio.—Mr. Weyland, ditto—Miss Newport, ditto—Mrs. Mordaunt, ditto—Mrs. Morris, ditto—Tyrconnel, ditto (Lord).

"My own, Florence upon raw cloth, cera solamente (wax alone).[2]

"The Children on Mrs. Sheridan, poi cerata.

"Mrs. Sheridan—The face in olio, poi cerata (waxed) Panni (drapery) olio,—poi con cera senza olio, poi olio e cera.

"Mrs. Montague—Olio e cera | Asphaltum nero e cinabro.

"Lady Dysart—Primo olio, poi cera solamente et pour (French) il viso (Italian).

"My own Picture, marked † behind, finished con Vernice di Brim. senza olio (di Brim. perhaps copal from Birmingham.—B. R. H.)

"My Lord Althorp—Minio, e nero, sol. poi giallo, e verm. senza biacca—Olio. (It must have been exquisitely rich, making yellow the light, without white, like Rubens and Titian.—B. R. H.)

"Mrs. Montague—Olio poi cerata e ritoccata con Biacca.

Oct. 2, 1772.—Miss Kirkman—Gum Dr. et whiting—poi cerata (waxed,) ovata poi (egged), poi vernicata (varnished), e ritoccata (and retouched.)—"Cracks." (By Heaven, I should think so.—B. R. H.)

To us artists, this is exquisitely interesting—getting into the tricks of so great a man—Sir Joshua wrote all his memoranda in such a mixture of English, French and Italian, as if to conceal them from every body. To proceed.

"Aug. 15, 1774.—White, blue, asphaltum, verm. senza nero—Miss Foley—Sir R. Fletcher—Mr. Hare.

"Aug. 26, 1774.—White—asphaltum—verm.—minio principalmente, e giallo de Napolino, nero ni turchino—Ragazzo con Sorella.

"To glaze con Asphaltum e Lacca the Boy with Child at his back A.

"Sir R. Fletcher

"Biacca, nero, ultramarino, verm. sed (latin) principalmente minio senza giallo, e ultima volta (Italian) oiled out and painted all over (English).

"Ditto Mr. Hare, except glazed with varnish and Giallo di Napoli.

"Finito quasi con asphaltum—minio—et verm. poi con poco di ultramarino quella senza giallo.

"Mr. Whiteford[3]—Asphal. verm. minio principalmente senza giallo.

"Blackguard Mercury and Cupid,[4] black and vermilion, afterwards glazed.

"Sir John Pringle—Verm. minio—Giallo di Napoli et nero.

Mrs. Joddrell—Head, oil—cerata (waxed), varnisht, with ovi (eggs), poi varn. (varnished) con Wolf (Wolf's varnish)—Panni, cera—size—oiled—verniciata (varnished) con ovo (with egg) poi con Wolff."

Good heavens! Let us recapitulate in English. The head painted in oil, then waxed, varnished, egged, varnished again with Wolff's, then waxed, sized, oiled, egged again, and then finally varnished with Wolff!!! That is, varnished three times with different varnishes, and egged twice, oiled twice, and waxed twice and sized once—perhaps in 24 hours.

The surface Sir Joshua got was exquisite, his delight must have been intense, and though the reward was worth the risk, in such extraordinary infatuations he must be a beacon.

The artists ought to feel greatly indebted to Mrs. Gwatkin's liberality in permitting this curious extract to be published, and I hope I have satisfactorily proved Sir Joshua did keep a journal of his practice, and that the journal thus held in care and veneration by his amiable descendant is not a journal "of shreds and patches by some keen observer of his habits," but a journal by his own hand, of his own mind in its secret and confidential meditations, invaluable to art, to the distinguished artist and the eager student.

I am, Sir, yours, &c.,
B. R. Haydon.

14, *Burwood Place, London,*
November 12, 1844.

P. S.—I shall be happy to show to any artist this interesting document during the week.

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1 His own spelling.

2 Of this portrait Wilkie says, when at Florence (see Life), "perfect as the day it was painted, not a crack."—B. R. H.

3 Caleb Whiteford.

4 Lately exhibited at the British Gallery, and has stood well.—B. R. H.

ON THE PRESENT STATE, THEORY AND PROSPECTS OF PAINTING.

No. III.

Chalk Drawing, Chalk Fixing and Water Colour Painting.

Having glanced at fresco, *en passant*, with the intention of recurring to the subject again; having hastily traced the more important errors and desiderata of oil, and suggested the means of improving the art to the full extent of our present or probable knowledge; let us return, with Father Matthew, to water, without quoting Ezekiel for trick; although, maugre any charge of egotism—for he who knows must *feel* he knows, and in saying so, in the confidence of his strength, is the better man than he who, with lengthened chin, and upturned eye, and oily tongue, and glavering yet half-masked smile, begins with a certain bishop, "In all due humility, my Lords," or in private life, "I confess I am an humble judge, &c. &c." and which, forsooth is mocked with a titular "modesty of mien." Pshaw! as Timon would say, and say truly, I am not thus modest, Sir, and hate the craft:—maugre, I say, the milk skimmers of life and all their opinions, "All those who use water *shall be* comforted to the nethermost parts of the earth;" and if, with Dickon among the doctors, we show the fallacies of the faculty, we shall not be classed with Morrison, for we have no personal interests to puff, no motive to deceive.

To chalk, in all human probability, or charcoal,[1] used as such, we owe the origin of an art capable of, humanly speaking, defying time and stamping immortality on the works of man. Take Raffaelle and Caracci as the proofs; for if the cartoons had been fixed as we could now fix them, fully, firmly, imperishably, evenly, without stain or gloss, without size or gluten, without steaming or disorder, and finally without injuring the slightest half tint,[2] where is the man who could approximate their possible age? and taking the constant copying and multiplication of them, with the powers of the modern press, into question as a beacon and a guide to posterity—where is the man who could calculate the probable period of time at which, from the contact of a comet with this earth's revolving ball, they should cease to be?

I allude obviously to those cartoons and those drawings carefully preserved and decently used; while those in the print room of the British Museum cry aloud for the cheesemonger's scale or the housemaid's hand; they are notoriously depreciated and depreciating,[3] are worth little and soon must be worth-*less*; imbedded in oatmeal and guarded by wire-haired curs, no man leaves them gratified but the ratcatcher serf, accustomed to thumb the thing he examines, and who feels unusually pleased to be led humbly by self-important hands. And if I say, with deference to better judges, Haydon's "Black Prince[4] leading John through the streets of London," or his much abused and ridiculously mangled "Curse," the so-called uglinesses of which have been bandied abroad probably as ironic praises of Challon's figurantes, or Corbould's powder blue and washing tub forms—candelabra ornaments aad sliced turnip bosoms; or real slurs upon Armitage's bandy legs and Puddle-dock grandeur,—if these, I say, had been thus fixed, the Duke of Sutherland might have left to his posterity heir-looms of real worth; and I say, also—for men are omnipotently so cast as to differ in opinion as in form—the Commission of the Fine Arts thought wisely, and did well in making chalk the nucleus of worth, and have done more to exalt it than all the patronage of the last half century by the impetus thus given to art—would to Heaven the same impetus had developed its force in mind—aye, more than all the efforts of genius during the last century. Had Watts's Caractacus been thus fixed or the Fight for the Beacon been thus rendered permanent without size, the steaming of which must disconnect the colourman's pasted sheets, disfigure the face of the cartoon by blisters, folds or corrugations, and finally give so fierce an affinity for damp, so inherent a disposition to mildew, the twin sister of dry rot,[5] as, in such a climate as this, can never permit the drawing to reach a Raffaelle Age or Caracci term—they might have infinitely surpassed both with reference to mere preservation. The only obstacles are trouble and cost to the artist; and these, a higher grade in life, more patronage, more means as the result and increasing self-respect will teach him, ere long, to scorn.

What the means are, and the *modus operandi* of their action, I do not feel at liberty to develope, the confidence of friendship having placed them in my keeping by one who had also sold the result of his labours to an artist's colourman[6] in the way of existence; more especially too, as the existence of such men, among the moderns, vastly resembles that of their brethren of old—a wearied, incessant, restless, laborious, costly and precarious scene; they are men who none but the street mendicant can envy, and he only because he cannot as classically ask the *Data obolum Beisario*? Men on whom the shopocrat looks with all the scorn of a till; and merely adopts, aids or trusts, in fact tolerates, at all in the "pale of civil and social relations" as the stage autocrat does the talented buffoon—because he feels his own nothingness, and that he cannot live without him; men who, if they serve the trader are served out—if they serve the public weal are treated with a letter of thanks, equally matter of course and unmeaning, as it is void of intrinsic use, in a word delusive, vain, empty, and a blight; the principle, however, is the simple evaporation of spirit from the surface after permeating the texture of the paper, when applied to the back—and leaving, in such evaporation, sufficiently well modified matter behind as effects the desired end; many trashy attempts at which have been formed of camphor and other powerless and objectionable agents before for sale. Let us now examine for the painter in water colour the present state of his art, its wants, wishes, and hopes; its history, origin and present usage, open as it is like oil, from his not being his own manipulator, to every trick of trade.

Of tempera, so long and so beautifully practised in Greece, and by no means to be confused, much less identified with distemper, from which it markedly differs in vehicle and effect, Mr. C. L. Eastlake has given, in the Report of the Commission of the Fine Arts, a better history and description with more elaborate authority than I can presume on, or the space of this Journal permits. Suffice it then to say, it is one of the most permanent species of painting, very brilliant in effect and worthy of more consideration than it has hitherto received among us; and I can hardly conceive a more to be wished for improvement in the amusements of our amateurs and occupation of our artists of the lighter class, or a more delicate one either for our females, than tempera painting on artificial marble slabs. The chief defects of the art, as handed down to us by ancient historians,—however, much what Plutarch says casually and defusively may be relied upon infinitely more than all the gossiping twaddle and bookmaking detail of Pliny, who in all probability was in the constant pay of some Longman of his day,—were the use of the yolk abounding in colour, and sulphur in lieu of the white of the egg, and the disposition of that agent to scale or crack, and these are real defects indeed; but, acetic acid and sugar candy, pure boracic acid and ether, or both, might do more than liquorish-toothed jujubes, a trashy mixture of East Indian gum, jujubes, currants and lump sugar do for Sir William Newton in lieu of more simple, dignified and intelligent agents; by the bye, why not enquire about the nature of sugar candy, Sir William?—Ask Etty!

The Egyptians evidently painted much and, in their way, well in tempera, and in all probability were the discoverers of it, and they, like the Greeks, varnished with wax; with reference to which I would ask—does it follow, of necessity, that what Plutarch describes as "*cera punica in oleo liquefacta*" should have really been bleached wax?[7] Plutarch would have described, and his *Latin* followers surely reiterated, the *cera alba* or *cera decolorata* by some definite language if the wax had been bleached at all. I would also enquire whether many Egyptian paintings, very beautiful in aspect to the inexperienced eyes of some travellers, might not be indebted greatly to mere *contrast* for that beauty as to effect, and to density of body for their permanence? giving thereby a false idea of the permanence of the vehicle. Some Chinese paintings, at a hasty view, are equally beautiful, though mere trash—real Poonah-daubings as to art, because of this contrast of dense, unsoftened, unblended purple and gold, gaudy yellow and scarlet, deep black and sky-blue; while the pigment must be changeable

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1 Such is Plutarch's account at least.

2 This effect is certainly produced by the Transfixing Liquid sold, I believe, exclusively by Newman, in Soho Square.

3 This was modestly pointed out two years ago to the person in charge of the Print-room, rather as a compliment than otherwise, as Sir Henry Ellice was assuredly the most proper person, and the means of preservation gratuitously suggested; but either the man mistook a gentleman for some brother of the north seeking to rob him of his place and no gentleman at all, or he remembered the Spanish proverb—"There is a fig at Rome for the man who gives when not asked, or gives more than he is asked for;" Scotchmen proverbially giving nothing, but bows to the rich and insolence to the poor.

4 And yet, it is but justice to say, Haydon's cartoons were as little disfigured by this unsetting of the paste and bad joinings as any in the exhibition; some drawings there were disgusting specimens of want of mind and matter too.

5 So inherent and inevitable is this effect of size on exposed surfaces in damp atmospheres I cannot believe Raffaelle or Caracci used it at all; and nothing but an experimental examination of the cartoons by tests would change my belief that historians have deceived or misled us on the subject.

6 Newman.

7 In this translation, therefore, of "cera Punica in oleo liquefacto," we must differ with Mr. C. L. Eastlake's report, in which it is translated white wax; now surely cera alba would have been used, or cera candida—in fact there was no paucity of language—cera depurata, cera purificata, or some expression to define or express bleached wax. Vitruvius was probably his authority, and Vitruvius used the expression as a vulgarism equally applied to red wax. Cera Punica I humbly conceive could only be properly translated or spoken of as 'Punic or Carthaginian wax in its natural state;' and, en passant, I may here notice a very ignorant, silly thing transmitted to Mr. Eastlake, viz. a recommendation to use "salt of tarter, cream of tarter, or soluble tarter," as synonymes for one and the same end, when, equally as to language and chemistry, they are different things—opposites and inefficient; caustic ammonia being the proper agent for making wax soap, or, if potas must be used, caustic not carbonated potas.

ndeed not to stand, being, unlike our thin tints and mere washes, in fact, solid bodies of colour literally dredged upon, not mixed with the vehicle;—a species of painting followed also by the ancient inhabitants of Peru. I question, also, whether Davy was quite correct as to Egyptian azure. A blue pigment *may* be made, of course, by fluxing flint, copper filings, &c., but it is a poor, weak, drossy, bodyless frit of little worth; no painter of the present day would use it twice; indeed, Davy,[8] maugre the cackle of the F.R.S. tribe, though of brilliant mind and ingenious, was infinitely more *practical* and *practicable* on salmon fishing than on painting; on good living than on the arts.

Distemper painting now claims our notice; and comes strictly within the express position laid down in my first paper, viz., that while oil painting must place its reliance on the vehicle used, water painting must rely only on the individual permanence of its pigment, to which may be added, in the cases of tempera and distemper, its varnish. The best vehicle for distemper is unquestionably parchment size, which though inferior to solutions of isinglass in colour and for glazing has none of the chilling or setting powers of it, and only requires precautions to be taken against cracking from its drying power,[9] of which the use of sugar candy is the most efficient, with this advantage, that the bearing-out is also achieved by it; and the painting may not only be looked upon, when dry, but looked into; its very base and inmost core is open—deep, clothy, rich, and full. Lakes and carmine should never be used a *second time;* carmine and scarlet lake deteriorate by every wetting with distilled water alone, that is, go back to the purple hue of the cochineal, and only two means exist to prevent it; either to use, as formerly, a purple-toned carmine, the *ne plus ultra* of Guyton Morveau or Gay Lussac's day; or, in using the present butterfly of art, carried to excess in the scarlet tone by an admixture of a fugitive yellow, to keep up that tone by using on the palette, as the flower painter does, citric acid, and still better citric acid and nitrate of ammonia, in very minute quantities; the same minute quantity of phosphate of lime (not burned bones as for oil, but the artificial phosphate,) will retain the purple tone as long as any modern water painting will last or can last. Barytic sulphate white—commonly called permanent or often constant white—not the native sulphate, which some anserine scribe, delighted with his grey "goose quill," suggested to the Royal Commission of the Fine Arts in the Athenæum some time back, but that which any respectable colourman would use for his cakes—should be used in delicate pictures and retouchings, while good German kremnitz suffices for others, but requires very rapid varnishing, not being itself permanent. The use of barytic white, however, is never fortunate in effect if impure or at all iron-tainted water be employed; for, this turns it foxy.

Distemper, without a question, has manifold good qualities for decorative purposes; and as many of the Venetian masters, and in the best days of art, employed distemper in the highest order of pictures, two modern imitations of which I have before spoken of as executed by Bonnington and Mr. Henderson in Paris, I am yet to be informed why the junction of distemper and oil, in one painting, should be abandoned? The *luce de dentro* of a white ground of Cornish porcelain clay, washed until clean, white and silky, would, in such cases, produce that grand effect, that tone, that clearness and beauty which oil alone can never reach; and the glazing in oil, as a real varnish, protects you from the chief evil of water painting—viz., the *non*-permanence of many colours where *all* ought to be ultramarines in power.

Much as I admire fresco in the mighty hall and majestic dome; much as I think fresco practice will improve the arts; durable as I know it is, and practised well and successfully as I am sure it *will be* ere long; I am still bound to confess I believe tempera, distemper, and oil will infinitely suit us better, be more pleasing to the general eye, be more patronised, more profitable, and ultimately more beneficial to man.

Wax painting, of course, I exclude from present consideration. It is very beautiful and very permanent in proper atmospheres; and certainly well adapted for mural decoration. In the vestibules and porticos of the ancient Balbec or Palmyra, in Carthage or Herculaneum equally grand; and, imperishable in the chambers of the pyramids, but in the name of common sense, I ask, what figure will it cut in Cornelius's very *admirable situation* for a palace? How will it look near Sir John Cowan's candle shop, in defiance of Gresham's name or Sang's flowery festoons, fat griffins and incomprehensible shapes of nameless things, neither seen in the earth or the sea, in the heavens or the regions below? Can it be supposed possible that, in seven years, the smoke and filth and cent. per cent. degradation of the city of London should leave his yellows, and greens, and reds, and blues visible at all except as the finger posts of scorn? But Sang probably follows the Turner school, and they will last "his time." Oh, that he had been patronized by persons of more *faith*—yes, a little more faith, and a *thousand sovereigns down* had shone brighter far than Indian red; and, Sang's important secrets burst forth in more than meteor glare; then, indeed, might high art have hidden her head beneath her vest and sat like "Patience on a monument smiling at grief;" but, Sang was right thus far; it is dangerous to be a volunteer with "*more* fighting and *no* pay;" for as the Spanish proverb says—"there is a fig at Rome for him who gives advice when *not asked*, or gives *more* than he is *asked for*."

Looking to men, manners, and things of real life—things as Nature made them or as they are, for I detest polished frippery as much as learned, pious, philanthropic, or artistic affectation—I hate the trumpery fig leaf of Haydon's Curse[10] equally with the unnatural and monstrously denuded Omphale at Gwydyr House; looking at things as they are in actual life, ninety persons out of every hundred stand too close to all pictures: how disgusting then the general effect of the fresco must be—I mean the genuine fresco, not the frittered-away, tempera-loaded dowdy of a small apartment—to such a near-sighted race?

I now repeat the axiom, that with reference to permanence, water colour must place no reliance whatever upon media, but wholly and solely on the *individual* permanence of each pigment wherever such *can* be attained, or, on subsequent varnish: water colour may, with glazing, become an approach to oil effect, but except in such cases as those spoken of before, viz., a mixed style, never can equal it. Still may greater richness, bearing out and effect, be gained when colourmen advance a step beyond A, B, C.

I have said nothing of the ordinary cakes now made by three[11] of the makers, both neatly and free from that miserable mixture of trash common thirty years ago: the late Mr. Reeves used to boast that *his colours washed infinitely better than those of other men;* and well they might, Windsor soap was a very conspicuous ingredient, and Windsor soap washes neatly enough, a slight dash of water will wash it out. The chief defects of cake colours are, the total want of "bearing out powers," when dry; and total absence of all "resisting" or preservative power in the compound; so that scarlet carmine becomes purple, in fact depreciated by the making and *worthless*, if used, from the palette a second time; hence miniature and flower painters have each their nostrums, like Sir William Newton's solution of jujubes, better adapted to the mouth than the pencil, and bespeaking an infinitely greater degree of intelligence in the stomach than the head; or Mister Bartholomew's colour cups, adapted to nothing earthly beside; for these are marked blue esquire, yellow esquire, green esquire, and so forth,—and yet Bartholomew, maugre this weakness of our nature, is a man of unquestionable talent, and by supplying what the colourman ought to have supplied before hand—produces fine work,—flowers which might have deceived King Solomon's bees, and placed his far-famed wisdom at a discount.

Wilhelm de Winterton.

November 8, 1844.

[8] Such I am aware, is high treason, and may raise a hornet's nest, of this I am reckless. Davy was highly gifted, ingenious, and showy; but, saving his decomposition of the alkalies—by such agency as Baron Born had not possessed, and therefore could only suggest the facts—he was practical and practicable in nothing else; and in the zenith of his assumed name applied to Mr. Field, the author of Chromotography, to assist him in 'getting iron from lapis lazuli.' Mr. Field is still living, and his grey hairs hairs too respectable for the splutterers about Davy to impugn his veracity; but more anon, when Dr. Faraday and his wether-bell tingle about the "Davy lamp" come fairly before me, then this unwarrantable data-less assertion shall have justice, justice of the Shylock school, to a hair. Indeed, the animus is simply this—something must be said on emerging from his mission to the collieries, and Davy, the immortal Davy's mantle is the panoply and shield. The man of theory pockets his fee for saying a practical nothing; but benefit he must, as the the ministers godsend.

[9] More than half the nonsensical praises lavished on the Chinese flexible varnishes originate in ignorance of the fact that many of their very bad ones are flexible merely because sugar candy is used in the colouring beneath, which therefore cannot crack.

[10] To shew the mawkish affectation and mere caprice of such pseudo-delicacy—a gentleman who had just been descanting on the indecency of a certain nude figure in a fine picture and really dignified subject, went to prayers in the cathedral at Lincoln with his daughters, over the doorway of which an immense casting, in high relief, of the deeds of Sodom and Gomorrha stands too conspicuous to pass unseen. O tempora! O mores! The authorities would have been petrified if an engraving of such a thing had appeared in a book, or had it been painted on canvas, while that which had nothing impure in it gave real offence; veritably, we have academical as well as polemical Agnews, and the artistic as well as dramatic Miss Nancy.

[11] Newman, Winsor and Newton, and Roberson; the rest may be taken by the lump at twenty-five per cent. discount for sale, with an extra five per cent. for the drawing master's recommendation.

Iron Ships.—The *National* states, that the Government proposes to permit the importation of iron ships, subject to a duty of 45 francs the 100 kilogrammes.

THE HIMALAYA FUNNEL,

For the Cure of Smoky Chimneys, Registered pursuant to Act of Parliament, 6 & 7 Vic. c. 65. Sole Proprietors, James Boyd and Son, 78, Welbeck Street, Cavendish Square, London.

Fig. 1.

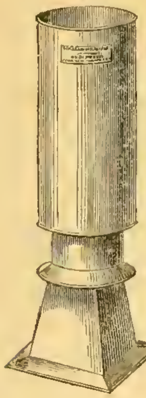
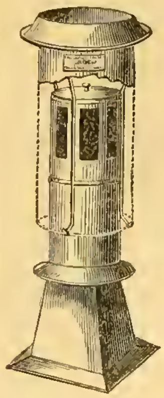


Fig. 2.

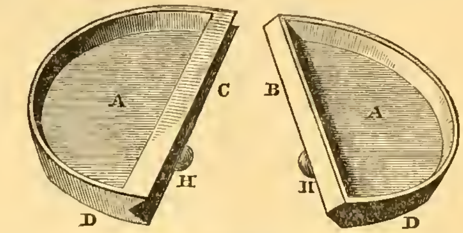


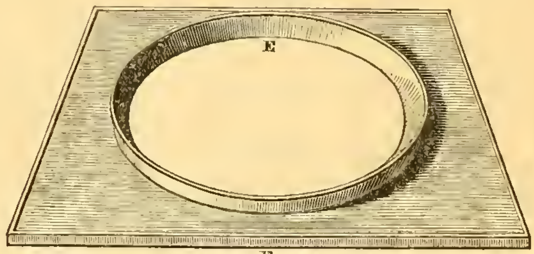
The principle upon which this apparatus is constructed, is that of conducting the smoke through apertures in the sides of the chimney shaft; into an outer case of considerable length, which extends above the top of the chimney, and is open both at the top and bottom, the chimney shaft itself being perfectly closed at the top. A current of air thus passes vertically through the outer case; and, in conformity with an established law, both of pneumatics and hydraulics, that when two currents of fluid matter passing in the same direction, but in separate channels, arrive at any point of confluence, the stronger current draws along in its course, and with a considerable portion of its own velocity, the weaker current: so the force of the wind, which checks in other instances the action of a chimney draught, in this is made to produce a stronger draught exactly in proportion to the violence with which it blows. Whether the wind blows *upwards* or *downwards* through the outer case the effect is the same, as the chimney shaft is closed at the top. The Himalaya Funnel thus becomes a perfect wind guard, equally applicable for increasing the draught, whether exposed to horizontal or vertical currents of wind; and will therefore remedy the largest class of smoky chimneys, which are those arising from high winds and *downward currents*, produced by adjacent buildings of greater elevation, or by any other *external* cause; and for all such defects it must be an infallible remedy. The conical projection upon the funnel a few inches below the exterior case (see Engravings) is intended to increase the effect of horizontal currents of air, by deflecting them upwards between the funnel and the exterior case, at the same angle at which they strike upon the said projection, and thereby assist the efflux of the smoke; but no air passes into the *interior* funnel, either at the conical projection or elsewhere. And in order still further to increase the effect of horizontal currents of air, the conical projection on the top edge of the outer case (figure 2) may also be used when required. The Funnel may be constructed of zinc, iron, or other metals. It is extremely simple—not liable to derangement—is readily swept by the ordinary machine—effectually excludes rain—and being perfectly devoid of machinery, it possesses great advantages over all revolving chimney tops or cowls, which are liable to continual derangement by their exposure to the weather.

THE HERMETIC CHIMNEY VALVE,

For Preventing Downward Draughts in Chimneys when without a Fire, Registered pursuant to Act of Parliament, 6 & 7 Vict. c. 65. Sole Proprietors, James Boyd and Son, of Welbeck Street, London.

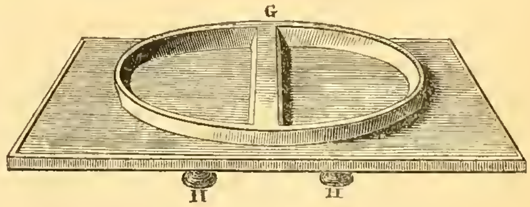
The inventors propose to substitute the Hermetic Chimney Valve, which is very simple and efficacious, for the imperfect smoke doors hitherto fitted to register stoves, which have proved totally inadequate to exclude from chimneys, *out of use*, the intolerable nuisance of *downward draughts*, and the accompanying annoyances of sulphureous smell, smoke, soot, &c. This evil so much complained of, but hitherto so imperfectly remedied, is particularly found to prevail where two or more chimneys are connected with one apartment, or, more frequently, where two or more apartments, each having a chimney, communicate with each other. In such cases, the air withdrawn by a fire burning in one chimney, instead of being replaced by fresh air from the staircase or interior passages of the building, is more readily supplied by the nearest chimney shaft, in which the specific gravity of the air is greater than the warmed air of the apartment, and thus *downward draught* is produced. In the vast majority of cases, this can alone be prevented by effectually closing the chimney through which the air is found to descend; but, owing to the extreme subtlety of atmospheric air, it has ever been a matter of difficulty to contrive a chimney door (though many expensive plans have been tried) combining the requisite accuracy of construction, with durability and perfect freedom of working, after exposure to smoke, soot, damp, &c. These desiderata, however, the Hermetic Chimney Valve will be found fully to afford, at a moderate expense; and being constructed without hinges or fastenings of any description, it cannot possibly become corroded or unsound—may be readily cleansed from any deposit of soot—is capable of application to any chimney, without alteration or removal of the stove in use; and, as regards durability, is confidently stated to be indestructible. By the use of the Hermetic Chimney Valve, the advantage of an open chimney will be combined with the facility of effectually closing the flue at pleasure, in cases where a downward current of cold air is found to prevail; and this invention cannot fail to increase the domestic comfort of those houses where these annoyances at present exist, which, while they are unpleasant to all, are peculiarly prejudicial to the valetudinarian and the invalid.





Description of the Drawings.—(A A) are two semi-circular pieces of cast iron, the angular edge (B) of the one being ground and fitted air-tight into the groove (C) on the edge of the other, and the two pieces when together form a circular valve, the circumference of which (D D) is ground into the groove (E) in the plate (F).

The position of the whole, when together, is shown in the prespective view (G.) The plate (F) is intended to be so fixed horizontally into the brickwork of a chimney, that the circular hole therein shall be the only aperture for the escape of the smoke, and the valve (A A) is intended to close up the opening in an air-tight manner when the chimney is out of use: the valve being in two pieces, may be readily removed from the chimney by the handles or knobs (H H) through the opening in the plate (F) when required, for the purpose of sweeping the chimney, or lighting a fire.

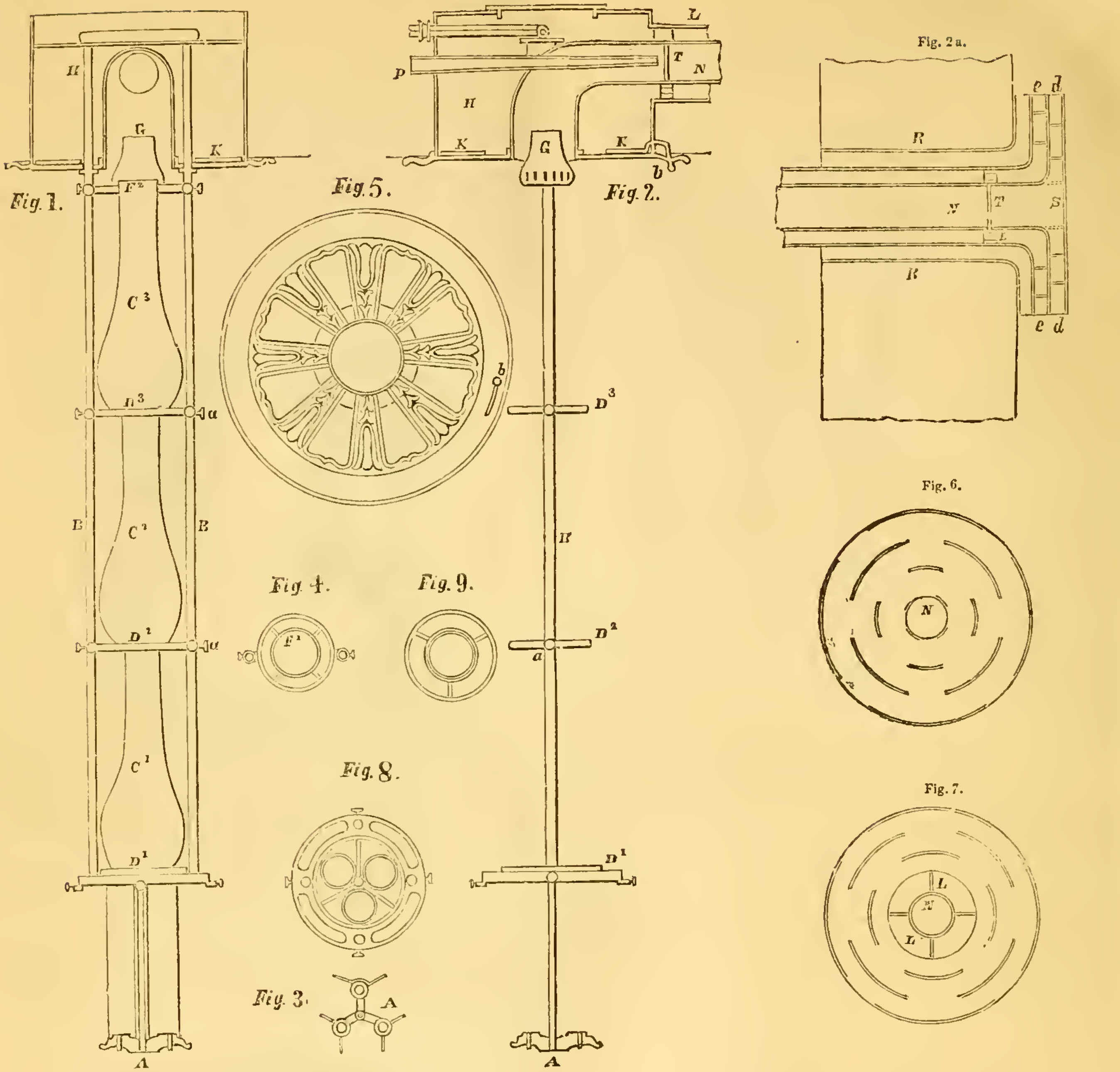


JONES'S PENDANT GAS LAMP.

Registered under the Act for the Protection of Articles of Utility. James Jones, of Bow Street, Gas Engineer, Proprietor.

(Communicated by the Inventor.)

This mode of burning gas, to which the inventor directs attention, is the subject of a registration, and presents a system of discharging the deleterious gases, in many respects superior to all ventilated gas lights which have preceded it. It is peculiarly adapted for consuming gas highly carbonized by Mr. Lowe's patent process of napthaliz-



ing, owing to its being raised to a high temperature previously to combustion at the burner. It is intended to use in conjunction with this light the earthenware pipe and conical glasses patented by Mr. Grant, for the purpose of causing a more rapid discharge of the vitiated air, and also to diminish the quantity of radiated heat attendant upon the use of metallic pipes. It will be observed from the accompanying diagrams, that not only are the products of combustion completely discharged, but the apartment in which the light is fixed is thoroughly ventilated and kept at any degree of temperature at pleasure. Back draught is avoided by the construction of the external wind-guards, thus insuring an atmosphere at once healthy and under perfect control. It may be as well to state that this mode of lighting is equally applicable to a public building or a private apartment, any quantity of light being obtainable from one focal point.

DESCRIPTION.

Fig. 1 is a front elevation, and fig. 2 a side elevation of this lamp and its appendages. A is a compound burner consisting of three burners on the Argand principle, arranged in one plane, so as to produce one strong column of light, as shown in the separate plan of this part of the apparatus given in fig 3. B B are two tubes, which conduct the gas from the supply-pipe downwards to the jets of the burner.

C^1 C^2 C^3 are three bulb-shaped glass chimneys rising one above the other, and resting just below their greatest diameters, on rings D^1 D^2 D^3, which are connected to the supply pipe, E E, which are pendant from the roof, and common to all three. A plan of the lowest ring, D^1, is given in fig. 8. The top of each of the two lower chimneys, C^1 C , rises a little way within the chimney immediately above it; the height to which each is so raised being adjustable at pleasure by means of the thumb-screws *a a*. Within each of the rings, D^2 and D^3, there is an inner ring, F^1, fig. 4, which encircles and serves to keep steady the tops of the chimneys, C^1 and C^2. The top of the chimney C^3 is also encircled and steadied by a similar ring, F^2, which is attached by radial arms to the funnel G.

H is a ventilating head, or cap, which is inserted between the ceiling of the room in which the lamp is hung and the floor of the apartment above. It has openings on the under side which correspond with similar openings in the fly-plate K. The ornamental face plate is represented in fig. 5. K is the fly-plate, by turning which round, by means of the knob *b*, the different apertures are opened or closed, and either wholly or partially, at pleasure. L is a pipe, which is carried from the head H in a lateral direction through the wall M, to the external atmosphere.

The metal funnel G, opens into a pipe N, which, passing up the centre of the head H, turns off at a right angle, and terminates in the windguard, (fig. 2*a*) on the outside of the building.

While the more immediate products of combustion pass away through the chimneys C, funnel G, and pipe N, the heated and vitiated air of the apartment escapes through the openings in the ventilating head H, along the pipe L, to the windguard S.

P is a small conical draught-pipe, which is carried from the outside of the building through the ventilating head H, into the funnel-pipe N, terminating just beyond the right angular bend of the latter. The cold air rushing through this pipe serves to impart a great increase of velocity to the column of heated air and vapours escaping through the tube.

R is an opening for the escape into the atmosphere of any heated air which may accumulate between the ceiling and floor.

T is a ring by which both the outer and inner pipes are joined; an edge view of it is given in fig. 9.

S (fig. 2*a*) is an external cover or windguard, affixed to the mouth of the pipe L, by which any back draught is prevented. A section of this windguard on the line *d d*, is given separately in fig. 5, and a section of it on the line *e e*, in fig. 7.

REGISTER OF NEW PATENTS.

(Under this head we propose giving abstracts of the specifications of all the most important patents as they are enrolled. If any additional information be required as to any patent, the same may be obtained by applying to Mr. LAXTON at the Office of this JOURNAL.)

VENTILATION BY GAS LIGHTS.

Donald Grant, of Greenwich, Esq., for "*Improvements applicable to the ventilation of apartments in which gas and other combustible matters are consumed by ignition.*"—Granted April 18; Enrolled October 18, 1844.

The improvements consist of a mode of constructing and arranging certain apparatus in connexion with gas or other burners, whereby the products of combustion may be carried off, and the apartments in which such burners are situate effectually ventilated; the temperature of the apartment may also by means of these improvements be maintained uniform or nearly so, as the heated and foul air which rises to the upper part of the room will be carried off by means of my improved apparatus, which will be found more particularly useful and advantageous when burners which give out considerable heat and a large body of flame are used, as is the case with most centre lights constructed on the Boccius or Bude principle, in which metallic tubes are employed to carry off the products of combustion. It has been found that the gases and other products arising from the combustion of carburetted hydrogen gas injuriously act upon and destroy these metallic tubes even when they are made of copper. Metal is also so good a conductor of heat that tubes made of this material are liable to get overheated, and would ignite any inflammable substance that might be contiguous thereto. The object of the present invention is, as far as possible, to obviate these difficulties, and to effect this object the inventor proposes to employ pipes made of earthenware or stoneware to conduct the products of combustion away from the burners. This material is not only a bad conductor of heat, but it may be heated to a very high temperature without danger; moreover, it is not liable to oxydation, or to be otherwise injuriously acted upon by the carbonic acid or other gases arising from the flame. The patentee employs either the Bude light, the Boccius light, or any other in which there is a large body of flame and consequently great heat, and suspends it from the ceiling in the ordinary manner.

The upper end of the ordinary glass chimney is inserted a short distance, about half an inch rather more than less, into the lower end of the lowermost conical chimney, and the upper end of this latter is inserted in the lower end of the next and so on, the upper end of the uppermost conical chimney being inserted into the opening in the earthen or stoneware tube in the ceiling. By this means the products of combustion are effectually prevented from escaping into the room, and a constant draught of the heated and foul air is kept up into the interior parts of the chimnies at all the junctions and also through a ventilator in the ceiling into a chamber surrounding the pipe. The products of combustion are, as before stated, carried up into the earthen elbow tube, from whence they pass along the long straight tube made of similar materials, and constructed in lengths of about two feet. These lengths are securely luted together with any suitable cement, so as to form a continuous length of tube. A metal ventilating plate surrounds the aperture into which the upper end of the uppermost conical glass chimney is inserted. This ventilating plate is furnished with holes or apertures whereby the hot and foul air from the apartment is admitted into the space between the metal tube and earthen tube, and allowed to pass along this annular space until it ultimately escapes either into a flue or into the external atmosphere by means of the aperture. The products of combustion being conducted along the earthen tube do not become mixed with the heated air from the apartment until both are upon the point of escaping into the atmosphere through the aperture. In order further to insure against any of the parts becoming overheated by the heat arising from the flame of the burner a cold air pipe, communicating with the external atmosphere, is made to convey a stream of cold air and cause it to impinge against the outer surface of the metal jacket, and this current of cold air being allowed to play freely all round the whole extent of the external surface of the metal tube will carry off the superabundant heat therefrom and keep the tube moderately cool.

As the heat given off from a burner of magnitude is very considerable, the patentee proposes to utilize this heat for the purpose of warming an adjoining apartment. One plan of effecting this object is instead of carrying off the products of combustion directly, as in the former case, he conducts them upwards through the flooring of the room above into an earthen or other vessel, chamber, or stove, where they radiate their heat and then pass down another earthen pipe into the horizontal pipe, and finally escape into the atmosphere.

A reference to the engravings in the present Journal, page 420, of a pendant gas lamp, registered by Mr. Jones, who has adopted Mr. Grant's invention, will, together with the above abstract, explain the nature of this patent.

RAILWAY IMPROVEMENTS.

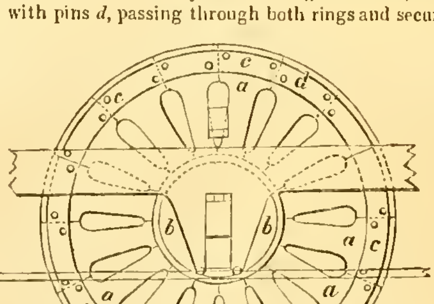
John Melville, of Upper Harley-street, Middlesex, Esq., for "*Improvements in the construction and mode of working railways.*"—Granted April 30; Enrolled October 30, 1844.

The improvements are in the form and construction of the rails upon which the carriages run, and also in arrangements for increasing the adhesion of the driving wheels of the engines to the rails; for guiding and retaining the trains upon the rails, and for retarding and bringing them to rest, and the prevention of accidents at the passage of the curves; likewise for diminishing the effects of concussion and vibration, and for preventing the loss of water attendant upon the ordinary method of connecting the water tank with the feed pumps. The specification contains eight claims.

The first is for an improved form of rails on which the carriages run. They are formed of timber; the upper surface is flat, with a plate of iron for the wheels to run upon, the plate is slightly inclined at the curves so that the inner edge is rather lower than the outer one. The wheels of the carriage are formed without flanges, but the carriage is guided and retained on the rails by means of two horizontal wheels connected to the frame of the carriage and running in a groove formed midway between the rails by means of two wooden rails. At the curves it is necessary to fix an iron plate for the guide wheels to run along in the inner side of the outer central rail.

The second claim is for a tramway consisting of wooden sleepers with a portion of the inner side cut away at the upper edge to receive an iron tram plate.

The third claim is for increasing the adhesion of the driving wheels; the wheels are formed of segments of wood *a*, inserted in a cast iron boss or nave *b*, with the grain of the wood standing in a radiating direction and braced together near the circumference by two flat rings of iron *c*, one on each side of the wheel, with pins *d*, passing through both rings and secured by screwed



nuts or by rivetting. To promote the adhesion the peripheries of the wheels are scored with minute oblique or transverse grooves, or are indented with numerous small holes, and filled in with a composition of sand or similar substances mixed with glue or other adhesive matter; the inventor has found marine glue to answer this purpose well.

The fourth claim is for diminishing the effects of vibration and concussion, which the patentee proposes to accomplish in the following manner—buffers are fixed at one end of the carriage, they act principally by the elasticity of air. A number of strong hollow spheres of caoutchouc filled with compressed air are placed in a cylinder attached to the frame of the carriage, and the cylinder is closed by a piston attached to the spindle of the buffer, which moves in a guide fixed across the mouth of the cylinder; when any pressure is thrown upon the buffer the spheres, from the elasticity of the air inclosed within them, as also in some degree from the elasticity of the material of which they are composed, yield to the force and become compressed, thereby allowing the piston to advance further into the cylinder, and on the pressure being relaxed the buffer is again forced outward by the expansion of the air. The springs for supporting one end of the carriage are upon the same principle of construction, they consist of a cylinder open at bottom and fixed between the axle guides, within this cylinder is placed a hollow sphere of caoutchouc filled with compressed air, and upon the top of the axle box is fixed a plug or piston which enters the cylinder and forms the support upon which the sphere rests.

The buffer springs at the opposite end of the carriage are upon a different principle, and are constructed with a flat drum or barrel mounted in bearings attached to the carriage frame and containing within it a strong helical spring, one end of which is attached to the axis and the other end to the barrel; a chain is attached at one end to the barrel and at the other end to one arm of a lever which turns upon a fulcrum fixed to the back of the carriage frame, the other arm of the lever is forked and works upon the spindle of the buffer between two collars or ruffs. The supporting springs at this end of the carriage are upon the same principle but somewhat differently applied, they consist of two spring barrels, the axes of which are supported by the axle guide; a chain attached to the two barrels passes over the axle box and thus supports the carriage.

The fifth claim is for stopping and retarding the carriages by an improved break. It consists of a block of wood saturated with water placed in an iron case which is open at the bottom, the block being retained in the case by pins. The case is moveable in strong iron guides attached to the frame of the carriage, and is connected by a link to one end of a lever, the other end of which is connected to a screw, whereby the block can be raised off the rail or pressed down upon it with great force. A supply of blocks are to be kept constantly in a vessel of water at the stations for the purpose of replacing them when they become too dry.

The sixth claim is for preventing the engines running off the rails when going round curves at a great velocity. Two horizontal wheels are attached to the fore part of the engine and within the rails, so that the deviation of the engine to either side causes the horizontal wheel on that side to come in contact with the inside of the rail, these wheels are attached to vertical spindles with levers for raising and lowering them.

The seventh claim is for preventing accidents from the engine or carriages getting off the rails at curves. It consists in placing a preventer tram plate between the rails and nearly close to the inner rail, leaving a little more space between them than is required for the flanches of the wheels in the cases where the wheels have flanches.

The eighth claim is for preventing the loss of water; in lieu of the flexible hose commonly used to connect the tank with the feed pumps an arrangement of metallic pipes is employed, capable of motion in all directions.

SEASONING WOOD.

ROBT. DAVISON, C. E., of Brick Lane, Spitalfields, and WILLIAM SYMINGTON, C. E., of East Smithfield, for "*A method or methods of drying, seasoning, and hardening wood and other articles; parts of which are also applicable to the desiccation of vegetable substances generally.*"—Granted April 28; Enrolled September 28, 1844.

The first or principal part of the invention consists in drying, seasoning and hardening wood and other articles, among which other articles are included generally all things made of wood or chiefly of wood, such as ships, barges, punts, tanks, &c. by means of rapid currents of heated air. The manner in which these rapid currents of heated air are produced is by an apparatus consisting of a furnace and a series of pipes withinside of a case of brickwork. On each side of the furnace, on a level with the fire bars, is a horizontal tube, communicating with and springing from these tubes are a series of 18 tubes, placed vertically and parallel to each other over the furnace. The outer end of one of the horizontal tubes communicates with a fan, or other impelling apparatus, for driving a constant stream of atmospheric air through the tubes; as the air passes through the tubes it becomes heated at a high temperature and rushes out at the farther end of the other horizontal tube, and is then conveyed to the place where it is to be applied.

The articles to be subjected to the heated currents may be of two sorts; either such as can be heated by external application as logs, deals, and portable wooden articles of all sorts, or such as must have the heated currents applied interiorly, as ships, tanks, &c. In the case of the former class of articles, they must be placed in closed chambers, galleries, vaults, or flues. These chambers and other places may be of any suitable form or magnitude, but it is recommended that they should be built of fire brick, and have double doors or shutters for introducing or removing the wood. Flues or channels for the heated air may be constructed in parallel lines either in the floors or in the upright walls of a building, having narrow openings through which the heated air may issue in thin streams and spread itself over the surface of the wood. If the opening are in the floor the wood will require to be placed in an upright position, but if admitted in a horizontal direction, standards and skeleton shelves will be necessary to lay it upon. The great object in all cases is to bring the heated air as speedily as possible into contact with the wood, and to allow it, after it has done its office to pass away as speedily. Furnaces and apparatus for the production of rapid currents of heated air may be erected to prepare any quantity of timber or articles in wood at one time, but care should be taken that whatever the size of the outlet may be from the series of pipes or vessels by which the heat is generated, an outlet of at least equal dimensions is left for the free exit of the air and vapours thrown off. It should also be observed, in constructing the open spaces in the floor or upright walls for the stream of heated air to pass towards the timber, that the superficial area of the whole of them combined does not exceed the outlet of the principal outlet of the pipes at the extremity of the furnace so that a free current of heated air may be allowed to pass uniformly throughout the chambers containing the wood to be prepared. With respect to the second class of articles, namely those which must have the heated air applied to them internally, as ships, barges, &c., they must, before introducing the hot currents of air, be covered in from the external atmosphere and made as air tight as may be conveniently practicable, except at the inlet provided for the admission of the hot air, and the outlet for the escape of the hot air and vapours.

The temperature proper to be given to the air and velocity to the current in each case will depend on the size, density, and maturity of the wood to be acted upon. The inventors find by their experiments that wood generally may be advantageously subjected to currents of air raised to a temperature of from 400° to 500° F. when the currents are impelled at the rate of 100 feet per second. But when the wood is in a green state it is better to commence at a lower temperature, say from 150° to 200°, and gradually raise it to the high degrees before stated as the dessication proceeds, an object which may in some cases be facilitated by carrying a cold air drain from the fanner or other propelling apparatus and attaching a damper to it, so that any quantity of cold air required to reduce the temperature of the hot current may from time to time be admitted. When, again, the wood is in the log or unconverted state it should be bored or augered out in the centre, and the current of hot air caused to traverse it as well interiorly as exteriorly, whereby much time will be saved in the process of dessication and a more uniform result obtained. Woods treated in this manner and with the above modifications when requisite, part rapidly with their natural sap, and any other aqueous matter which they may contain, and the fibres are brought closer together, acquiring thus more rigidity and strength.

With respect to the time required to season the wood upon this plan, much must depend upon the original state of dryness it may be in, as well as the quality and temperature of the heated air forced into contact with it, and it may suffice to remark that the wood may safely remain thus exposed till any escape of moisture ceases to be perceptible. This may be readily known either by applying a mirror or any other polished surface to the outlet, or by calculating the quantity of moisture removed from the wood, which will be found to range between ¼ and $\frac{1}{16}$ of its whole weight. For the purpose of ascertaining more correctly the amount of moisture removed from time to time, where the articles are placed in seasoning chambers as before described, an opening should be constructed in the chamber in any convenient position through which a specimen of the wood may be withdrawn and weighed.

The second part of the invention consists in purifying wood and other articles, as well as drying, seasoning, and hardening them, by subjecting them to the combined action of steam and of rapid currents of heated air; and the manner of doing so is exemplified in the following description of the mode of treating wood which is intended to be made into casks for containing articles such as beer, beef, butter, &c. which would be injured by any emanation of colouring, odours, or noxious matters from the wood. It is now a frequent practise to steep such wood, when made into staves, in cold water for a long period before making them up, the water being renewed from time to time as it becomes discoloured and foul. Instead of this the patentees place the staves, or pieces of wood of a scantling suitable for conversion into staves, in a close chamber piled edgeways, either vertically or horizontally, so as to leave a space of about an inch between every two pieces or ranges of pieces, and then charge the chamber with steam conveyed into it from a boiler, which is placed over the heating pipes. As the steam becomes condensed it is allowed to run off from the bottom of the chamber, and a rapid current of heated air is then forced through the chamber by the means before explained. After this the steam is once more let on and as it becomes condensed a rapid current of heated air is a second time passed through. And this alternate process of steaming and rapid air heating is continued until the water of condensation comes off colourless or nearly so; the rapid current of heated air which is last introduced being kept up for a considerably longer time than in any of the preceding instances.

The purification of wood and other articles of wood by this combination of the action of steam and rapid air heating, is effected in much less time and much more effectually than by any other method known to the patentees as being heretofore in use.

The claim is for the employment, as hereinbefore described, of rapid currents of heated air to effect the drying, seasoning, and hardening of wood and other articles, and the application, as hereinbefore exemplified, to the desiccation of vegetable substances generally of so much of our invention as is applicable thereto.

SLATE COVERING.

Thomas Martin, of Withybush, Haverfordwest, Pembroke, for "*certain Improvements in the construction of slated roofs or floors, tanks or cisterns or reservoirs for water, and in pipes, tubes or channels of the same materials for the conveyance of water.*"—Granted May 22; Enrolled Nov. 22, 1844.

This invention consists firstly in the construction of roofs, flats or floors, by combining squares or slabs of slate together, and attaching them to the boards or rafters in such a manner that the contraction of the timber will have no effect in disturbing the joints or junctions of the slate; and secondly in combining slabs, and other forms of slate hereafter described, for the purpose of holding water and other fluids, and also for conducting the same from one place to another. The first claim consists of three methods of combining slabs or squares of slate together, by which means the contraction of the planks and rafters of a roof or floor is prevented from affecting the slate covering. The first method is by fastening on to the boarded roof square slabs or blocks of slate from ½ inch to ¾ inch thick. In the centre of these blocks a pin or trannel is cemented which projects out from the under side of the block, for the purpose of being inserted in a hole in the boards of the roof, this hole is of a rather larger diameter than the pin to allow of the contraction and expansion of the wood. A series of squares of slate cemented together are then so placed on the boarded roof (after the blocks are inserted in the boards) that one corner of the four adjoining slates comes immediately over the block of slate, and are there attached by pins or trannels which enter holes made about two-thirds of the way through the thickness of the block to receive them. The holes which pass from the upper to the under square of slate must be larger in diameter than the pins or trannels by a ¼ or ⅜ of an inch, and previously to placing the squares of slate upon the boarded roof these holes must be luted; the pins or trannels are likewise luted, and when inserted into the holes a cement or composition in a fluid state is poured down the holes, and uniting with the composition at the joints of the squares a perfect and indestructible mass is formed. Blocks and squares of slate arranged and cemented together as above described may be applied directly to the rafters of roofs, without using boards, and likewise to the joists and framing of flats or floors. By the second method a roof is constructed of rows of square slates cemented together, with each row lapping over that which is below it, and the junctions of the slates arranged so as to break joint. The rows of slate are united together by pins or trannels passing through the laps of the slates into holes in the boards of the roof, as before explained. By the third modification longitudinal slabs of slate are laid with square blocks attached thereto by pin or trannels and cement. These slabs are affixed to the roofs by the pins or trannels which pass through the square blocks of slate and the slabs and enter the wood as above explained.

The second claim relates to the construction of tanks and reservoirs for holding water, and pipes or channels for conveying the same, in the following manner. A number of square slabs of slate (cut to any required size) are connected together at their edges as before mentioned, and upon them are cemented other slabs of slate in such a manner as to break joint; four such combinations of slate being made form the sides of the reservoir or cistern, and a similar one is to form the bottom. Around the bottom of the tank or cistern are grooves in which the sides are cemented. To the vertical edges of the sides upright grooved pieces of slate are affixed by trannels and cement, and the other sides of the tank are secured thereto in like manner. Leaden rivets are passed through the bottom at the outside of the grooves to prevent the lamina from splitting. Continuous lines of trough, the sides of which form an obtuse angle to each other, are constructed on the same principle as the tank.

The third claim is for the construction of pipes, tubes, or channels for conducting water from one place to another, in the following manner. Any suitable number of blocks of slate are hollowed into a semi-cylindrical form, and two of them are first joined together by means of cement and pins or trannels which run through both blocks. In the ends of the pipe thus formed a circular hollow is made and has an opening to the outside of the pipe, with vertical holes leading down to horizontal holes which are made to receive half the length of an iron rod or wire. Another couple of blocks being similarly prepared and joined together as above mentioned are ready to be connected to the former couple; this is effected by inserting the iron rods or wires into corresponding holes, and by pushing one part until it up comes flush with the other, by which means the junction is effected; a fluid cement is than poured into the opening, and flowing round the circle the joint is made air tight and impervious to the escape of water. Into the pin holes melted lead is poured, which flowing into the holes firmly secures the pins in their place, and thus connects the pipes firmly together.

The composition which the patentee prefers for uniting the sections of slate employed for all the above described purposes, consists of equal portions of carbonized coal tar and resin, and a ninth part of linseed oil melted and mixed together.

LIGHTING MINES BY GAS.

James Murray, of the Garnkirk Coal Company, Cadder, Lanarkshire, Scotland, for "*a new method of using and applying artificial gas made from coal, oil, or other substances, for lighting and ventilating caverns, pits or mines, or other pits where minerals or metals are worked or extracted.*—Granted April 10; Enrolled Oct. 10, 1844.

The patentee has two claims—firstly, for lighting; and, secondly, for ventilating pits, mines, &c, where minerals or metals are worked, by means of artificial gas. The first claim the patentee proposes to accomplish as follows:—The gas may be made above ground, from coal, oil, or other substances from which gas can be produced, and conveyed through pipes into the mines and into the different workings; or it may be made below ground, and conveyed through pipes as aforesaid, along the workings at convenient distances; jets or burners may be used for burning the gas which may be uncovered should the state of the mines or workings admit of this being done with safety, otherwise the flame may be covered in the manner in which lamps or lights in mines have heretofore been covered, or in any other suitable manner.

The second claim is for ventilating. The patentee states that the gas burning as above stated, will also have the effect, in whole or in part, of ventilating the mines, by gradually consuming fire-damp, foul air, or other noxious vapours. A current of air will also be created, by which the fire-damp, foul air, or other noxious vapours will be carried off, either in whole or in part, and replaced by a supply of pure air from the mouth of the mine, or from any other communication of the mine, with the pure atmosphere. By this mode of ventilating, the accumulation in large quantities of fire-damp, or other noxious vapours, will be either in whole or in part prevented, and the workers will be secure, or at least more so than at present, from the fatal or injurious effects of these noxious vapours, by instantaneous explosion or suffocation, or the fatal or injurious effects produced from inhaling such vapours.

SURFACE FOR PAINTING.

Elijah Galloway, of Nelson-square, Blackfriars-road, in the county of Surrey, for "*certain combinations of materials, to be used as a substitute for canvass and other surfaces employed as grounds for painting; some of which combinations are applicable to other purposes.*—[Granted Feb. 14; enrolled Aug. 14, 1844, *reported in the London Journal.*]

This invention consists in the application of certain mixtures or compositions to canvass or other woven materials, to be used as grounds for painting, and to the surfaces of walls, &c., as hereafter described.

The mixtures consist of India-rubber, combined with earthy, woody, or fibrous matter, and any insoluble substance capable of being reduced to fragments not coarser than sand or sawdust, and, in some instances, to a fine powder. The India-rubber is prepared by a well-known process (fully described in the specifications of other patents,) of grinding or crushing, in a vessel heated by steam, so as to bring it to a plastic or pasty state; the pulverized matters are then mixed with it, by a process resembling kneading or rolling, and the mass is reduced to a uniform thickness, by being passed between cast-iron rollers.

The mixtures, prepared in this manner, are to be attached to some other body, by India-rubber cement or other adhesive material; that is to say if intended to remain fixed, like cartoons or other decorations of walls, they are to be cemented to the walls, ceilings, floors, or other surfaces; but if they are to be moveable, like a painting, they are cemented to canvass, network, or other coarse fibrous fabric. For large paintings, the particles of pulverized matter may be of the coarser kind above mentioned; but for small works, chalk, dried clay, or similar materials, capable of being reduced to fine powder, are employed. When the mixtures are used for covering floors, and are to have ornamental designs painted upon them, finely-powdered cork is mixed with the plastic India-rubber. In cases where they are employed out-of-doors, and exposed to moisture, mouldiness is prevented by the addition, to each hundred pounds of India-rubber, of half an ounce of corrosive sublimate, or other metallic salt which will resist vegetable decomposition.

These mixtures are also intended to be used in ship-building instead of felt, between the copper and planking of the ship; being made in thin sheets, which are cemented in their places, and then coated on the outside with cement, and before this becomes dry, the copper is fixed on in the usual manner. They are also made into blocks or masses of suitable forms, and applied to the purpose of filling the spaces between the timbers or planking of ships; being cemented to the wood, and to each other, so that the whole becomes impervious to water. For boat-building, the mixtures are formed into sheets, planks, or slabs, and used with or without timber courses.

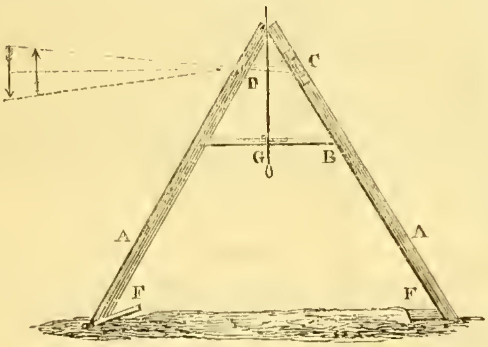
A substitute for floor-cloth is formed, by rolling the material into large thin sheets, the sides of which are cut parallel, and bevilled off to thin edges; these edges are rubbed over with India-rubber cement, and united by causing them to overlap, and then pressing them carefully together; when the cement is dry, the side that is not intended to be printed upon is coated with cement, and a piece of canvass, cloth, or other woven fabrics applied thereto; the substitute for floor-cloth, thus made, is now ready to be printed on.

For covering roofs, walls, or other surfaces, where it is required to exclude rain and moisture, the material is rolled into sheets, which are cemented to the surfaces to be covered, and to each other.

For paving or covering floors or roadways, the sheets or slabs are cemented to the "subsurface," and to each other.

The patentee says, in conclusion,—"I hereby declare that I lay no claim to the invention of any of the mixtures herein referred to, nor to the method of preparing them; such mixtures, and the processes of preparation, being already well known. But what I claim, as my invention, is, their application to the purposes herein described, in the manner I have pointed out; more particularly the cementing the said mixtures to some other body, and to each other, according to the respective purposes to which they are to be applied."

MR. DENTON'S "A" LEVEL.



The annexed woodcut shows the instrument —its figure will explain the reason of its being called the "A Level;" while the observer will comprehend at a glance its portability and the facility with which it may be used either on the surface or in the trench. The bar B turning up on a hinge and falling into grooves cut in the legs A, these legs may be closed, as a pair of compasses fold; and the whole may be used as a rod for measurement. The legs A are sufficiently narrow to stand in the narrowest trench; while the false feet F afford the means of stationing the instrument on the surface.

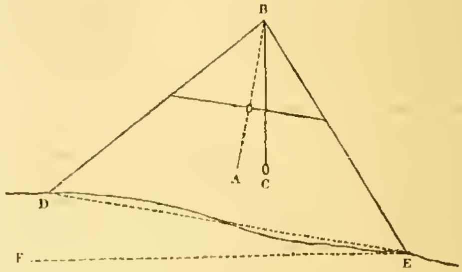
The object of the instrument is to assist foremen and workmen in testing and preserving an uniform fall in all works requiring such regularity. A spirit level, if understood by workmen, is a thing easily put out of order, and is at all times liable to be broken; its use, therefore, is dreaded by workmen, as a process involving too much time, care, and precision, for their fingers to perform.

In draining and sewering, if the first object of the operator is to direct his drains according to the best fall of the ground, the next point of importance is that the floor of the trench, and the course of the tiles, soles, or bricks should be even and regular from the top to the bottom of the drain. Any hollow in the drain intercepts the sedimentary matter which the flow of the drain water would otherwise carry out with it; the sectional area of the water-way is thereby lessened, and the sediment, gradually accumulating, after a time causes a stoppage, the drain bursts, and the work has to be re-done.

The level placed in the trench, as it is dug preparatory to laying in the tiles, indicates by the plumb-line any irregularity bad work may occasion. Such use of the instrument is merely analogous to the mode by which the carpenter applies his square and plummet. It is my wish to prove that the extended principle upon which the A level is based is so sound, that if accurately constructed, the instrument cannot work otherwise than with perfect efficiency, *in determining the average fall of surface between any two spots within sight of each other.*

It should be observed, that the legs of the instrument being equal in length, form, with the base upon which they are placed, an isosceles triangle, and that, when that base is perfectly level the plumb-bob pendent from the apex must necessarily divide the triangle directly in half. This admitted, it is equally clear that by means of a bar connecting the two legs at any given distance, and exhibiting on its face the centre or half of the angle at the apex, any person is competent, guided by the plumb-line, to raise or depress one leg until it stands on a level with the other: the plumb-line will then hit the centre.

Now, as the plummet will always hang vertically, by reason of its weight, any rise or depression of either leg is immediately indicated on the connecting bar by the equivalent deviation of the plumb-line from the centre.

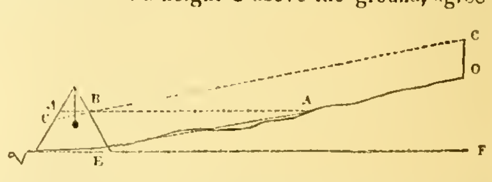


The angle A B C is equal to the angle D E F, *i. e.*, the angle made by the hypothenuse or surface with the horizontal line, is equal to the angle of the line dividing the triangle in half, with the vertical line.

Thus, the difference of height between D and E may be calculated by multiplying the natural sine of the angle D E F (read off on the bar as A B C, *if the index represents degrees*), by the length of the ground spanned between E and D. In the A Level, this is already done; and instead of degrees and minutes, inches and quarters are divided on the bar, so that the operator may at once read from it the difference of height between the two spots upon which the instrument stands, and *vice versâ.* If it is required to sink one leg an inch below the other, the ground is lowered until the plumb-line strikes the I-inch division of the index on the bar.

It will be seen, that at a certain distance from the apex, on each leg a line of sight is shown. On the one leg there is a sliding sight-hole answering to a fixed index, agreeing with that on the bar B; on the other leg, there are cross hairs fixed, the centre of which are exactly the same distance from the apex as the nonius of the index on the opposite leg. The line of sight therefore from these two points is ever parallel with the base of the instrument.

To arrive at the average fall of surface from the top to the bottom of a field, the instrument must be placed on a level by means of the plumb-line. The operator must then send forward his assistant-workman to the spot D, at which he intends to end his drain, with a stick marked by a paper fixed in it at a height C above the ground, agreeing with the height of the cross hairs B, above the base of the instrument. He then slides up or down the sight-hole until he fixes the cross hairs upon the paper in the stick.



This line of sight, C B C, is parallel with the general line of surface, E D (regardless of its sinuosities), and therefore forms, with horizontal line of sight A B A, an angle C B A, equal to the angle D E F, formed by the datum horizontal and the surface.

Now, as the opposite angles of lines crossing each other are equal, the angle A B C is equal to the angle C B A; and we have shown that the angle C B A is equal to the angle D E F; therefore A B C is equal to D E F, and consequently you are enabled to read from the index at C, the angle *converted into inches and quarters*, which is common to the whole distance from E to D. The height thus read off is transferred to the bar B, and retained by the shifting limb G (see the woodcut), to the edge of which the plummet is afterwards worked. This limb is used only to save memory, and assist the man who cannot read.

From the explanation given, I hope I have shown that, without any measurement of distance whatever, the average fall of surface is ar rived at without any chance of error, if the span of the instrument is always the same and the indices are accurately made (agreeing with that space) in the first instance.

J. Bailey Denton.

9, *Gray's Inn Square.*

MEMOIR OF THE LATE PETER NICHOLSON, ARCHITECT,

Born July 20, 1765. Died June 18, 1844.

Peter Nicholson was born in the parish of Prestonkirk, in the county of East Lothian, being the son of a stonemason. At the age of nine, young Nicholson was sent to school, where he remained three years under a master of the name of Richardson, brother to George Richardson, an architect, who published a work in English and French in 1787, on the Five Orders of Architecture. John Brown, the celebrated agriculturist, and John Rennie, the great engineer, were born within half a mile of the same locality, and attended Prestonkirk school; the former having just left, and the latter being on the point of doing so, when Nicholson entered the school. At the age of twelve he assisted his father, but took a disrelish for the business, and was bound for four years to a cabinet-maker at Linton, after which he went to Edinburgh, and worked for a short time as a cabinet-maker. He then left for London, being in his twenty-fourth year, working at his business, and teaching with success at an evening school in Berwick-street, Soho, which ultimately raised him above the necessity of following his trade as a journeyman, and afforded him leisure for his inventive faculties, which he employed in engraving with his own hand the plates for his first publication, "The Carpenter's New Guide," 1792, which contains an original method for the construction of groins and niches of complex forms, where curves of double curvature exist. This publication was followed by the "Student's Instructor," "The Joiner's Assistant," and "The principles of Architecture," in 1797.

Mr. Nicholson returned to Scotland in 1800, and stayed a few months at his native village, and thence went to Glasgow, where he practised as an architect until 1808. Among his works at Glasgow are a Wooden Bridge over the Clyde—Carlton Place—Additions to the College Buildings—and the Town of Ardrossan in Ayrshire, designed for the Earl of Eglinton. He next removed to Carlisle, where, through the recommendation of the celebrated Mr. Telford, he obtained the situation of architect to the county of Cumberland, and superintended the building of the New Court Houses. In 1810 he returned to London, where he again commenced the labours of authorship, and produced "The Architectural Dictionary," "Mechanical Exercises," and "The Builder and Workman's New Director," all relating to the art of building; also, "The Method of Increments," "Essays on the Combinatorial Analysis, "Essay on Involution and Evolution," "Analytical and Arithmetical Essays," and "The Rudiments of Algebra," pertaining to the science of analysis. For the "Essay on Involution," he was honoured with the thanks of the Academie des Sciences at Paris. During his stay at Carlisle he obtained rewards from the Society of Arts for an improvement in Hand-railing, and for the invention of an instrument named "the Centrolinear," and for its further improvement, the first in April, 1814, the Gold Isis Medal; the second in May, 1814, the sum of 20*l.*; and the third in 1815, the Silver Medal.

Mr. Nicholson visited France in 1826, and on his return had acquired a sufficient knowledge of the language to enable him to translate mathematical works. In 1827 he published a work called "The School of Architecture and Engineering," which was intended to be completed in twelve numbers, at 1*s.* 6*d.* each, but only five appeared, in consequence of the failure of the publishers. This is the only work commenced by him and left incomplete, and which was a great loss both to the author and the public: it contained an original method of describing an ellipse of great beauty and of easy simplicity, as regards the manner.

Mr. Nicholson, on account of his loss and the vexation arising out of this failure, left London in 1829, and went to live at Morpeth in Northumberland, where he had acquired a small property left him by a relative; here he remained until 1832, when he left for Newcastle-on-Tyne. During his stay at Morpeth, he produced a work on Dialing, which contains a new method of drawing a meridian line, and on the application of the formulæ derived from the trehedral to the angle of pyramids, the regular solids and roofs. This investigation led him to dispute a rule laid down by Dr. Lardner in book 2nd. of his "Elements of Euclid," viz. "that a solid figure will have as many edges as it has distinct pairs of faces," which Mr. Nicholson says is not true, and is only correct in the tetrahedron, but that a solid will have as many edges as it has distinct pairs of sides bounding its faces, and that the formula of Dr. Lardner is only adapted to find the number of combinations taken two and two of any given number of things. The application of trigonometry to find the length of the hip and common rafters from the angle of inclination of the eaves, is fully carried out in this work, and it is illustrated with useful tables of the lengths of the rafters requisite, by a variation of the angle of inclination of between 20° to 30° progressively for each intermediate degree.

When at Morpeth, his wife Jane, died Aug. 10, 1832, aged 48 years, and to whom he erected a neat memorial in the ground of the High Church.

On arriving at Newcastle he settled in Carliol-street, and opened a school in the Arcade, which he continued for three or four years, and at the same time laboured as an author. In 1835 he was elected President of a Society in connection with the Newcastle Mechanics' Institution, for the promotion of the Fine Arts, Architecture, and Civil Engineering; and on the establishment in October, 1836, of the North of England Society for the promotion of the Fine Arts, as a distinct society, under the sanction of the Philosophical Society of Newcastle, he was appointed its teacher. Almost immediately after his arrival at Newcastle, he was elected the first honorary member of the Mechanics' Institute, and a very fine bust of him was modelled by Robert Saddler Scott of Newcastle, and presented to the institution. The Literary and Philosophical Society also complimented him by electing him an honorary member. His pecuniary circumstances were to a certain extent improved by the liberality of the inhabitants of Newcastle. A public meeting was held Jan. 31, 1834, to enter into a general subscription to present him with an annuity, the eminent coal viewer, John Buddle, being in the chair. Thos. Sopwith, the geologist, was appointed secretary, and Rev. R. Green, treasurer. Somewhere about 320*l.* was collected, which was given to Mr. Nicholson, being insufficient for the intended purpose. Another attempt for his relief was made by a petition to the King to grant him a sum from the privy purse.

Mr. Nicholson left Newcastle Oct. 10, 1841, for Carlisle, after a residence of nine years, during which period he had produced "A Treatise on Projection and Isometrical Drawing," which contains a portrait of Mr. Nicholson, drawn from life, by Edward Train, the original picture being in pen and ink, and in the possession of Mr. John Glynn of Newcastle; also "The Guide to Railway Masonry, being a Treatise on the Oblique Arch," which appeared Jan. 1, 1839, and was the last of his works. Among his general contributions may be noticed those to Dr. Brewster's "Edinburgh Encyclopædia," also to "Rees' Encyclopædia," and to the publications of the Society for the Diffusion of Useful Knowledge. He contributed also several plates and illustrations to the work of his friend Mr. Sopwith, on the application of Isometrical drawing to Geology and Mining, especially those introduced for the use of mathematical students, and which is fully acknowledged in the preface.

After leaving Newcastle, Mr. Nicholson did not long survive but died at Carlisle, June 18, 1844, and was buried on the 25th in Christ's Church, Carlisle.

For nearly two years before his death he was very feeble, had difficulty in breathing, and was unable to write, although he retained his sight and hearing, and his perceptive faculties remained strong to the last. He was supported in his latter days by the liberality of Thomas Jamieson, Esq., of Newton, Northumberland, who was connected with him by marriage, Mr. Nicholson himself having married into the same family. Mr. Nicholson was twice married. By his first wife he had one son, Michael Angelo, who died in 1842, leaving a numerous family; he published in 1826 "The Carpenter and Joiner's Companion," illustrated with a portrait of his father, painted by Derby. By his second marriage Mr. Nicholson had a daughter, Jessie, who married Mr. Bowen, of Bridgewater, and has a family; also a son, named Jamieson T. Nicholson, who, through the kindness of Mr. Errington, is employed on the Lancaster and Carlisle Railway. To Mr. Jamieson Nicholson the writer of this memoir applied for information relative to the life of his father, but he stated that he had very few manuscript papers, and possessed no further information than was to be obtained in the Introduction and Prefaces to his different works. Before Mr. Nicholson left Newcastle the writer of this applied to him for a list of his works and obtained the titles of eighteen in his own handwriting, but he was unable to complete it. The writer has, however, endeavoured to supply the omissions in the list which is appended to this memoir. "The Builder and Workman's New Director" is prefaced by a memoir supposed to be written by his son-in-law, and it is also illustrated by a portrait by Heaphy, engraved by Armstrong. The "Mechanics' Magazine" vol. 4, 1825, is illustrated with an engraving from a portrait in the possession of Mr. Nicholson, but the artist is not named; Mr. Nicholson was at the period it was taken in the full vigour of manhood, and the contrast between it and the portrait by Train, prefixed to the "Treatise on Projection," is very great indeed. The "Mechanics' Magazine" of that date also republished the memoir from the "Builder and Workman's Director," which is the only one published respecting the life of Mr. Nicholson, and does not extend beyond 1825; it concludes with this tribute to the worth of Mr. N.—"The whole of his active and scientific labours has been directed towards applying science to useful purposes." At the meeting in Newcastle, before alluded to, Mr. Buddle said "Mr. Nicholson has devoted his life to those branches of science which are of the greatest practical use to society, and he has bestowed the fruits of his labour freely on the public, without having received anything like an adequate reward." At the same meeting other speakers alluded to Mr. Nicholson's character through life as being excellent and unexceptionable, and to the service which each had obtained in his own professional advancement from the works of that excellent author. The above notices entitle Mr. Nicholson to the character of a practical man, a scientific man, and a good man, qualities not uniformly to be found in individuals in general. But to return to the former memoir, which contains several anecdotes. One of these is related of the precocious talent and industry of Nicholson in his youth, and the difficulties which he had, on account of poverty, in obtaining proper books consonant with his own pursuits. Even before he went to school he showed a turn for drawing and modelling machines from the mills in his neighbourhood. On the north bank of a small river near his father's house was a small mill for dressing barley, and on the same river were saw, flour, and snuff mills. Young Nicholson was trying a model of a saw mill worked by wind in a lane near his house, the late Earl of Haddington passing at the time was nearly thrown from his horse, and pursued Nicholson; on finding out the cause of the fright the Earl gave Nicholson half a crown and took him to the hall. Whilst at school, Nicholson borrowed from an elder boy a copy of Commadine's Euclid, translated by Cann; the upper plate of diagrams of the 18th proposition of the 3rd book was wanting, he however constructed one from the demonstrations. Whilst in Edinburgh he went to Mr. Bell, a noted bookseller, and obtained Emerson's Fluxions on credit, which he paid for by instalments, and which is stated in the former memoir as an excess of liberality on the part of the bookseller to the pressing necessities of poor Nicholson. It also states that "Emerson's Fluxions," which is one of the most difficult works in that branch of analytical science, was soon followed up by other books, among which were "M'Larrin's Algebra," "Ward's Introduction to Mathematics," and "Salmon's London Art of Building."

Mr. Nicholson was the first author to write on hinges for doors, and to publish plans of roofs as executed, which he did in his "Joiner's Assistant," and was also the first who discovered that Grecian mouldings were the sections of a cone, and was the inventor of the application of orthographical projection to solids in general, which appeared in "Rees' Cyclopædia" and was previously unknown to English or continental writers, and also published in his "Carpenter's Guide" the plan of finding points in the periphery of an ellipse by the intersection of lines, and which plan was used in describing the arches of London Bridge. The generalization and discovery of orthographical projection I think the greatest work in the life of Nicholson; in the "School of Architecture" he says, he first attempted it in the year 1794, and that it was published in vol. 2 of "The Principles of Architecture," which also contained new general methods for drawing Gothic arches and the profiles of Grecian mouldings, and modes of describing the spirals of volutes to any number of revolutions, hitherto limited to three, as also to the projection of a parallelopipedon and a leaf of a capital of a column, and lastly, the entire doctrine of shadows geometrically delineated. He also observes, in the "School of Architecture," in reference to Projection, as published in the "Principles of Architecture" and in "Rees' Cyclopædia," that "This method will remain exclusively my own discovery until it can be shown to have existed prior to publication of, 1813." He also defines the subject, by saying it is the "orthographical projection of figures by means of traces or intersections of the several planes of the object, with the plane of projection, the dimensions and position of the traces to one another, and the position of one of them to the plane of projection being known." The adaptation of this science to really useful purposes is beautifully exemplified in the case of handrails for staircases, which are enabled to be manufactured with the least quantity of material by finding the section of a cylinder from three given points, whether these points are within or without the surface of the cylinder. In the "School of Architecture," in reference to the remarks of the editor of "Practical Carpentry, Joinery, and Cabinet-making, published by T. Kelley, stating that Nicholson derived his knowledge from foreign works, Mr. N. says, "I will defy this editor, or any other person, to prove that ever I derived any information from foreign works;" the remarks of the editor that called forth this declaration were "But there does not appear to have been much, if any, assistance derived from those foreign works by any writer prior to Nicholson;" the works alluded to were "Coupé des Pierres et des Bois," 1739, and "Géometrie Descriptive," by Gaspard Monge, 1795; and further, as a comparison with Monge and himself, as regards their two works, "they are as differently conceived as can be, each having its peculiar advantages and peculiar claim to originality in the problems and examples, which are by no means common to both;" and further, in reference to another work in French, in a small 12mo. volume, on the "Projection of Shadows," Mr. N. observes that he has forgotten the name of the author, and that most of his examples on the projection of shadows were before the public ere it fell into his hands. The editor of the work on carpentry previously mentioned, however, gives the credit to Mr. N. as being the introducer of the true principles of carpentry, and of making valuable additions and corrections to the labours of those who had preceded him. His words are—"The establishment of the principles of joinery in this country on the basis of geometrical science was, however, reserved for Nicholson." In the "Civil Engineer and Architect's Journal" for 1840, is a letter from Mr. Nicholson in reply to Mr. George Buck, on the oblique arch, where he says had not Mr. Buck been acquainted with his work on stone cutting, in all probability Mr. Buck's essay would not have had an existence. The letter is dated Newcastle, May 23, 1840, and is written under great excitement, and shows that Mr. N. was becoming enfeebled; I rather suspect it had to be written by a friend, as Nicholson was unable to do so. Mr. Buck wrote a letter in reply in the same Journal, and he also called in the aid of his assistant, Mr. W. H. Barlow, the son of the professor.

In conclusion, I must say that I think the testimony of Mr. Nicholson, C. E., Mr. Welch, C.E., Mr. Hogg, mason, and Mr. Ridley, mason, is sufficient to show that Mr. Nicholson was practically, as well as theoretically, conversant with the oblique arch. Mr. Fox, who wrote on the oblique arch, also commenced a paper war with Mr. Nicholson, who had for his defender Mr. Henry Welch, for which correspondence see the "Philosophical Magazine," March 1837. There is only another author on the oblique arch, Mr. Hart, who wrote in 1837, and his name is introduced for the information of those who have attended to this subject in particular.

The "Companion to the British Almanac," for 1839, in an article on the progress of the problem of Evolution, notices the claim of Mr. Nicholson to the discovery of the method now in use "of obtaining the rational roots, and approximating to the irrational roots of an equation of any order whatsoever;" and the writer affirms, that Mr. Nicholson is under an erroneous impression as to his being the first publisher of Mr. Horner's simplification, and that Mr. Holdred communicated his method to Mr. Nicholson, who stated, that he had suggested some improvements, which Mr. Holdred declined to publish, unless he were allowed to pass them as his own. The author of the paper in the "British Almanac," in a foot note, states:—"We do not know that this statement was ever answered;" and further, in another foot note, in reference to Mr. Nicholson's remarks on Mr. Horner's paper in his Essay on Evolution and Involution, viz.—"I perceive, however, that the paper contained the substance of what I had previously written and published." The second foot note in reference to the above statement of Mr. Nicholson asks—Where? where? where? and, in corroboration, says—we have searched the Combinatorial Essays without finding anything which more resembles Mr. Horner's process than would any other in which such a succession of processes occurs; and then giving an example, observes:—"Here we should be obliged to leave this claim, were it not for a more precise repetition of the statement, which occurs in 'A Practical System of Algebra,' by Peter Nicholson and J. Rowbotham, p. 196, with reference to Mr. Horner's rule, viz. 'The very same process was published in Mr. Nicholson's 'Increments' in the year 1817, and was derived from the doctrine of combinations; also p. 126 "contains an improvement upon the former, and is the same as that now used. The author did not then think of applying these rules to the finding the root of equations, though they were far superior to the method discovered three years afterwards by Messrs. Holdred and Horner in point of brevity, facility and perspicuity."

The author of the article in the "British Almanac," in another foot note, says:—"We have not explained the details of Mr. Nicholson's process; for it either is not the 'very same,' as that now used," —and in the body of the article in reference to the brevity of the method of Mr. Nicholson, observes:—"If, then, the writing down of two or three figures be avoided by a process which will involve a moment's thought; it *may* very easily happen that there is nothing gained by the omission," and further as to priority of discovery, "Mr. Nicholson had the means in his hand, but did not *then* think of applying them. Did he do so *afterwards?* His own words previously quoted, show that the "non-figurate method" was first revealed to him by Mr. Horner's paper," and finally dismisses the claim of Mr. Nicholson as unintelligible, and nothing more than a total mistake." But before the paper is concluded, and in reference not to priority of discovery, but to Mr. Nicholson's statement of the introduction of an improvement, as stated at p. 126 of his "Increments," the writer of the paper in the "British Almanac states," Mr. Nicholson has obtained what he stated to have been his object, viz. "the placing of corresponding processes in the same horizontal line; but further observes, "by sacrificing a much more important element of arithmetical accuracy. Numbers which are to be added together should always be written under one another; whereas in Mr. Nicholson's form, this is very frequently not the case. We think that the brevity of his method can profit no one but a very expert arithmetician indeed; that its facility is considerably below that of the form given by Mr. Horner; and that in point of perspicuity it is hardly as good. The introduction of the ciphers is a decided improvement;" and, further, in reference to parties claiming the merit of new discoveries regrets that they do not make themselves better acquainted with the previous history of the science to the improvement of which they lay claim, and says in reference to Mr. Horner, that had he done so, "it is more than probable that his honours would not have been claimed by others." The writer claims, therefore, the discovery in question for Mr. Horner. This subject of priority of discovery between Mr. Nicholson and Mr. Horner, is noticed in "The Monthly Review," vol. 93, 1820, "after explaining Mr. Horner's method of solving equations, we observed that Mr. Nicholson had also succeeded in attaining a method of approximation, which though in some degree less general, was still fundamentally the same;" and "that these two gentlemen by following writers altogether different, have arrived very nearly at the same time, at the same point of destination; and it is remarkable that it should be one which has been sought in vain for by all the most eminent algebraists of the last two centuries," and further, "that Mr. Nicholson did not claim the exclusive merit of the discovery, but only an improvement on the method communicated to him by Mr. Theophilus Holdred or Holdroid, and that they afterwards disagreed, which was the means of leaving Mr. Holdred far behind Mr. Horner in his claim to the discovery; but that from the works of Mr. Nicholson it is clear that Mr. Holdred was in possession of the method long before Mr. Horner; and that certainly Mr. Nicholson published his account of Mr. Holdred's method of approximation before Mr. Horner's paper appeared, although the paper was read before Mr. Nicholson's book had issued from the press. It also appears that Mr. Holdred was in possession of his approximation ten years before his acquaintance with Mr. Nicholson, and, until then, was unaware of the great task which he had accomplished."

Mr. Nicholson gave me a rule in 1835, which I think has never been published, for "A New Method of Extracting the Cube Root;" it is given in the Appendix.

When the writer of this memoir first made the acquaintance of Mr. Nicholson, his wife was then alive, and he lived in the back part of what had been the old prison of Morpeth, and which had been converted into dwellings under his superintendence, and there is an arched passage which is the covering of a frustrum of a cone, so that even in this humble dwelling he has left evidence of his handywork. The writer was then very young, and had been just bound apprentice to a carpenter, and was favoured by a loan from Mr. Nicholson of his work on "Perspective," and Turnbull's "Treatise on the Strength of Cast Iron." When Mr. Nicholson came to Newcastle, the writer became one of his pupils, and continued so as long as he kept his school in the Arcade. On going to London in search of employment, Mr. Nicholson furnished him with recommendations, and during his stay in London he received many kind letters from him. After returning to the North, which was a year before Mr. Nicholson left Newcastle, he had opportunities of returning the kindness of his venerable preceptor, and when Mr. Nicholson resided in Carlisle visited him a few months before he died, viz., on Feb. 18, 1844, when he found him bedridden by infirmity, with difficulty being able to breathe, and scarcely able to articulate, yet he knew the countenance and pronounced the name. At that time he was seldom out of bed and unable to write, and had no subsistence but from the liberality of his relative, Thos. Jamieson, Esq. Being at a distance from his relatives, they were precluded from attending him in his last moments, which were passed amidst strangers, who, however, gave him every attention. As to the want of pecuniary success of Mr. Nicholson's works, at the meeting held in Newcastle to get up a subscription, it was stated, he made engagements with designing men which tended much to his disadvantage, and that the profits were appropriated by the publishers, and that some of his works were of a description that did not sell readily; yet among this description of works the sale of them had exceeded the sale of all others, and became as it were, a test of the repute in which his talents were held. I have heard that forty thousand pounds were realized by the sale of his "Architectural Dictionary," and that he was engaged on account of it in Chancery for 31 years, and finally obtained a judgment in his behalf, which was, however, of no money advantage. This is his greatest work.

O. T.

Newcastle-on-Tyne.

APPENDIX.

List of Mr. Nicholson's Works.

1. The Carpenter's Guide, 1792, 1 vol. quarto. The Carpenter's New Guide, 7th edition, 1792, 84 plates, quarto, 21s. bound.
2. The Carpenter and Joiner's Assistant, 1 vol. quarto, 79 plates, 21s. boards, 4th edition, 1793.
3. The Principles of Architecture, 3 vols. 8vo., 1794 to 1797 and 1809.
4. The Student's Instructor, 8vo., 1 vol., 41 plates, 10s. 6*d*. 5th edition, 1823; Taylor, London, pp. 39.
5. Mechanical Exercises, 8vo., 1 vol., 18s., 1812, 39 plates; Taylor, London.
6. The Architectural Dictionary, 2 vols. large quarto, 1812 to 1819, Sept. 1st, 5*l*. 5s.
7. The Workman and Builder's Director, 1 vol. quarto.
8. Method of Increments, 1 vol. 8vo., 1817.
9. Essays on the Combinatorial Analysis, 1818; Longman & Co., pp. 200.
10. The Rudiments of Algebra, 1 vol. 12mo., July, 1819; 2nd 1824; 3rd 1837; 4th, 1839.
11. Essay on Involution and Evolution, 8vo., May, 1820; London, Davis and Dixon, pp. 92.
12. Treatise on Handrailing, 39 plates, 18s. 1820.
13. The Practical Builder, 1 vol. quarto.
14. The Carpenter and Joiner's Companion, 1 vol. 8vo.
15. A Treatise on the Rudiments of Perspective, 1 vol. 8vo., 38 plates, 14s. boards; J. Taylor, High Holborn.
16. The School of Architecture and Engineering, 1827, 5 Nos.; J. and C. Adlard, London, at 1s. 6*d*. each.
17. Treatise on Stone Cutting, 1 vol. 8vo., 1828.
18. Treatise on Dialling, 1 vol. 8vo., 9 plates, 4s., 1833; Blackwell and Co., Newcastle, pp. 58.
19. Treatise on Projection, 62 plates, 1 vol. 8vo., 16s., 1837; T. and J. Hodgson, Newcastle, pp. 136, 44 plates by Collard, engraver.
20. A Practical Treatise on the Oblique Arch, 1 vol. 8vo., 1839; Pattenson and Ross, Newcastle, pp. 50, 39 plates.
21. The Mechanics' Companion.
22. Course of Mathematics, published at the expense of Sir Richard Phillips, 1825.
23. The Builder and Workman's New Director, 1827; Lewis, Poultry, edition 1836.
24. The New Carpenter's Guide; Jones and Co., 1835.
25. Popular Course of Mathematics, 1822.
26. Mechanics' Companion, 8vo., 40 plates, 1824; Bartlett and Hinton.
27. Analytical and Arithmetical Essay, 1820.

Address to the King, 1835.

To the King's Most Excellent Majesty's,

We, the undersigned, your Majesty's loyal and dutiful subjects, being Fellows of the Royal Society, Civil Engineers, Architects, Builders, Mechanics and others, interested in the arts and sciences, beg leave to approach your Royal person with every expression of our attachment and respect. Emboldened by former instances of your Majesty's royal munificence in rewarding persons who have conferred benefits upon their country by their valuable literary productions and discoveries in science, and their inventions in the useful arts, we would humbly beg leave to recommend to your Majesty's notice an individual who in every of these respects has deserved the gratitude of his fellow-subjects, and we trust the approbation of your Majesty. The works of Peter Nicholson, while they have contributed to the advancement of knowledge, have tended to raise the English mechanic to that pre-eminence he has attained over the other artificers of Europe, and while they have been honoured with the proudest marks of distinction by the various learned societies of this kingdom, have yet failed to produce to their author those benefits which are necessary for his existence, and it must ever be a source of regret that an individual who, having devoted his best energies to the advancement of science, should be left, at the close of a long and laborious life, and in his 73rd year, to struggle in penury and want. Presuming that an individual who has conferred a national benefit might be entitled to national gratitude, we most humbly beg leave to point out Peter Nicholson as an object for the exercise of your Majesty's royal favour, and remain your Majesty's devoted subjects and obedient humble servants.

A new method of extracting the Cube Root, by Peter Nicholson.

RULE, PART 1.—Divide the resolvend by the trial divisor, and the first figure of the quotient is expected to be the next figure of the root.

Wanting below on the right hand side of each of the three numbers under the line, annex one cypher to the first, two to the second, and three to the third. Triple the root found, and annex the new figure on the right.

Multiply the sum by the new figure and add the product to the trial divisor.

Multiply this last sum by the new figure and subtract the product from the resolvend; if less, but if not the work must be repeated.

RULE, PART 2.—Add the new figure of the root to the number formed by the triple root and the annexed new figure.

Multiply the sum by the new figure and add the product to the complete divisor, and the sum is the new trial divisor.

Example.

0	0	12	(2·2894
2	4	8	
40	1200 trial divisor	4000 resolvend	
62	1324 complete divisor	5648 subtrahend	
640	145200	1353000	
668	150544	1204352	
6760	15595200	147648000	
6849	15656841	140911569	
68580	1671856300	6736431000	
68674	1572130996	6288523984	
		447907016	

Proof. The Root is 2·2894.

$$(2{\cdot}2894)^3 = 11{\cdot}999552092984$$
$$447907016$$
$$12{\cdot}000000000000$$

ON THE PROPOSAL FOR ESTABLISHING A ROYAL NATIONAL EXPOSITION.

No. I.

SIR,—Having thrown out the hint, to Timon, that such an institution, especially if accompanied by a really working and workable board of trade, would do more to encourage rising talent, more to ensure the adoption of perfect works of art, commerce, and manufactures than all the institutions and efforts of the last century, I am necessarily much gratified to see the spirited manner in which you have adopted my views.

An English institution of this kind must be free and and unbiassed; patronized as much as you please; but left to practical men alone for direction and control; and, held annually not triennially.

If once you admit the fetters of Lordocracy, the trammels of royal Societyism, and the tinsel glare of Diplomacraft, which covers, in ninety-nine cases out of a hundred, shallow brains, impudence and trick, you will crush, in its bud, the spirit and the worth which thousands yet unborn ought to see only to admire, and join only for personal profit, protection, and fame.

As it is, the practical applications of science have neither hope, shield, nor home; their arduous suggestors are beggars, as a consequence, living only to deplore lost time, foolish outlay, and blighted hope; at least, so thought and felt such men as Captains Bosquett and Tuckey, Harrison, Parkinson, John Murray, Skeane, Trengrouse, Horner, and a phalanx of worthy men.

In my memory I have numbered among my friends Henry Bell, poor Dodd, the suicide, to whom Rennie owed more than half his fame, Albert Winsor, Archibald Earl of Dundonald, William Nicholson, Frederick Accum, when starving in a garret in Islington, Sir Anthony Carlisle, Captain Christopher Wilson, and a host of men who, like Fourdrinier, must either starve in disguise or be ruined in public by the lax, disgusting state of our contemptible protective laws, or the still more contemptible common-place stultification of public office routine, in which my Lord Cheeseparing, green from the mint, where he knew nothing, is at liberty to condemn, through the medium of some clerk, in a few vague and every day phrases, the whole results of *an infinitely superior man's life*—aye, perhaps, at the Post Office or Admiralty, the affairs of which he learned yesterday evening by —— signing his name!

This is no vituperation, no democratic asperity of mine; but, the essence of the Royal reply to an exasperated Lord who vowed vengeance against Hans Holbein:—"Touch him not unto his injury: remember, that *out of seven ploughmen* I can make *seven Lords;* but I cannot, out of seven Lords, make one Holbein."

I have a case now before me, where an individual, after ten years' scorn and gibes and contumely, succeeded in sending a "Ship's Life Boat" [1] to sea ten years ago, making twenty. Three years ago, when the Thames steamer was wrecked off the Scilly Isles, he addressed the then Lord Mayor, Mr. Alderman Thomas Johnson, with the hope of arousing mercantile spirit—a report of his address went the round of the papers, and nearly three years afterwards the Shipwreck Committee (then unborn) copied all his long told tale, all his positions and then recommended them for adoption with another man's boat and, (*in its own* sphere), a foolish one in contravention of the first fundamental principle of life salvage at sea, though an useful good boat *out of its sphere,* viz. where Archimedean or other screws are used; now, by a National Exposition this man's arduous life had been saved *half* its pangs, *all* its robberies; his purse had been replenished by sale, and the *meruit qui palmam ferat* held forth as a stimulus to man. Such, Sir, is not only the fact, and the working, but more; more than one peer of France owes his rank, title, and wealth to the influence of the original of our proposed exhibition; and, will any man point me out *one* Peer of England whose coronet was given as the absolute reward of genuine worth? Will any man tell me the stereotype Stanhope would have ever become a Peer at all on such a ground?

Is there a Smeaton peerage? or a Herschel barony? No—no. Let us have then an Exposition, like the French, and by honesty and worth neutralize, *not destroy* the magpies and rooks, the Culpeppers and Monteagles of this day; he then who saves a human life will not be insulted by a threepenny copper or parchment reward.

Again, the same person suggested to the Admiralty the means of making use of the then waste liquor of the charcoal burners for gunpowder works, and also an apparatus for making it on shipboard in the South Seas and other localities where salt might be scarce, for preserving pork and other meat and fish by injection thereof, and further, as a substitute for vinegar. He was little better than laughed at under John Wilson Croker's enlightened direction of the Admiralty, yet less than a quarter of a century thereafter he saw a trading manufacturer, to whom the hint had been given by an Admiralty clerk, enter into contracts for it, sell it, and raise thirty thousand pounds by it; and further sees its now universal adoption in the army, navy, and domestic life as better than vinegar! But enough, I am prepared to fill your whole impression, if required, with gross, palpable, unquestionable facts, amply developing the absolutely crying want of such a stimulus to, and refuge for, individual worth, no matter what its object or grade of life; and, with reference to its commercial effects, the mind can scarcely expand in proportion to the picture: the curse of the cheap shop system and *bad* goods for exportation where the *best* are required,—forged cutlery and plate marks, &c., would be so far checked, that, at the Leipzic Fair a knife or razor from Sheffield, and a gun from Birmingham, should not be as now, looked upon with scorn: Buenos Ayres should not again reject our barter—the Chinese laugh at our trash, or the East Indiaman demand before he buys, the broker's guarantee.

My guinea is at any time ready towards this great undertaking, which, as long as history lasts to tell the nation's name on the map of time, will carry its projectors' fame to every man's door for every man's praise; my mite is humble, but my time and my pen shall join your endeavours freely.

At present, we have no body which merits the name of a Public Institution of the Arts, though several tin kettle little-goes assume it.

I am, Sir, with sincere belief in the success of the attempt, and a full conviction of its worth, yours,

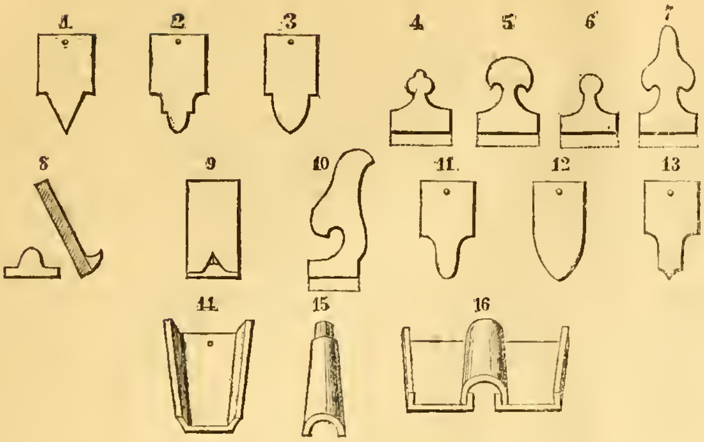
WILHELM DE WINTERTON.

November 8, 1844.

[1] Mr. W. Marris Dinsdale, to whom the navy is indebted for an assimilation of the diet of seamen to that of landsmen—in the use of tea, coffee, sugar, pyroligneous vinegar, &c.—as the only rational means of preventing sea scurvy. This person also suggested the use of register wreck buoys, to denote cases of foundering at sea; post-office packet salvage buoys, and buoyage for securing the sea mails from loss, &c. &c. twenty years ago, and incessantly repeated their value to every successive Postmaster General in vain!

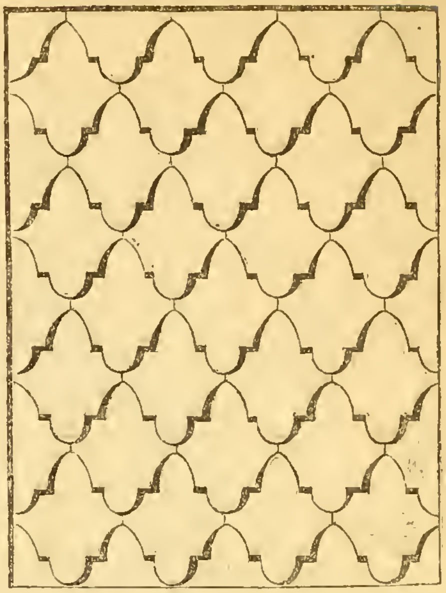
TO MAKE CAOUTCHOUC IMPERMEABLE TO GAS.—M. Chevreul has shown that linseed oil placed on the external surface of the caoutchouc renders it impermeable to gas.

BROWN'S ORNAMENTAL TILING.



Figs. 1, 2, 3, 11, 12, 13 are ornamental Plaintiles.
Figs. 4, 5, 6, 7, ornaments for Grooved Ridge Tile:
Figs. 8, 9, end, side and plan of Eaves' Tiles.
Fig. 10, end ornament to finish a Gable to Grooved Ridge Tile.
Figs. 14, 15, 16, Italian Tiles.

Fig. 17. No. 2, Surbiton Plaintile.

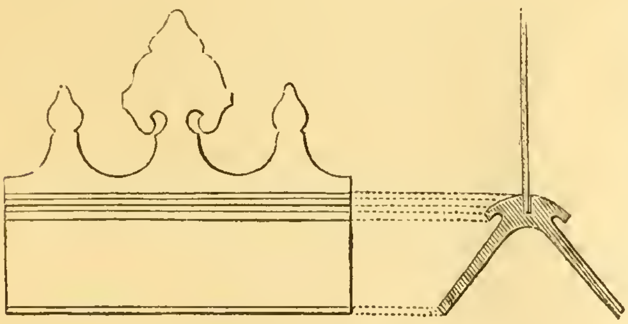


We have much pleasure in introducing to architects the designs of some plain tiles made by Robert Brown, of the pottery and tile-works, Surbiton-hill, near Kingston, Surrey, who has turned his particular attention to manufacturing ornamental tiles from designs that may be furnished him by the profession, which must be acknowledged is a great desideratum. We here subjoin some of the patterns which are now in use by architects, and which can always be had of Mr. Brown.

The price of these tiles does not much exceed the ordinary price of common plain tiling, the charge is 2*l.* 8*s.* per thousand, delivered in London, or per square, including lathing, 2*l.* 10*s.*

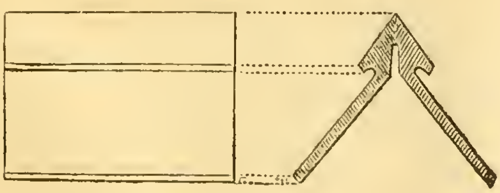
Mr. Brown has also introduced an ornamental ridge tile; it has a groove in the top edge, in which can be introduced any form of ornament that the architect may desire; it was first used as shown in the annexed figure (18) by Mr. Kendal. For the introduction of this tile

Fig. 18.



Mr. Brown was honoured with a medal by the Society of Arts at the last annual meeting. The price of the tile including the ornament is 1*s.* per foot run, or fixed complete in London, 1*s.* 3*d.* per foot. There is also a plainer description of ridge tile, as per annexed figure (19) the price of which is 10*d.* per foot run.

Fig. 19.



With regard to the colour, an object so desirable, Mr. Brown informs us that from experiments which he has recently made, that gas tar is an excellent colouring for tiles, at a trifling cost. The various light and dark gray colours may be obtained by making the tar more or less diluted. Besides being a good colour, the tar forms a better protection to the tile than glazing, as a hard frost often causes glazed tiles or pots, when exposed to the weather, to chip or spalter, caused no doubt by the glaze being of a harder nature than the tile which it covers.

There is another mode of colouring tiles which Mr. Brown considers is not unworthy of notice. It is thus performed—with a large brush put on as much gas tar as will remain upon the tile, then take green pit sand or Thames sand, and while the tile is wet sift such sand upon it, a portion of which will become incorporated with the tar and adhere to the tile, this will give a good dark colour. If a lighter or greener colour is wanted, with oil paint cover the whole slightly over once—this is all that is required to produce a good colour, or that most approaching to nature. The sand has the effect of making the tile have something the appearance of stone by its roughness—when sand is not used the colouring appears glaring and vulgar, and sand moreover tends to collect the vegetable matter occasionally floating in the atmosphere, the consequence of which is moss begins soon to form, the colour of which is considered by many the perfection of all colours for tiling.

THE FALLING OF A MILL AT OLDHAM.

The inquest on the bodies of the 20 persons (12 males and 8 females) killed by the fall of the mill of Messrs. Samuel Radcliffe and Sons, at Lower House, Oldham, on Thursday Oct. 31,—which was commenced before Mr. John Molesworth (deputy coroner for Mr. Dearden) and a respectable jury, at the Black Swan, Greenacres Moor, on Saturday, Nov. 2, and continued by adjournment on Monday, Nov. 4,—was again resumed and concluded on Wednesday, Nov. 6; the adjournment to that day having been made solely to enable Mr. Wm. Fairbain, M. Inst. C.E. and Mr. David Bellhouse, both of Manchester, to prepare an elaborate report as to the cause or causes of the fall of this fireproof mill.

On the assembling of the jury, on Monday, Mr. Fairbairn presented to the coroner the joint report of himself and Mr. Bellhouse; and. in doing so, said, "The object which Mr. Bellhouse and myself had, in drawing out this report was, in the first instance, to determine the true cause of the accident, and also, at the same time, to lay before the jury such facts as will enable them to come to a correct verdict. We have probably gone further into this inquiry than is usual on such occasions; but, if the report be considered too long, it may be curtailed—and with your permission, sir, I will read the report, as I may have observations to make as I go along.—The Rev. T. S. Mills: You have entered into all the facts bearing on the defects in the structure?—

Mr. Fairbairn: Our object has been two-fold; first to inquire into the true cause of the accident; and next, to set the public right with regard to the construction of fire-proof fabrics in future."—[Mr. Fairbairn exhibited the plan of one floor of the mill, as to its bays, principal and cross beams, and arches in order to aid in his explanations; and for the same purpose we have given below a copy of the diagram embodied in the joint report of Messrs. Fairbairn and Bellhouse.]

Mr. Fairbairn then proceeded to read the report, as follows; adding explanations as he went on, to the following effect:—

"In consequence of a unanimous expression of feeling on the part of the coroner's jury, that a full and satisfactory inquiry should be made into the causes which led to the death of Joseph Tweedale and others, at Messrs. Radcliffe's cotton mill, Oldham, on Thursday last;—we, the undersigned, have carefully examined the building, and, having noted every particular relative to the walls, foundations, iron beams, columns, and their fractures, are of opinion that the accident has arisen from one or two causes; namely, from the falling of one of the arches in the first instance, or, what is more probable, from the breaking of one of the large beams supporting the transverse and longitudinal arches at the extreme gable of the mill.

"From the evidence already adduced, it appears that one of the arches in the top room (the fourth from the old mill) was observed to sink, some days previously to the accident which subsequently occurred; this arch, which had sunk about four inches, was considered unsafe, and the necessary preparations for refixing the centres were immediately taken for its renewal. During the re-building of the arch (of which about one-third was completed, the middle being removed, and the other remaining), the building at this critical period, gave way; and, as stated by one of the witnesses, the beam broke short by the column, and the whole came down with a crash. Now in this view of the case (and assuming the evidence to be correct), it is obvious, the beam must have broken from the lateral strain of the arches, and not from the weight acting vertically (as assumed) upon the beams which remained. In confirmation of this opinion, it will be observed, that the middle beams were unprotected from the lateral thrust, unless we except an imperfect wooden stay, which, from its soft and fibrous nature, would easily split, or crush, by the force of the edge of a flange of only one inch thick pressing upon it."

In order to explain this more clearly, it may be necessary to refer to the plan a little. This [marked bay 3 in the plan below] is the arch where the accident is said to have commenced. The north third of the arch had been taken out and renewed; the middle third was taken out altogether when the building fell; and the south third was the old arch, as it had sunk. The middle beam [that between bays 2 and 3, marked *b*, and thirteen feet ten inches in length] broke off at the collar [at the north end]. Two square pieces of wood, 4½-inch scantling, were put across at these points only [indicating them], bearing upon the lower flange of the beam: consequently, if any lateral thrust took place from the adjoining arch or arches [marked 2 and 4 on the plan], its tendency would be either to split the wood, or to crush its fibres, and thus to cause the beam to break. That is one way of accounting for it. I am, however, of the opinion myself,—and Mr. Bellhouse concurs with me,—that this was not the cause, here, but another, which will presently come before you:—

"Hence it follows, that the thrust of two wide and flat arches would be quite sufficient to fracture the beam, and thus loosen or destroy the abutments on each side. The beam being ruptured, it is easy to conceive the result which must inevitably follow such an event. From the breakage of this beam, we may infer a serious and extensive accident; but to our minds, it does not sufficiently clear up the full amount of injury sustained; nor does it account for the immense crash and total destruction of the building, which ultimately took place."

I believe that the whole building came down almost instantaneously. If I am rightly informed, both the side walls and the gable end fell outwards.—The Foreman: Not outwards, but inwards: the walls came principally inwards, like a funnel.—Mr. Fairbairn: But I am strongly inclined to think that the walls would be crushed outwards.—A Juror: There is evidence to show that the walls first fell outwards; and, on the south side, a stable and several pigsties, at some distance from the building, were knocked down.—Mr. Fairbairn: I did not hear the evidence; but I made inquiries at the place; and I saw, that, on the side next the engine-room [the north], the walls had evidently, in falling, struck the side of that building, because there were indentations on the bricks. On the other [south] side of the building, again, at a distance of not less than six yards—[Several jurors: Oh! considerably more], some buildings were destroyed by the falling walls; and I was also informed, that immense quantities of material had fallen outwards at the gable end. [Indeed, it was here that Whitehead was killed by the materials falling outwards, towards the detached chimney at the north-east corner of the building.]—The Coroner: Do you not think that the beams pulling the walls inwards would tend to make a collapse? Mr. Fairbairn: If the pillars had given way first, it would; but, if the pillars remained, the walls would go outwards.—The Coroner: Did you read the evidence of Mills, the beer-seller, who saw the fall from his house? He says: "On Thursday last, I was at my house, facing Lower House Mill. I saw the [north] side next the chimney begin to fall. When the roof had fallen two stories, it made a stop for a second or two. The outer walls then flew in, and it all came to the ground.—A Juror: That is, the upper stories fell outwards; and then, the walls breaking, the lower portion went inwards.—Mr. Alexander Taylor (juror): One of the firm (Messrs. Radcliffe), who has not been examined, says that the building began to fall outwards, and ultimately went in: that would be the lower part of the warehouse that went in.—Mr. Fairbairn: However, it is not very material; for I do not know that it affects the principal cause of the accident at all, and it is not a question of any great moment.

"One of the middle beams, or any one single beam of the building giving way, could not, in our opinion, have made the ruins so complete; and, having reason to suspect some other cause, we were induced to institute a still more minute and searching inquiry into the strengths and proportions of other parts of the structure.

"On a careful examination of the fractured beams, and more particularly of those which stretch transversely across the building, at a distance of 15 feet from the extreme gable of the mill, we found a more convincing proof of the cause which led to this unfortunate occurrence.

"These beams carry the ends of four other beams, which extend longitudinally from the gable on which they rest, as shown in the following sketch:—

South.

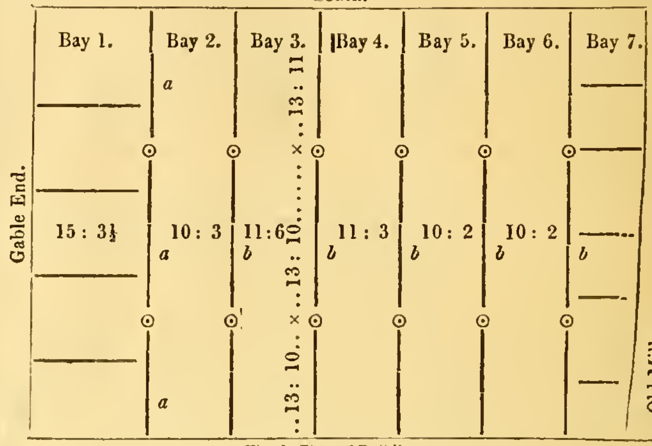


Fig. 1, Plan of Building.

[The figures indicate measurements in feet and inches.]

"From the above, it will appear evident that the beams *a*, *a*, *a*, had to support a much greater weight than the beams *b*, *b*, *b*, &c.; and consequently they required to be made of proportionately greater strength. They were made stronger; but unfortunately, from inadvertency, *or rather from want of knowledge*, they were strengthened in the wrong place; and instead of adding the additional strength to the bottom flange, which is always subjected to the greatest strain, it was given to the middle of the beam where it was not required."

Now, with respect to this point, if you take a beam with a single flange at the bottom ⊥ and break it with the flange downward, we may call the breaking weight 1,000; but, if you take the same beam, and break it with the flange upward T, you will find, that it will only carry a weight of 323 to break it: consequently there is a deficiency of strength, from merely reversing the position of the same beam, in the ratio of 1,000 to 323. But people totally unacquainted with this fact might suppose there was as much strength in the beam laid the one way as the other. But it is a totally different thing from timber; and cast-iron is a material so extensively used, and of so much importance in the economy of building,—and, indeed, in almost every thing connected with the industrial arts of this country,—that I have taken the liberty of pointing out to the jury the fact of the great difference in strength, in the same beam, between the one position and the other.

"It is well known, or it ought to be known, to every person giving instructions for the form and construction of iron beams, that the strength is nearly a proportional of the section of the bottom rib or flange; and, according to Mr. Hodgkinson's experiments, a bottom flange of double the size will give nearly double the strength."

[Mr. Fairbairn further illustrated the form of the beams by some model drawings, not having any reference to those in Messrs. Radcliffe's mill, but which were made for a mill in Ireland,—that of Messrs. Alexander, near Lough Swilly. In reference to these drawings, he said:] These beams are not correct as to the perfect form of each; but they are as near an approximation as practice will allow; and, if the person who gave instructions in this instance for strengthening the beams, instead of putting the additional metal on the body of the beam, had attached it to the bottom rib, these beams would have been made one-half stronger, or rather more than that; but unfortunately the additional strength, in this case, has been put upon the middle of the beam. In order to explain the nature of this beam, I may observe, that, if you take a beam of any dimensions, and suppose it supported at the two ends, and then lay a weight on the middle, you cannot break that beam without pulling the particles of all the bottom part of the beam asunder, and you must break the upper flange by compression or crushing. There is a point called the neutral point, where the particles are neither extended nor compressed; you cannot break it without bending; and you must disturb all the particles by drawing them asunder at the bottom, and crushing them at the top. Consequently it was found, by the very numerous, ingenious, and laborious experiments of my friend Mr. Eaton Hodgkinson, that the bottom flange came out a proportion of about one-half of the whole section of the beam; and, in the beams in question, the quantity of metal in the bottom flange is probably not more than from a quarter to one-third of the section. The bottom flange should be parabolas; and, in order to give it the correct form, this beam would have to be enlarged along the lower flange, and then it would be of equal strength along the whole line of the beam. I mention this merely to show the necessity which exists for getting greater strength, by throwing the greatest portion of the metal into the lower flange.

"These facts having been proved by direct experiment, it is important to all those concerned in the construction of fire-proof buildings, in which the lives of the public and the property of individuals are at stake, that the form of beams and the section of greatest strength should be *perfectly and thoroughly understood;* and to those unacquainted with the subject, we would beg to refer them to Mr. Hodgkinson's paper on the strength of iron beams, in the fifth vol. second series, of the 'Memoirs of the Literary and Philosophical Society of Manchester.' In ordinary cases, we should not have troubled the jury with these remarks; but in a case of such importance as the present, where the lives of so many persons have been sacrificed to defective knowledge and skill in the construction of buildings, wherein considerations of such importance are involved, we have considered it our duty thus publicly to direct attention to the subject, not only as regards the present but in all future cases, and respectfully to urge upon the proprietors of mills, and of other buildings containing workpeople, the necessity which exists for a more secure and perfect system of building, and for a further developement of the principles upon which fire-proof edifices are founded. If this suggestion is properly received and acted upon, we have reason to believe, that we shall not again have occasion to investigate occurrences of so lamentable and so distressing a nature. We have already observed, that the beams *a, a, a,* in the preceding sketch were strengthened; not, however, in the bottom flange, but in the middle part of the beam, where they are thickened, and where it was absolutely of no use. Had the same quantity of metal been given to the lower flange, these beams (the weakest in the building*) would have carried nearly double the weight; and thus, by a proper and judicious distribution of the metals, the building as well as the lives of the people, would have been saved. These observations apply to all the other beams of the mill, which are also defective as respects their strength."

"In computing the weights upon each beam, it was found that those supporting the arches of ten feet six inches, and those of eleven feet six inches span, had to support a load (without machinery) respectively of ten and eleven tons."

That is thus:—We compute the weight of the arch at about 10 tons for the short span, and 11 tons for the other; and that is about the weight required.

"And those sustaining the ends of the longitudinal beams were acted upon with a load of 13¾ tons."

That is, particularly, the two shown here [the two outside beams, *a, a*], because each of them had not only half the long arch to carry, but also half, or more than half, of the short arches on the other side.

"Now, if we take the sections of these beams, and calculate the weights necessary to break them, when laid upon the middle, it will be found that the breaking weights for the beams *a, a, a,* and *b, b, b,* &c. will be nearly the same, or about 9½ tons. This is the breaking weight of an average quality of iron; and, allowing for the difference of metals, it could not be raised much above 10 or 10½ tons."

They must of necessity be broken, with a weight of from 10 to 10½ tons. I have taken the average at 10 tons.

"The breaking weight would therefore be about 10 tons when the beam is loaded in the middle, and 20 tons when equally distributed over the whole surface of the projecting flange of the beam."

Now, there is a wide difference between the beam being loaded on one point in or near the middle, and being loaded along the whole beam. In the latter case, it would carry just double the weight. Consequently, you have in arches an equally distributed weight; so that a beam supporting them, and which would break with 10 tons, applied to a single point in or near the middle of the beam, will take 20 tons to break it, when the weight is so distributed.

"Having ascertained the bearing of the beams, we shall next compare their strength with the actual loads they were called upon to sustain; and, in making that comparason, it must be borne in mind that the two beams *a, a,* next the side wall, had their loads unequally distributed, which reduced their bearing powers to 15 tons."

Now, you see, that on the west side of the beam *a*, it was equal to carry 10 tons; but the cross beams on the east side threw the whole weight upon the middle of the beam; and, consequently, instead of the breaking weight of the beam *a* being 20 tons (as it would have been, if equally distributed), it was only 15 tons, having a distribution of the weight only on one side; and the weight on the other bearing upon one point only.

"Now, the load which these beams had to support was 13¾ tons, 8¼ tons being supported on a single point on one side, and 5½ tons distributed over the surface of the opposite flange on the other. From this it will be seen, that the actual load was to the breaking weight as the numbers 13·75 to 15, or as 1 to 1·09 being within a mere fraction, or one tenth, of absolute destruction."

That was the very critical state in which this building was standing, as to those beams, just previously to the fall.

"Viewing the subject in this light, and taking the above calculations as data, we are no longer at a loss as to the cause of the accident. Even supposing the arches to have stood, it will appear obvious that so close an approximation of the breaking weight to the actual load was extremely unsafe; and that, under such circumstances, no precautions could have prevented the rupture of the transverse beams *a, a, a,* whenever they happened to be subjected to the slightest impact, or any vibrationg motion tending to disturb the parts under strain, and eventually, still further, to lessen their already too much diminished powers of resistance."

It is clear, that they must have gone some time or other. I believe Mr. Bellhouse and I are of the same opinion, that that was the real cause of the accident; that, probably, from the vibratory action of the mill gearing on being set going, or from some other cause, the slightest shock in the world would fracture either of these beams (*a, a,*); and then it is easy to conceive how the others would follow. It would not only carry the gable end down, but it would loosen the whole of these arches on the same floor, and the whole would soon come down in the mass. It would be impossible to account for the entire destruction of the whole building, unless, by some cause, the whole of the framework of one floor came down; and one of these beams [*a, a*] giving way, would account for that.—The Foreman: I called the coroner's attention at the time to the evidence of Mills, taken as he lay in bed, to the effect, that after the arch fell, where he was working, the whole gable-end fell. This seems to confirm the view taken by Mr. Fairbairn.—The Coroner: "It fell bay by bay," was Mills's expression.—Mr. Fairbairn: Of course, we were not present at the time of the accident. All we can do is to reason upon it from the facts given in evidence:—

"Irrespective of the weakness of the iron beams, which we consider as the primary cause of the accident, we would beg to advert to the tie-rods, which, although sufficient in number and strength, were not judiciously placed as respects their position for resisting the strain of the arch, their maximum point of tension at the bottom flange of the beam; but, that being inconvenient, they should on no account be placed higher than the soffit of the arch; and in this position, they would perforate the neutral axis, and give sufficient security to the arch, without injuring the strength of the beam. Instead, however, of approaching this point, they were on the top of the beam, and 18 inches from the bottom flange."

Now, with respect to the tie-rods, instead of their being placed above the arch, the true position of the tie-rods should be below, forming the chord of an arc. But that, especially in low rooms, would be found exceedingly inconvenient; and, according to the experience of Mr. Bellhouse and myself, we say, that it should never go higher than the soffit of the arch.

"As respects the arches, we found the versed sine, or rise of the arch, too low; on most occasions they are 1¼ inches to the foot."

We generally prefer an inch and a half rise to every foot of span, if it can be obtained. If this be done, you will find the arch come out a very fair and correct form of arch; and it is only at the sacrifice of an inch or two in the floor, which would not be an object, compared with the security of the arches. I do not know that this has any reference to the present inquiry, except that it is a proof that the arches were too low.—Mr. Bellhouse: I think it bears directly upon it; because the arch in the top story gave way or sunk, simply from that cause,—a want of sufficient rise.—Mr. Fairbairn: I have already stated, that we had two objects in our inquiry; the one to trace out the true cause of this accident, and the other to direct public attention to these facts, in order to prevent not only the loss of property, but, above all things, the loss of life. In this latter view, every thing bearing on the construction of these buildings is important.

"As respects the arches, we found the versed sine, or rise of the arch, too low: on most occasions they are 1¼ inches to the foot. But, in order to insure perfect security, we should advise, in all future buildings of this description, that the rise be 1½ inches to every foot of span. In the arch which first gave way, the rise was only a small fraction above an inch, having a rise of only 12 inches in a span of 11 feet 6 inches."

[The Foreman suggested an alteration in the report (which is made above), to prevent any mistake as to the supposition that the proportion of rise was the same in all the arches; and Mr. Fairbairn observed that, of course, a rise of one inch in every foot of span would be a greater rise in that arch which was only 10 feet 2 inches, than it would be in that which was 11 feet 6 inches. The correction was accordingly made, and Mr. Fairbairn resumed reading.]

"On viewing the columns, several imperfections were observed in the variable thickness of the metal; but, in other respects, the pillars were satisfactory, and presented no features of weakness indicating danger from those parts: one inch more in diameter, with the same weight of metal, would, however, have given greater security and greater strength."

On the whole it would have been better, probably, if the pillars had been a little larger.

"We cannot close this report, without adverting to the anxious solicitude of Messrs. Radcliffe, and the strong desire evinced by those gentlemen, to have every part of the structure upon the first and strongest principle; and we should imperfectly discharge our duty, if we neglected, on this occasion,

[* Mr. Fairbairn added, that these beams were rather weaker in original construction than the transverse beams; and that the whole of them were certainly not such as would be considered safe.]

to bear testimony to the superior strength of all parts of the building, except those we have just described, and on which it could not be expected they could form an opinion."

We cannot expect that gentlemen who are not acquainted with the principles of building should have an adequate knowledge of all the proportions, and as to what is necessary on such an occasion.

"In conclusion, we have great pleasure in stating, that it appears to us that no pecuniary considerations whatever were present to the minds of Messrs. Radcliffe in the due and perfect construction of these mills.

"WM. FAIRBAIRN,
"DAVID BELLHOUSE.

"Manchester, November 6th, 1844."

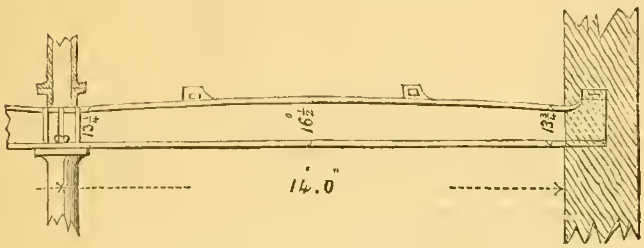
In addition to the above, we have procured drawings of the girders, to farther illustrate Messrs. Fairbairn and Bellhouse's report and observations.

Fig. 2.

Fig. 2, section of beam supporting cross beams at the end of the mill. Depth in the middle, 16½ inches; depth at the end, 13¾ inches; bottom flanch, 6 inches by 1⅛ inch thick; top flanch, 3 inches by ⅞ inch thick. Fig. 3 is a rough sketch of the form of one of the wall beams, and the others being nearly the same it may be taken as a fair average of the whole.

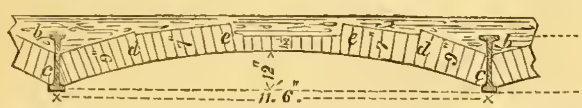
The longitudinal beams which rested on the extreme gable were ½ inch deeper in the middle. The arch tie rods, of ⅞ inch square

Fig. 3.



iron, were at the top of the beams, as represented by the holes *a a a*, (fig. 3,) whereas they are generally fixed in the position as under, at *e e*, (fig. 4).

Fig. 4.



From the above it will be easy to conceive the nature of the building, and the mode of construction in general use in these districts. The arches, it will be observed, are composed of a brick length from *c* to *d*, ¾ brick from *d* to *e*, and half brick in the centre. The top of the arches is then filled up with a concrete of lime and ashes, on which is laid either the stone flagging or tiles, as the case may be.

The verdict of the jury was accidental death.

THE NEW ROYAL EXCHANGE.

The intelligence of the tesselated pavement of the Merchants' Area being since taken up has given us rather a chill, for it seems at present rather doubtful whether it will ever be laid down again, and if so that part of the building will be deprived of what was not only a magnificent piece of decoration, but one quite unique in this country. We suspect that this unfortunate failure must have been, in a great measure, owing to the hurry with which the work was urged on, merely for the sake of getting the place in readiness by a certain day for a ceremony that was manifestly premature. A misnomer it certainly was to call that the "opening" of the Exchange, which was only the prelude to closing it again; and surely it would have been far more respectful towards the Queen to have delayed the "inauguration" until the whole had been perfected in every part, and rendered fit for immediate occupation. That economy could have been the motive for this strange precipitancy is utterly impossible, because the expense it occasioned for temporary preparations and fittings-up must have been a very formidable item indeed, considering that there is nothing now to show for it. What then is to be put into the opposite scale against it, those best can tell who are *au fait* in the mysteries of city politics and diplomacy. To us the affair of the "opening" appears to have been hurried on very injudiciously, if only because it now looks like a mere "flash in the pan," or a sudden start off before the signal of "all right!" had been given.

However, if we care nothing for the manner in which that business was managed, we can speak with satisfaction of the edifice itself. We do not, indeed, pretend to have as yet so fully examined it as to be able to give a decisive and matured opinion as to every part; but speaking from such observation as we have hitherto had the opportunity of making, and taking it as a rich and dignified pile, fully equal to what we expected—in some respects superior to what the architect's first designs promised. At present it is difficult to collect what is the general opinion of competent judges in regard to it, until the mere hubbub of newspaper praise shall have subsided. That it should be universally admired by professional men is not to be expected, if only because it throws some of them and their productions into the shade, and reproaches the poverty and dryness of manner which they would palm upon us for simplicity and purity. Accordingly we are not at all surprized at finding that a disposition to carp at the Exchange has begun to manifest itself. It is alleged to be overloaded with ornament, and coarse in its details; and it certainly must be acknowledged to be the first in an eminent degree, in comparison with the bareness generally, and the blankness with respect to sculptured enrichment in particular, which we have been accustomed to in other public buildings—some of them principal ones—erected in the present century. As to coarseness—what may appear such to some, we might call energy; and if both the design itself and the treatment of it in regard to style are somewhat *sui generis*, so also is the purpose of the building; and it was probably considered desirable that it should at all events express both stateliness and liberality of ornament, even though tinged in some degree with heaviness and quaintness. With regard to the shops we certainly do not approve of them, being decidedly of opinion that there ought not to have been any at all; nor do we see what particular advantage can accrue to the tenants from their shops being incorporated with the Exchange, since there is no sheltered walk before them as was the case in the former building. At all events they ought to be occupied as offices and not as shops for retail business. However, they were made a *sine qua non*, and the architect had no alternative but to comply with immutable instructions.—We annex a very able description of the Building from the *Times*.

THE SITE,

Is remarkable for its commanding importance in one aspect, the western, and for its irregularity on the other three sides, having, as is well known, a wedge-like form, produced by the convergence of Cornhill and Threadneedle-street towards the Mansion-house. The munificence of Parliament having facilitated the purchase of the isolated property to the west of the late Exchange, an opportunity was obtained for turning the most important façade of the new structure in that direction, instead of placing it to the south, as formerly. By this means the space unintercepted by buildings in advance from the centre of the present portico becomes extended to the unusual length of between 500 and 600 feet. On the other hand, the large and still increased amount of accommodation required in the new Exchange, together with the necessity for keeping that accommodation within an easily accessible elevation from the great thoroughfares, rendered it imperative that all the available ground on the north and south boundary lines should be occupied with building, in spite of the irregularity and want of parallelism to which we have just referred. We pass on, then, to examine what is the nature of that accommodation which principally governs the extent and distribution of the building under our notice. In the structure first raised by Sir Thomas Gresham only two objects seemed to have been provided for—the daily meeting of the merchants, and the reception of the shopkeepers; the upper part of the building having been, as it seems, arranged very much after the manner of a bazaar. Its successor, the late Royal Exchange, rebuilt after the great fire, ultimately received some new and important bodies of occupants, in lieu of the upstairs shopkeepers of the former establishment. First in order of time, came the association that originated in Lloyd's Coffee-house: their introduction was followed by that of the Royal Exchange Assurance Corporation, and this again by the provision for the Gresham College, on the purchase of its establishment by Government for the use of the Excise. In rebuilding the Exchange once more, the Gresham Committee have made provision, not only for an increase in the extent of accommodation to the shops, but for the reception of an additional company, that of the London Assurance; while they have assigned the Gresham College to a separate edifice, and provided a suite of rooms, hitherto unallotted, in the situation at first devoted to that body. The principal departments of *the present building* consist, therefore, of the following portions, as to number and order:—

The Merchants' Quadrangle.
Lloyd's.
The Royal Exchange Assurance.
The London Assurance.
The unappropriated offices.
The offices and shops of private parties.

PLAN OF THE BUILDING.

Setting the portico out of notice for the moment, the mass of building produces a figure about 272 feet in length from east to west, with a frontage of 118 feet at the west end, and of 176 feet at the opposite extremity, the north and south sides being equal, and connected with the eastern face by large quadrant corners. The portico gives a further extension to the west of about 28 feet in depth, by a length or frontage of 90 feet. Nearly in the centre of this entire mass is the Merchants' Quadrangle, occupying a space of 168 feet from east to west, by 111 feet across, these dimensions being inclusive of the covered arcade or ambulatory all round, which is about 26 feet wide, leaving an open centre in the proportion of a double square. In the interval remaining to the east of the Merchants' Quadrangle occurs another little court, some 60 feet in length from north to south, and 19 feet in width. It is only necessary to add to this general description of what is technically "the plan," that there is an entrance to the quadrangle from the centre of each of the four fronts of the building; that the centre of the portico is recessed to a depth equal to its projection; and that the entrance from the east front occupies the base of the tower. We may, however, mention further, by anticipation, that the height of the building embraces a basement story, ground floor, mezzanine, one pair or principal floor, and in many cases, a two-pair story.

Returning, then, to the distribution of the ground floor, we have all its western portion, between the quadrangle and the portico, occupied by the Royal Exchange Assurance, with an entrance within the portico on each side. The London Assurance engages a small portion of space on the south or Cornhill side for an entrance; while the establishment of Lloyd's has its approach by the small eastern court, before referred to, between the quadrangle and the tower. Almost the whole remaining space on the ground story, both in the three street frontages and in the eastern court, is devoted to the shops and private offices, some 37 in number, which, accordingly, form the characteristic external features of the lower portion of the building. It is on the one-pair, or principal floor, that the three great public establishments have their chief accommodation. Two-thirds of the space to the north and east of the quadrangle are occupied by Lloyd's rooms. Thence, from the south-east corner, past the centre of the Cornhill front westward, extend the rooms of the London Assurance. The Royal Exchange Assurance continues the range to the south-west extremity, and then northward past the centre of the west front, where the unappropriated offices complete the circuit by the occupation of the north-west corner. It would be tedious and unnecessary to particularize the rooms in each department; a sufficient notion of their extent may be gathered from the following comparison of surface. We believe that we shall not be found far from the truth, if we estimate the whole covered superficies upon this story at 31,000 feet. Out of this total a rough allotment will give to

Lloyd's	15,500	superficial feet.
London Assurance	5,900	—
Royal Exchange Assurance	5,700	—
Unappropriated offices ..	3,900	—
	31,000	

The only rooms that appear to demand a more detailed notice are the important suite devoted to the business of Lloyd's, which, however, will more properly engage our attention in the course of the examination which we proceed to institute into the architectural composition and decoration of the structure.

Architectural Character of the Exterior.

To consider the Royal Exchange, then, as a work of art, we presume that the west front—the principal, though smallest of the four—furnishes the governing lines to the rest of the external design from the proportions of its portico. The order employed is Corinthian, 50 feet in height, that is, 41 feet for the column, and the remainder for its superincumbent entablature. This order is continuous round the entire building, being elevated upon a granite stylobate or pedestal, varying in height from four to eight feet, according to the fall of the ground; and it is also surmounted generally by an attic and balustrade about ten feet in height. To this mention of the order and its proportions we will just add, that in all matters of detail preference appears to have been given to the Italian school of design, that reigned universally in this country at the beginning of the last century.

Portico or West Facade.

But, to return to the west façade, we have a portico of eight columns in width, and two in projection, leaving a narrow blank wing in the back ground on each side. The front rank of eight columns is backed by a line of four, so placed as to give an internal space to the centre and sides in the proportion of three to two; the centre, as we have before intimated, is also deeply recessed. To avoid a multiplicity of small windows for lighting the various apartments behind the portico, that object is attained by means of two large and boldly arched Venetian windows of Ionic detail; and between them, in the central division, is an archway of corresponding outline, which gives access to an inner vestibule communicating at once with the quadrangle. These three arches are finished with well executed keystone shields and foliage, exhibiting in the centre the merchant's mark of Sir Thomas Gresham, and, over the windows, the bearings of the old Merchant Adventurers, and the Merchants of the Staple of Calais. The distribution of space in the portico affords an opportunity for carrying over it a vaulted ceiling in three compartments, enriched with panelling and flowers. Of the pediment, which contains a display of sculpture by Mr. Westmacott, we shall speak hereafter, in noticing the accessories to the general design: and shall only add to this description of the portico that, as it occupies the lowest position in the declivity of the site, it is approached with effect by a flight of nine steps, well flanked by the advancing stylobate at each end.

The abuse of such an architectural appliance as that of the Greco-Roman portico is so much more common than its felicitous use, that we do not wonder that professional men of high genius forgo its application altogether, rather than have recourse to it in an unfavourable position and aspect, or under circumstances where it would be unsuited to internal arrangements. Wren's porticoes of this description are extremely rare, and so are those of the late Sir John Soane. We have already in London porticoes *usque ad nauseam*, crammed with little openings at the back, telling all the story of a house built within the shell of a temple. On the other hand, those architects whose taste has led them to avoid this incongruity and trifling have produced by the reverse an effect that may be classical, if that be any recommendation, but which is too frequently sombre and destitute of animation, manifestly unsuited to the dull atmosphere of Britain, and especially so to the genius of commercial London. It is a great relief, therefore, to meet with a specimen that does not excite our indignation at the repetition of the "everlasting portico;" and that relief we certainly enjoy in the inspection of the west front of the Royal Exchange. The situation it occupies is one so temptingly commanding, that though we might have recommended the trial of some more novel combination, we can excuse the architect's preference for a portico, since his choice has been conducted to so happy a result. The composition under notice has the merit of character; it is manifestly the portico to an important secular building, and not to a church, much less to a pagan temple. It has, in an eminent degree, the advantage of artistical "breadth," and possesses a play of outline and force of shadow unequalled in any other example in the metropolis, the west front of St. Paul's excepted. The arrangement of its plan bears some resemblance to that of the Roman Pantheon; while the niches or recesses in the latter offer, to the sticklers for precedent, some lines of authority for the introduction of the Venetian windows of the Exchange. As to these windows, we may just observe, that while their outlines eminently help the effect of liveliness in this portico, they are so designed as distinctly to express their multiform duty, though combined in such a way as to preserve perfect unity. The management of the portico ceilings, which in the Pantheon are of bald timber, is here so conducted, by the vaulting we have described, as to complete the expression of the internal design, to enhance the effect of loftiness and general magnitude, and to meet the eye of the passer-by with a succession of pleasing forms that would have been lost under any of the older modes of arrangement. It is not superfluous to add, that the slope of the pediment, or roof-line of the portico, approaches more nearly to the outline of beauty for such subjects than in most cases to which we can refer. This may be felt by any one who looks at the two extreme instances in Trafalgar-square; the one pediment gaping for more than its allowance of the Royal arms—the other incapable, from its flatness, of receiving any sculptured device worthy of attention.

Resuming our description, it only remains to be stated, respecting the west front, that the narrow compartments beyond the portico on the north and south are occupied by solid rustication in the lower part, above which, in each case, is a panel containing a flowered wreath and mantle, charged with the Royal cypher; this again is surmounted by a festoon, and the crowning attic exhibits a device formed with the prætorial insignia.

South Facade.

But it is time that we look at the other fronts of the building. Throughout the south façade the main order is continued by pilasters, dividing the whole length into thirteen equal portions, the pilasters being doubled at the extremities of the front. In each of these thirteen divisions is a rusticated arch of due proportions, the rustic arrangement, with its surmounting mouldings, occupying about two-thirds of the available height beneath the general entablature. The arch we speak of contains ordinarily a shop, with its mezzanine story above; in addition to which, each shop has a room in the basement, furnished with all appropriate accommodation. Above the rusticated shop arches appear the windows of the principal story, deeply sunk, and surrounded by enriched architraves with boldly-carved keystones and panelings. Of the thirteen compartments into which this front is divided, the central one, as the entrance, and that on each side of it, are deeply recessed within the main order; in each is a screen arch carried upon corbels, and decorated with a bold shield having rich festoons of flowers attached. These shields are charged respectively with the arms of Sir Thomas Gresham in the centre, those of the city of London on the dexter, and of the Mercer's Company on the sinister. In the spaces above are three windows, boldly composed with scrolled piers, carrying enriched segmental pediments, and decorated with lion-masks and massive drops of flowers. The attic, which crowns the five middle divisions of this front, is elevated above the wing portions, its extremities being charged with devices of mantles and regalia, with the cyphers of Queens Elizabeth and Victoria, and the dates at which their respective Exchanges were completed; while the three middle compartments are recessed like those below, and occupied by deeply-enriched panels.

The quadrant corners which connect this façade with the eastern, and that again with the north front, are without pilasters, but contain three rusticated arches below, and as many windows above. The central window is finished semi-circularly, with somewhat massive accompaniments; and above it, to give variety to the line of attic, is a pedimented tablet-composition, exhibiting the grasshopper, as Sir Thomas Gresham's crest, surrounded by branches of the oak and palm.

East Facade.

The east front, at which we now arrive, sustains in general the character of the south, and is divided into seven compartments, three of them being formed into a centre, and the remaining two on each side being treated precisely in the same manner as the ten wing-divisions in the Cornhill front. The three central compartments are somewhat recessed, and are divided by four columns instead of pilasters, two of the columns being isolated, and two partly attached. The arches in these are of a more ornate character than their neighbours, each being surrounded by a band of oak leaves, and finished with a massive keystone, that branches out with scrolls to form a corbelling for the support of the window dressings above, which are of large proportions and elaborate finish. The attic above this portion of the design is elevated, and fortified with massive inverted consoles, one rising from each portion of the entablature which breaks over the columns below. In each of the three divisions of this attic is a large shield, with foliage, displaying, respectively, the arms of the city, Gresham, and the Mercers. Each extremity of the attic is crowned with a fanciful terminal, bearing the caduceus of commerce, and apparently designed to produce a proper combination with the outline of the tower, which rises from the centre. This important feature, whose practical object is to contain the clock, with an improved chime-apparatus of fifteen bells, is carried to a height of 170 feet from the ground by four successive stages of design, above the general order of the building. In the first or lowest of these its plan is a square, fortified with double buttress-like piers at the angles, of which the two on the eastern face are made to carry up the perpendiculars of the columns below, so as to produce continuity of line from the ground. This stage of the design is occupied in the east front by a niche, and, in the others by corresponding openings, with architraves and bold keystones, the whole being bounded by a massive cornice. The niche is intended for the reception of a colossal statue of Sir Thomas Gresham, from the chisel of Mr. Behnes. The next story of the design exhibits in four aspects the clock-dials, which are nearly nine feet in diameter; it is flanked at each angle by two vases, and is somewhat more broken than the former stage. The next consists of an octagonal lantern pierced with a long ornamental outlet on each alternate face, and fortified anglewise on the remaining four by two columns of a composed order, with their appropriate accompaniments. The fourth and last stage consists of a circular tambour, surrounded by eight consoles, and pierced with outlets in the intervals; the whole carrying the dome, from which is elevated the grasshopper vane rescued from the former building.

North Facade.

We pass on to the north front, which differs in its subdivisions from the south, having, instead of thirteen, fifteen arches of narrower proportion, five of them forming an advanced centre, and the remaining five on each side being carried by rusticated piers without any pilasters. The centre of five arches consists again of three, with recessed divisions in the upper story, flanked by two of a more solid character. In the former, between the arches and the richly decorated windows which surmount them, is a tablet-course bearing three inscriptions: over the entrance the motto of Gresham, in old French, *Fortun a my;* to the east, or dexter, *Dne dirige nos;* and on the west the *Honor Deo* of the Mercers' Company. The advanced compartment on each side of these central three contains, on a level with the windows, an enriched niche; that on the east is intended to receive a statue of Sir Richard Whittington, by Mr. Carew, and that on the west a figure of Sir Hugh Myddelton, by Mr. Joseph. As the upward termination to these portions of the design, the attic is raised to form ornamental groups of chimnies, faced with carved festoons of fruit and flowers. The three intermediate divisions of this attic follow the recessed lines of the architecture below, and have the piers surmounted by altar-like terminals, carved with the Mercurial caduceus. The wing portions of this front have, above the shop-story of arches, a tier of elaborately composed windows, whose dressings reach the entablature above, an arrangement which is evidently intended to obviate the feebleness of effect that would otherwise result from the absence of pilasters. These wings are terminated by the general balustrade.

General Remarks on the Exterior.

Having thus carried our survey round the exterior of the building, we will briefly offer our opinion that the merit of expression, which we conceded to the west front, may be justly claimed by the other three; the whole effect is distinctly commercial; the structure solid, as the representative of British trade, yet ornate, as the centre of our mercantile wealth. This fitness we conceive to constitute the first requisite of good design; and we find it in this building not unaccompanied with unity and breadth, nor yet destitute of the variety attainable from light and shade. The detail is of a clear and decided character, evidently studied with a view to future effect under the discolouring hand of time. It is generally original in design, and free from the charge of uninventive repetition. Among other points we may notice the windows in the principal story, of which we have counted seven carefully-studied varieties, yet so applied as to avoid any frivolous disturbance of continuity and breadth. We could have wished that some of the shops had been dispensed with, so as to have allowed of more spacious entrances to the quadrangle from the north and south sides; but this we presume was a considertion of rental too powerful for the architect to encounter. A threefold, instead of single external vestibule in these aspects, would have formed an important accession to the effect of the design. The treatment of the tower, considered as a portion of the building, is felicitous, whether as combined with and growing out from the sub-structure, or viewed with reference to its outline at various angles of sight. The obstruction of its front view from the eastern approaches is a much less misfortune than that which would have arisen from the discordance of outlines, had the tower been placed either in the north or south front; and to have raised it in the west, behind the portico, would have been in point of character the most fatal of architectural errors. Situated as it is, the tower produces one of its happiest effects as a termination to the vista obtained on approaching the quadrangle by the great western entrance.

The Merchants' Quadrangle.

To this portion of the building it is necessary that we should now direct our attention. The Merchants' Quadrangle, of which we have already stated the dimensions, presents to our view an open court, whose length from east to west, is twice its width. Its height presents us with a composition of two orders—Doric below, and Ionic above, the columns being engaged to the solids behind, and elevated upon pedestals. Each of these orders comprehends a line of well-proportioned arches, with appropriate imposts and dressings. The arches of the lower tier being open, communicate with the ambulatory or arcade that surrounds the court; and at the back of this ambulatory are corresponding divisions of piers with arches deeply recessed. The arches of the upper tier, comprised within the Ionic order, are treated as large curved recesses, enriched with panelling both reticulated and plain, and containing each a window, whose dressings are advanced in a very prominent relief, standing within a carved stone balcony, and finished above with an elaborate and pedimented top, that occupies the head of the great recessed arch. Above this window, in the crown of each arch, is a keystone, forming a handsome cartouche-shield, charged with the arms of one of the states with which we have commercial intercourse. This is surmounted by the entablature of the order, the cornice of which is of unusually bold projection and detail; and from this rises the attic, which, with its broken outline of piers and open panelling of playful design, terminates the composition. This description embraces one vertical compartment of the general design; to complete the circuit, it must be understood that on each side of the length of the court there are seven of these compartments with two small ones, and, at each end of the court, three such compartments with two small ones. These smaller compartments, being two at each corner of the quadrangle, have each a rusticated double arch below, and, variously, a window or niche above, surmounted, successively, with a carved festoon and a panel containing a wreath of oak and laurel. An ornamented group of chimnies terminates the attic over each of these corners.

We consider the composition of this court eminently successful. It is more imaginative than any of the external design; the combination of forms is grateful even to the uninitiated eye, while the subdivision and character of detail are calculated to enhance its apparent magnitude. We are only uncertain whether we should not have proposed a greater width of proportion—whether that of three to five, for instance, would not have been preferable to the present of one to two.

But, we must complete our description of the surrounding ambulatory, by observing that its ceiling is formed on a principle somewhat analogous to that developed in the wooden ceilings to some of our churches of the later Gothic period. Every pier of the arcade has a band or beam crossing over to its neighbour against the opposite wall, which beam is curved down to its springing at each end, and carried by a corbel or console. In the opposite, or longitudinal direction, these beams are intersected by two others, so as to form in each division of the ambulatory one large panel between two narrow ones. Pendants of varied foliage are applied at all points where these beams or bands intersect each other. A similar arrangement is recognized in the pavement, which repeats in party-coloured stone the architectural lines of the ceiling.

The Encaustic Decoration.

It is on the ceiling and walls of this ambulatory that the extent of the so-called encaustic painting, of which we have heard, has been executed by, and under the direction of, M. Sang, the artist of Munich. Some notices of the day have proved a verbal description to be of so little use in elucidating mere matters of colour and pictorial device, that we shall abstain from anything more than a very general notice of M. Sang's performance. His object has been to obtain colour by the Raffaellesque style of decorative design, and in this he has admirably succeeded, displaying a most inventive fancy, great elegance of outline, large resources for the enrichment of purely architectural members, a perfect knowledge of the harmony and balance of colours, and extreme beauty of execution. Under the advice of the architect, he has maintained the expression of the edifice by the various national heraldic subjects, introduced into the leading compartments of the ceiling, while the somewhat minute character of his detail increases the expansiveness of the general architectural effect. Notwithstanding its frequently-questioned appropriateness, we are glad to see this class of decoration finding its way into the mart of merchandise; even there, the loiterer may now become impregnated with some of that zeal for art, which shall ultimately vindicate us from the alleged tastelessness of the mere *nation boutiquière*. Not that we speak of this mode of embellishment, for a moment, in the same tone that we should adopt towards the highest school of pictorial composition; but it is still a department well calculated not only to please but to improve the common taste, and quicken the perception of beauty in general. It is, moreover, a department to which English skill has been very little directed; while on the continent, and especially under the auspices of the King of Bavaria, it has for years been cultivated with great assiduity and success. Hence the difficulty in the present instance, where expedition seems to have been a primary object, of decorating such a large extent of surface without some assistance from those accustomed to the same work abroad. Had the Gresham Committee been prepared to authorize the execution of a series of paintings of a far higher order, in the historical and descriptive departments, so far as these might have been applicable, it is matter of evidence that English talent would have been more than adequate to every exigency; it is from the novelty and peculiarity of the work alone that any necessity arises for extraneous assistance.

We have hitherto omitted to state, that the north and south approaches to the quadrangle, as well as the entrance under the tower, have also had their ceilings painted by M. Sang, in fresco; the eastern entrance is particularly successful. We must also mention, before leaving the ambulatory and its decorations, that its north-east and south-east extremities contain niches, which are tenanted respectively by the statue of Queen Elizabeth, by Mr. Watson, and of Charles II., by Gibbons; the latter being the identical occupant of the central place in the former Exchange. These statues, of course, refer to the buildings for the same purpose erected in the reigns of the sovereigns they represent.

Tesselated Pavement.

In closing our account of the quadrangle, we have only to observe that its open area is floored with tesselated pavement, under the care of Mr. Singer.[1] Its design consists, generally, of a large fret and accompaniments, forming a broad external border, after which the elongated form within is subdivided by other bands of ornament into a square between two oblongs; each of these figures has then a lozenge inscribed within it, entwined with a circle at each of the angles. The space left in the centre of the larger figure is intended to afford the site for Mr. Lough's statue of Her Majesty; the centres of the smaller lozenges are occupied by a semi-arabesque flower. he general design is by no means characterized by the exuberant fancy of some of the Roman remains; but its effect of colour is rich and good, harmonizing well with the *tout ensemble* of M. Sang's adjacent performance. We have only to hope that the dust of traffic may not totally obscure, nor exposure to the elements quickly destroy, Mr. Singer's production; as the experiment which he has here made is one which we would willingly see repeated, and with success, wherever a favourable opportunity may present itself.

The Sculpture.

We are sorry that, after going the round of the building we find we must be very brief in the consideration of the remaining accessory, that of sculpture. Mr. Westmacott's production, which occupies the tympanum of the pediment, seems to us a display of individual figures, civic, commercial, and foreign, rather than a composition, those figures being well executed, but minute withal. The whole is meagre as to descriptive interest; and the isolated as well as emblematical character of the presiding figure of Commerce, amidst sixteen occupied realities, leaves it open to the charge of that want of significancy urged by the author of a *jeu d'esprit* which appeared in *The Times* about a month since. The general effect, however, is rich, the relief powerful, and the principal lines in harmony with and subordinate to those of the architecture. We object to the motto from Scripture, as being a mere sculptural subterfuge, and especially out of keeping with the Latin inscription beneath.

The department of architectural sculpture, such as that of devices, draperies, flower-carving, and the like, has, we are given to understand, been committed to Mr. Westmacott. The golden days of Grinling Gibbons are gone, without leaving to us his worthy representative. Greatly is it to be lamented that our present architects are not more solicitous to revive the ancient school of carving, and reject the trumpery and meretricious finery of plaster and composition, which affords to every pretender a means of display as equivocal in taste as it is cheap in execution. The mischief of all this, is that it substitutes the mechanical for the imaginative, the perpetual repetition of one idea for the renewed creations of individual genius. As ordinary spectators, we never walk round the inside or outside of St. Paul's, without wishing that all the members of the architectural profession could be made to feel this fact as deeply as we do. In the Exchange, however, there appear many steps taken in the right direction; and we hope to see the same track followed with increasing success by all future practitioners who value their art for anything more than its commission.

Lloyd's Room.

Before closing our remarks, we must notice Lloyd's rooms, which are the only apartments of any public interest. They occupy, as before stated, the north-eastern portion of the principal story of the building, and are approached by a staircase of amplitude and solidity, arranged in easy stages, but exhibiting little effort at display. From this we enter the archway leading to what is, specifically, the lobby, a lofty apartment, equal to a square of about 35 feet, but of irregular form on the north side. From the irregular portion, however, a symmetrical space is cut off by the intervention of a columned arcade of three openings. This lobby communicates to the west with the commercial-room, to the south with the subscribers' or underwriters'-room and its suite, and to the east with the captains'-room. The commercial-room is affected in plan by the general obliquity of the site, but is treated in such a way as almost entirely to disguise that fact. Its extreme length is about 92 feet; its average width 40, and height 30. It is divided into five compartments in length by means of broad enriched piers on each side; these compartments answering to the same number of windows, which derive light from the upper part of the merchants'-court. Each corner of the room is a quadrant, in the centre of which stands an Ionic column, elevated on a pedestal, and giving support to an advancing angle of the entablature, which is continued round the room considerably enriched. From this springs a cove to meet the plafond of the ceiling, across which all the prevailing lines of the vertical architecture are continued, and from which, by the five principal compartments, light is liberally introduced through elegant horizontal glazing. But the principal of Lloyd's apartments, for size and symmetry, is the subscribers'-room, which looks into the quadrangle at its eastern end, and is an oblong of 98 feet in length by 40 in width. It is divided in length into six compartments, by members very similar in effect to those in the room last described, though their detail is totally different. Like that, it has its ceiling commenced with a cove-like arrangement, but pierced in each compartment into a half-groin, through the top of which light is introduced by an ornamentally glazed hexagon. The chief supply of light, however, is obtained reflectively, down the centre of the room, each of the six compartments of the ceiling being there elevated into a dome, with a window beneath its springing on each side. The effect of this mode of lighting is less brilliant, perhaps, than of that in the commercial-room; but it is beautifully diffusive and gentle, while abundant in its supply. The decorative detail in this room is very considerable, but far from overpowering: we observe in it the frequent repetition of the heraldic bearings adopted by the establishment of Lloyd's.

Leaving this room by an archway on the south-east, we enter the reading-room, an apartment 40 feet long by 25 wide, lighted by a lantern and fitted at mid-height with a gallery on each long side, approached by a double staircase on the east. The decorations of this room are not so elaborate as to detain us for a description; and we turn, therefore, by the north, successively through the secretary's-room, its anti-chamber under the tower, a clerk's office, and the kitchen of Lloyd's, which suite completes the circuit of the eastern court, and brings us to the captains'-room. More need not be said of this apartment than that it is a cheerful combination of three rooms in one, connected by wide archways, and occupying the north-east angle of the building; from this we are led out again upon the great lobby first noticed, and from which we retreat without thinking it necessary to carry the reader through a series of various other and less accessible apartments of no public interest.

Here, then, we conclude our review of this important structure; and in doing so we shall not pay the architect or his co-operators the adulation with which the crowd are too apt to laud every new building of magnitude when clean from the mason's hands, as a superb edifice, magnificent pile, and whatever else the use of equally discriminative terms can make it. Be it enough that we offer the expression of our opinion that the building has merit sufficient to secure for it the approbation of futurity; which is the highest object a true artist aims to secure.

That we may not leave our account incomplete, we subjoin the names of those gentlemen who have been immediately and statedly engaged in superintending the building, or conducting its decorative departments, not omitting to recognize at the outset the services of Mr. Richard Lambert Jones, as the chairman of the controlling Gresham Committee:—

Mr. William Tite, architect.
Mr. Ebenezer Trotman, assistant.
Messrs. G. and R. Webb, builders of the foundations.
Mr. Thomas Jackson, builder of the superstructure.
Messrs. Westmacott, Behnes, Carew, Joseph, Lough, and Watson, sculptors.
Mr. C. H. Smith, architectural carver.
Herr Frederick Sang, decorator in fresco and encaustic painting.
M. A. Singer, maker of tesselated pavement.
Mr. E. J. Dent, clockmaker.
Messrs. Mears and Son, bellfounders.

In conclusion, we derive satisfaction from a belief that the general state of professional, and even of public taste, as well as the recently increased facilities for building, are in favour of great advances in architectural excellence. Within less than an interval of 20 years, we find that an edifice, not far differing in size from the General Post-office, and displaying incomparably more studied composition and elaborate detail, can be raised at about half the cost which that structure demanded. We wish all success to art and its professors, and hope that, for the national credit, its interests may never be dissociated from the favour of those influential men who shall hereafter assemble in the new Royal Exchange, the centre of the commerce of the world.

Atmospheric Railway.—The *Constitutionnel* states, that "the first trial on a large scale was made of M. Hallete's plan of applying the atmospheric system to railroads a few days since on a space of 300 feet in his manufactory at Arras. The result appears to have been so satisfactory, that Messrs. Arago, Seguier, and other distinguished engineers, are to be invited to witness a second trial in a few days."

[1] The tesselated paving since the opening of the Exchange has been removed, it is a failure either through its being exposed to the open atmosphere, or not being properly embedded in a cement that would withstand the influence of moisture. The area is to be covered with Seyssel Asphalte.

REVIEWS.

Lectures on Painting and Design. By B. R. HAYDON, Historical Painter. London: Longmans. 1844.

Haydon has created such a sensation in the artistic world that the greatest interest has been felt with regard to his book. Those who have heard him lecture knew how to settle the matter, but many of the public knew scarcely what to expect. Was it to be something very bad and very horrible, abusing the cocked hats of the Academy, and putting forward a farrago of trash and discontent? This many have asked, and many will ask, on hearing of a book from the pen of the Great Satan of Art, which many innocent people, on the ingenious suggestions of their neighbours, believe him to be. To this we can answer that it is a mighty pleasant kind of book, hardly a word about the Academy but what is good, no treason about Queen Elizabeth, and a great deal of sound and useful information. It will be as pleasant to those who appreciate the exertions of a hard-working man to know this, as it is unpleasing to those who treat him as a bugbear to find that they have no points on which to lay hold. As to ourselves, we are not Haydonites, but we know of no allegiance we owe to the Royal Academy to take part in squabbles against Haydon, and we think we are able to form a good judgment of our own with regard to him. He has very likely been an indiscreet man, he has involved himself in artistic rows there can be no doubt, and he is morbidly sensitive as to the feelings of the Academy towards him, but what we have got to deal with is his public conduct as a teacher of art, and we can readily ascertain that. He has for the last ten years been engaged in diffusing public information on art among the literary institutions of the country, sometimes receiving an inadequate remuneration, but often, to our personal knowledge, making great sacrifices and putting himself to much inconvenience in order to promote some public object where he could meet no reward but the conviction of having rendered a valuable service. In his lectures he may on some points have been unsound, no man is perfect, but there cannot be the slightest doubt in the world that he has done more to give the public information on art than any man in this country. Haydon's lectures have co-operated more than anything else in the extension of schools of design and of artistic instruction, and he has every reason to be gratified that he has been listened to, upon a little known subject, with attention, with admiration, and with the determination to profit by his advice. These discourses have also roused the public as to the fresco competitions, and prepared them to appreciate the works exhibited for their inspection. Art Unions have also benefitted by the popular sympathy so excited, and no impartial inquirer will doubt that immediately and indirectly he has done more for the arts than any single individual. On these grounds he is entitled to our gratitude and our attention, and all the private demerits in the world, if any attached to him, could never cancel these public benefits. We believe, however, that as to the squabbles between Haydon and the Academy the exasperation is much moderated on both sides, and that with the good feeling of the public a better disposition will be infused.

The lectures of such a public servant demand, therefore our attention, but do so the more strongly as Haydon's exertions have greatly advanced the public taste for art, and excited a feeling which we have endeavoured to stimulate, and which is already bringing a powerful influence to bear upon architecture, as we hope it will yet more decidedly do. Let us have better educated architects, a better educated public, aye, and we say better educated critics, and we may hope for the advancement of architecture, and on these grounds we now, as we have always done, devote our attention with pleasure to one of the collateral branches of the fine arts, which we firmly believe are essentially united. We cannot but think it would be much better if painters and sculptors were more of architects, and architects more of painters and sculptors, for we are certain this is essential to the exertion of every energy of art. A great source of Charles Barry's power undoubtedly is his appreciation of colour and design in connection with his architectural monuments. Who does not prefer the Reform Club to the British Museum or National Gallery whitewash?

These lectures of Haydon we have had the pleasure of hearing more than once, and yet we read the book with as much delight as if it had been quite novel, and so, too, will all its readers. Difficulty, indeed, has been already experienced in finding fault with it; it has been intimated to be unsound, but it has not been proved, while that it is entertaining none have expressed a doubt. It is pretty certain, indeed, that it must become a manual not only for the student but for the public, and it is well qualified for this, including in a small space the rudiments of artistic knowledge, with adequate illustrations from Mr. Haydon's pencil. The anatomy is carefully got up for the use of the artist, elarging on practical applications, and free from non-essential anatomical minutiæ.

Haydon's doctrines are well enough known. First, that High Art is everything; second, that the Greeks were the greatest masters of High Art; third, that the ideal in art consists of the selection of the best points from the best models; fourth, that dissection and a knowledge of anatomy are the essential preliminary to the artistic career; fifth, that Michael Angelo is not to be swallowed wholesale; and lastly, that people may stop at home and become great artists by studying the Elgin Marbles. The last words Haydon says he wishes to utter on art are "Elgin Marbles, Elgin Marbles," and to them and the Cartoons he constantly refers. To Haydon's practice the public will of course appeal, and we think there he has many points in his favour, for though we believe he often misconceives his powers and has painted as many bad pictures as any man, yet we think few have produced more good works, and in those he shows more mind than any of his competitors. Unfortunately he paints for halls such as are not yet built here, and his efforts are often ill-appreciated, and yet such works as the Napoleon Musing and the Leap of Curtius would be alone sufficient to stamp him as a man of high genius, had he not other and not less valuable works.

It is of course a great temptation to rifle the stores of such a book, and we have many excuses for the author's benefit, but we feel we need be sparing, while as we can scarcely enter with our readers into the minutiæ of painting and design we must string together a number of desultory extracts and remarks. The anecdotes of artists and public men are often good illustrations of valuable doctrines. Here is a tradition of Vandyke—

In the same way, as the above descriptions come direct from the great men themselves. I can give you authentic intelligence from Vandyke's own painting-room.

An old lady of eighty sat to Richardson; she, when a girl, had sat to Vandyke. She told Richardson, Vandyke's pictures looked whiter and fresher than at present; Richardson told Hudson, Hudson told Reynolds, Reynolds told Northcote, and Northcote told me. So that I can give you positive information up to Vandyke.

Wilkie's first public appearance with the Village Politicians may follow—

Never was anything more extraordinary than the modesty and simplicity of this great genius at the period of this early production. Jackson told me he had the greatest difficulty to persuade him to send this celebrated picture to the Exhibition; and I remember his (Wilkie's) bewildered astonishment at the prodigious enthusiasm of the people at the Exhibition when it went, on the day it opened, May 1806. On the Sunday after the private day and dinner, Friday and Saturday, the News said, "A young Scotchman, by name Wilkie, has a wonderful work." I immediately sallied forth, took up Jackson, and away we rushed to Wilkie. I found him in his parlour in Norton-street, at breakfast: "Wilkie," said I, "your name is in the paper." "Is it really?" said he, staring with delight. I then read the puff "ore rotundo," and Jackson, I, and he, in an ecstacy, joined hands and danced round the table.

Haydon himself may come in on the subject of ears—

Not one in ten thousand perhaps, Mr. John Bell says, can move his ears.

The celebrated Mr. Mery used, when lecturing, to amuse his pupils by saying, that in one thing he surely belonged to the long-eared tribe; upon which, he moved his ears very rapidly backwards and forwards; and Albinus, the celebrated anatomist, had the same power, which is performed by those little muscles not seen.

I tried it once in painting with great effect. In my picture of Macbeth, (Painted for Sir G. Beaumont, 1812, now at Colchorton Hall,) when he was listening in horror before committing the murder, I ventured to press his ears forwards like an animal in fright, to give an idea of trying to catch the merest sound; and it was certainly very effective, and increased amazingly the terror of the scene, without the spectator's being aware of the reason.

Of his favourite Elgin Marbles he tells as follows—

"What are these marbles remarkable for?" said a respectable gentleman at the Museum, to one of the attendants, after looking attentively round all the Elgin marbles.

"Why sir," said the man with propriety, "because they are so like life!"

"Like life," repeated the gentleman with the greatest contempt; "Why, what of that?" and walked away.

To this gentleman it might appear no great thing to render works of art like life; but if he had reflected—so many are the by-paths which branch from the main one, so much do men sophisticate in favour of their own propensities,—so easily are all deluded by the seductions of idleness—that, in 4000 years, few indeed are the men who have made their imitations like that life with which they are eternally surrounded.

Opie is brought in for the following illustration—

In the infant, the jaw not being formed, the shape of the mouth is not altered; but in age, the jaw having been formed in manhood, the moment the teeth and alveolar process fall away, the jaw rises up, the lips double in, and the external shape, in consequence, is one of the greatest characteristics of age and feebleness, and more mortifying to human nature than any other that happens to it, in its progress to the grave: there is nothing so prostrates human vanity. There is a story told of Opie: he was painting an old beau of fashion! Whenever he thought Opie was touching the mouth, he screwed it up in a most ridiculous manner. Opie, who was a blunt man, said very quietly, "Sir, if you want the mouth left out, I will do it with pleasure."

And while on the subject of pictorial effect, we may sketch the following—

A critic has no more right to find fault with a picture where the effect of smoothness is given by roughness, than a lover has because the softest face of a beautiful woman is not as soft apparently, however soft in reality, on close inspection, as where it can be best seen.

I remember an old lady being astonished at the Duke of Wellington's Velasquez, and expressing great delight, and then looking close in, and saying in disgust, "Why, it is painted for the distance I see."

The following it is very clear applies to Brougham—

For thirty years I have urged the point of public encouragement, independent of academic influence, and all our greatest men seemed absolutely abroad on the subject. Even Canning was not at all aware of the connexion of art and manufacture, or the moral importance of High Art as a commemorative power. They shewed the best dispositions; they took it up always with enthusiasm, because their common sense was appealed to; they then proceeded to inquire of the official academician. He replied, the nation had no taste, the artists did not require it; and the minister, astonished at such remarks, received me the next time like a distempered madman. Lord Brougham, Lord Durham, Lord Farnborough, Lord Colborne, all took up the cause and dropped it in a fright. Wonder no longer at the fate of history, at Hussey's persecution, Barry's struggles, or my prostration of fortune.

Would you believe that a noble Lord, known to you all, to whom we all owe obligations, actually said to me, when laying before him my plan to adorn the House of Lords, in 1823, "Do you think the people will ever have any taste?" Suppose I had said to him, when he was founding a university, Do you, my Lord, think the people will ever have any knowledge? No, he would have replied, unless you give them schools and books, and open their understandings; and so I say of art. How can they have taste if you found not schools of design, or shew them fine works? Of all the ministers with whom I have had the honour of communication, none paid so much attention as the Duke of Wellington; he replied at once, gave his opinion, and received mine with the frankness of his character; he entered into the question, allowed me to argue it, and to prove him wrong if I could. I got no cold official sophistry from him, his mind is a mind not to be talked over by an academician; he saw the value to the country of public support to art, he lamented its dreadful condition, and I believe in my conscience he would have remedied its defects. I know he has said so since, but not to me.

Coleridge is one of the personages of the next extract.

Coleridge, with all his wild dreams, was always selecting for the artist; and I never in my life remember one of his subjects which had a single qualification. Coleridge was seldom intelligible, with the subtle distinctions of words, much less likely was it in art, which requires gross palpability, he could make himself understood.

I have seen the finest scenes in the world between Coleridge and Sir George Beaumont. Sir George's adoration of Sir Joshua was sincere. Coleridge would often attack him; the agony of Sir George between his enthusiasm for the genius of Coleridge and his awe for his departed friend are not to be done justice to.

The mania of Reynolds for colour is thus characterized—

The imitators of Reynolds endeavoured to get this beauty in their pictures by all sorts of solid materials, never considering it was not the solidity of the vehicle, but the manner of using the vehicle. The richest and most solid impasta can be got by taking the colour half dry and touching into it, thus half dragging up what was put on before, and embodying both in one rich gummy surface; this requires that rare quality—genius. The continual outcry of imbecility is, that the Italians had better reds, better yellows, better oils, and better brushes, than the moderns: this is a great delusion. Titian got his colours from the colour shops in the Rialto, as we get ours from Brown's; and depend on it, if Apelles or Titian were living now, they would paint just as good works with our brushes and colours as with their own. Sir Humphry Davy says, that the finest works of the Greeks and Italians were executed in the ochres, reds, blacks, whites, and blues, we all now use. Reynolds, from a craving for superior excellence, was at the mercy of every new freak—fancying one day, one material was the thing, and the next, trying a new one; to show you his extreme readiness to try every thing, Mr. Prince Hoare told me he once carried him a colour in a shell from India, a beautiful purple—he was glazing those three angels embracing each other, —he dipped a brush at once into it, and used it; the next day it had all flown. In reality, the Old Masters had by no means so many advantages as ourselves: Titian painted often on table-cloths; Rubens's pictures are often seamed; canvass was then narrow and coarse.

And it must not be said that Haydon depreciates Reynolds, though he contests with apparent justice many of the doctrines in his lectures. He says—

In the dignity of portrait, no heads exceed Reynolds', though Titian's and Vandyke's are more delicate in execution. He was a great man, but certainly a light thinker; and yet, considering his incessant practice in individual resemblance, it is extraordinary he wrote as he did. He first brought the principles of art into something like consistency; and, though greatly indebted to Coypel, he first rescued it from the trash of De Piles, the common-place recipes of Lionardo, great man as he was, and all the old bewildered theorists; and, in his immortal notes on Du Fresnoy, he has settled on a basis, never to be shaken, the leading rules of effect, light and shadow, and colour. Here he was truly great; it was only where his previous education and previous habits had not been deep enough that he wandered in his theory of beauty and form, which nothing but dissection of the brute and man can ever illustrate clearly. His eye for colour was so exquisite that I do not think there is a single instance in all his works of a heated tint which is called foxy. This cannot be said of Rubens or Rembrandt; and I believe in my conscience it can only be said of Reynolds and Titian.

And Sir George Beaumont's merits are also enumerated.

One of his dearest friends was Sir George Beaumont—he was one of those links between people of fashion and artists, who placed artists at their table with all who were distinguished in poetry, philosophy, oratory, rank or fashion.

There was a school in High Life of this description, which was formed by Sir Joshua, they looked up to him as a god, listened to him like an oracle, and believed a great painter to be the greatest of mortal beings.

On them Sir Joshua left his mantle, and they were principally instrumental in founding the British Gallery, and keeping alive in the fashionable world the taste for pictures. The loss of Sir George nothing has compensated us for,—his taste and genius were exquisite. Had he not been born in high life, in my opinion, he would have been our greatest landscape painter—he talked of art, he dreamed of art, and seemed to think nothing else on earth worthy consideration.

The moment he came to town, he set the whole world in an uproar, and made it an evidence and a necessity for any one of any pretensions of fashion to meet artists at his table, and to visit their painting-rooms, and buy their pictures.

He it was who laid the foundation of our National Gallery; he was the friend of Wordsworth, when the world denied his genius; and though he was capricious, and laid the foundation of all my distresses, as well as others, yet as painters we felt his loss bitterly in the art—a loss that never has been repaired, and probably never will; and when his admirable letters on art are hereafter published, it will be found his pretensions have not been overrated.

It was his decided opinion, and no one had greater right to hold one, that breadth and essential detail were the true excellence, and ought to be united; he knew the materials of art and the splendour of nature, and he knew nature could not be approached but by the most judicious artifice; and when painters painted all light, in hopes of getting brilliancy, or all dark, in hopes of getting depth, they entirely missed their object.

I have heard many artists complain of the disposition of people of fashion to bring forward young men—after having had the full advantage of such disposition themselves,—the more young men brought forward the better for the art; if the young men have not talent to keep the stations in which men of rank from the kindest feelings are disposed to place them, surely you are not to blame the patron for his good wishes.

Lawrence is also in our mind fairly appreciated. Haydon says—

Lawrence drew better than Reynolds, but Reynolds was never guilty of many ignorances of composition and design that Lawrence was guilty of every day.

In invention there is no comparison. Reynolds was a genius, and so he was in colour: whereas Lawrence had no eye, and I remember but one head of exquisite colour that might bear comparison with Reynolds—a head of Lord Bathurst; Gonsalvi, and the Emperor of Austria, *perhaps*, may be added. In composition, Lawrence was a child, and Reynolds a great master. Reynolds, from his knowledge of perspective, always planted his men on their feet; while all Lawrence's nobility stand upon their tip-toes, and will do so whilst the canvass lasts. Reynolds appeared, as Burke said, to descend to portrait from a higher style, while portrait and portrait only seemed to be the extent of Lawrence's understanding. Reynolds was the philosopher of art, Lawrence the gentleman, with a tendency to dandyism.

Lawrence's great power was seeing, transferring, and identifying the happiest expression of a sitter; and no man can bear testimony to this power more than myself, I had several under my own eye of the nobility he had painted; for the first half hour I saw no resemblance; at last, some lucky remark lighted up their features, and in these few moments I witnessed Lawrence's choice.

Before Lawrence went to Italy, which sobered his meretriciousness, Fuseli used to say, and truly, that his pictures in effect were sweepings of a tinshop; but through all his works there reigns a sense of beauty, which if it had been tempered and corrected by a reverence for the great names of the art, instead of being pampered by medals, with other young gentlemen and ladies in early life, would have corrected his taste; though Sir George Beaumont feared his eye was defective, and Reynolds predicted his style would attract the ignorant and ruin the art; he has not ruined it, but he did it serious harm. There is an interesting anecdote of the two men, so completely illustrative of each, that I will relate it. At a nobleman's house, there exists an exquisite picture by an old master. Reynolds, when there, always had it taken down, and with due humility dwelt on it for hours. Lawrence subsequently used to visit the same house. The nobleman, astonished at Lawrence's apathy, offered to have it taken down, which Lawrence declined, and retired to billiards.

With regard to the necessity for the artist to dissect, Haydon is most strenuous on that point, and we think with justice, even if abstract reasoning did not sanction it, practical experience is evidently in its favour. Let any one who can draw try to compose a figure in any attitude, and put in the muscles of the thigh or of the calf of the leg without a model, and he will find what uncertainty he will have as to their form, and the difficulty of getting a resemblance to nature. The study of the living model and of the antique will of course do much, but even this will be greatly forwarded if the student knows whence his muscles come, whither they go and how they act, and for this there is nothing like dissection. The author states what led him to his opinions on the essential characteristics of man.

Many years ago, whilst dissecting a lion, in my early youth, I was amazingly impressed with its similarity as well as its difference in muscular and bone construction to the human figure. It was evident the lion was but a modification of the human being, varied in organic construction and muscular arrangement, only where it was necessary he should be, that his bodily powers might suit his instincts, his propensities, his appetites, and his lower degree of reasoning power. On comparing the two, I found the human being stood erectly on two feet, the lion horizontally on four. On placing the lion on his two hind feet, resting on the heels and toes like a human being, I found he could not remain so; I found he had no power of grasping with his fore-paws (answering to the human hand, and but a modification); I found he could not move his fore-paw arms right from the shoulder, nor his hind-feet limbs right from the hip; I found his feet flat, his body long, his brain diminished, his eyes *above* the centre of his head, his jaw immense, and vast muscle occupying that portion of the skull, to assist the action of the jaw, which is filled by brain in a human creature; I found his spine long, his pan-bone narrow, his inner ancle lower than the outer, his chest contracted, and his fore-arm as long as his upper arm. I put down these distinctions as points characteristic in head and figure of a brutal and unintellectual being. I then examined the man: I found his power of grasping with the hand, by the action of his thumb, perfect; I found the motion of his arm free from the shoulder-joint, and his thighs free from the hip; I found his feet arched, his inner ancle the highest, his pan-bone large, which, by resistance to the action of the great extensor of the legs, increases their power, his eyes at the centre of his skull, his upper-arm longer than the fore-arm, his spine short, and his brain enormous. I put down these distinctions as characteristic in face and figure of a superior and intellectual being. These differences are facts—they were intentional, or accidental!—they were formed by the Creator, or they were not!—if they were as they were, there was reason in the differences, and that reason issued from the Creator's mind. Surely, then, it was justifiable to lay down a principle of form from ascertaining these distinctions. Full of delight, reference was at once made to the Metopes of the Temple of Theseus (which, being executed fifty years before the Parthenon, were more likely to develope system than the later works from the Parthenon itself, where art is so exquisitely concealed); and all the points put down as characteristic of a perfect human figure, were so evident, as not to be mistaken; and both in the works of the Parthenon, executed by Phidias and his school, and in those of the Temple of Theseus, the principles of a standard figure were so distinct, that I will defy any artist to have developed them so systematically and so decidedly without intention and without knowledge.

We are inclined to agree with the author that the Greeks dissected, we have positive evidence on the point, and the reasoning moreover on the negative side is, as he shows, defective. We agree with him, also, as to Michael Angelo; with him, we fully appreciate the talents Michael Angelo possessed, but it is incontestable that his sculpture really is generally extravagant and wanting in repose. We agree also with him that a man may become a great master without going to Italy, but his own impressions in the Louvre (p. 258) must show him that there is the greatest benefit in foreign travel, were it only to make a break in the conventional effect of home study it would be desirable. A young man mixing only with fellow countrymen and among exhibition works wants some lesson to remind him that there is other art besides the meretricious parades of Trafalgar Square or Pall Mall. The assertions of our author as to the supremacy of Greek painting must have the support of actual facts before we can receive them as anything more than ingenious assumptions. We must confess we are strongly inclined to believe that Greek art did not make the advances assumed, and we set at naught the hyperbolical expressions of contemporaries, for investigation will teach us how such have been misapplied even in modern times. A good feature in Haydon's instruction, and a fine characteristic of the man, is that he never forgets national interests, nor the connection of High Art with the humblest pursuits of manufacture, inculcating the importance of design as a grand principle in education.

Among the good advice with which the volume is thickly sown, the following will be appreciated by the young architect and engineer, by the old architect and engineer, as well as by the young painter and the old painter—

It was exceedingly fine of Sir Joshua, after making a large fortune, to tell the young men: "Were I now to begin the world again, to catch the slightest of Michael Angelo's perfections, to kiss the hem of his garment, would be glory and distinction enough for an ambitious man: I would tread in the steps of that great master." The question is, why did he not do it when he began the world? for this simple reason, he never had genius for it! Genius, be assured, is not a passive quality, and cannot conveniently be buttoned up for another opportunity, to be let out as Æolus does the winds, whenever the possessor is in the caprice. Genius is a gift which sits on a possessor like a night-mare; haunts him when a lisping child, a restless youth, or in confirmed manhood. Reynolds, Romney, Lawrence, and Chantrey, were always predicting what grand things they would do, as soon as they were above the necessities of life; as soon as snow ceased to fall and water to be frozen; as soon as babies cease to be tormented with abdominal twangs, and Daffy's elixir was no longer wanted; as soon as all was calm and sinless, and free from bad passion: when they were so, would not their judgment be more mature? When they have secured an independence, would not their genius be in a fitter condition for fancy? To this millennium of quiet they are always looking; at last it is the very time, to-morrow they'll begin. In comes another sitter—then come the guineas—then the dining out—then the bewitching flattery of some darling he has just painted successfully, and very like about the eyes. In the mean time, some youth, whom God has gifted, in poverty and struggle, spends his money, meant for food, to get clay for a model; conceives a grand figure—sets to work, without waiting for the three per cents., and you find, in an obscure, cheerless, wretched room, a gigantic figure of Milo towering to the ceiling, as fine a combination of High Art and true Nature as has ever appeared since the Greeks!

I am no friend to that lachrymose croaking about time of life; I am just as able now, at fifty-eight years, to set to work on a new acquirement as at eighteen years, and perhaps more able. "Was I to begin the world again," said Reynolds; of course he would do all sorts of things he had neglected to do, and follow Michael Angelo's steps. Now, he had been saying this forty years, why did he not at once, like Tintoretto, write over the door of his painting-room, "The day to Titian, the night to Michael Angelo?" and in six months we should have had his limbs more like legs and thighs than nine pins. Why? because he only had the consciousness of imperfection without sufficient power to impel the remedy. After lamenting thus to Burke, he would sit down to a game of whist, or adjourn to the club, to listen to the declamations of Johnson. Let every man begin at once, not to-morrow, but to-day, not by and bye at four, but now, at six in the morning, or as soon as it is light. No, no; Lawrence never would have executed a great historical picture, Chantrey, a grand heroic statue, nor Reynolds have become the Michael Angelo of the eighteenth century, had he began the world again; he would have done precisely what he did when he began it before: these lamentations of mispassed time are only artful palliatives to conscious defects. It is a refutable sophistry to say, the higher walk addresses the mind, the lower, the senses; the higher walk addresses the mind through the senses, and if the senses are shocked by the wretchedness of the imitation, and the want of power in the instrument of producing reality, the thoughts conveyed are not more impressive, because the means are inefficient—they are less so—and every thought, poetical, epic, pathetic, or comical, will have ten times more effect on the imagination in proportion to the abstract perfection of the reality of imitating the objects used to convey them. Study the great works of the great men for ever, but never as a substitute, always as an assistant to nature. Never hold any communion in early life with those who set out despising the illustrious dead, and you will find many—don't argue, fly; and above all things study alone. I can always predict the fate of any student who shares a painting-room with another for the sake of society. God help him who feels such a want with such a delightful vision in his brain, or at his side, by day and by night, as Painting! If you have genius, industry alone will make you ready for its inspirations; if you have not, industry at least will give you knowledge.

As to the grand doctrine of the ideal in art, we have long since declared that we do not believe in it. We think common sense in art is of much more importance than the ideal, and we are convinced a living human being, with all his imperfections, is worth the finest coagulum of selected beauties which ever were, or ever could be put together. This does not, however, affect the practical value of Haydon's work, which we are satisfied must, for a long while, be a great and popular authority, and as such we strongly recommend to all our readers engaged in the pursuit of architecture or the other branches of the fine arts, while we are firmly convinced that it adds to the claims of its author on the public gratitude and public admiration.

The Companion to the Almanac for 1845. *With Seven Woodcuts of Buildings.*

With respect to the general character of this annual publication, we need not say anything more than that it is still kept up with the same diligence and ability as have uniformly been displayed in it. Indeed, as regards that portion of its contents which is of more immediate interest to our own readers, and which, we think, must be the most attractive to the public generally, this new volume contains about half as much again of architectural information and description as the preceding one did, which space we should like to see still further increased, although the labour of collecting materials even for no more than is at present given must, no doubt, be very great, since, unlike all others, architects are apt to be far more reserved than at all communicative with respect to their works. The buildings here spoken of most at length are—the Royal Exchange; a church at Haugh, near Bolton-le-Moors, entirely constructed of terra cotta, and having an *openwork* spire; the two chapels at Nunhead Cemetery; Pugin's Roman Catholic Church at Nottingham, and St. Bernard's Monastery; two Institutes at Preston, the "Philosophical" and the "Mechanic's"; the Conservative Clubhouse; and the New Law Courts, or Guildhall, at Bristol.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Session 1844-45.—Ordinary Meetings.

Chair to be taken at 8 o'clock on the following Monday evenings:—December 2, 16, 1844; January 13, 27; February 10, 24; March 10, 31; April 14, 28; May *5, 12, 26; June 9, 23; July 7, 21.

* Annual General Meeting of Members only.

THE LATE COMPETITION FOR THE CHORISTERS' SCHOOL, MAGDALEN COLLEGE, OXFORD.

Sir,—Having seen from the careful perusal of your paper the great interest you take in the profession generally, and the desire you have always evinced towards exposing any grievances with which it may be assailed, I have taken the liberty of addressing you on the subject of the present faulty mode of competing for new buildings now so generally adopted, and frequently so unjustly terminated, and would call your attention particularly to that for the Choristers' School for Magdalen College, Oxford, which has, I hear, been decided in favour of a design sent in by Mr. Derrick, architect, of that city.

In the printed instructions issued to architects who might be willing to compete, it was distinctly specified that the designs must be sent in by the first of October, ample time being given (nearly two months) for completing the designs in question.

In commencing a competition two questions of the greatest importance naturally suggest themselves to the architect, first the sum of money to be expended, secondly the time allowed for preparing the plans, these are then considered as fixed points to be scrupulously observed, and he proceeds accordingly, however, on the present occasion all such general rules appear to have been treated with contempt by both parties, the facts of the case being simply these,—Mr. Derrick, who sends in his drawings at least two weeks after the time specified, is appointed to carry out his designs, he being a resident at Oxford, and having access, as any one had who was taken in by a member of the college, to the room where all the drawings already sent in were exhibited. The sum of £20 each has, I hear, been voted to Messrs. Allom, Pugin, and another; the estimate of the former being £1800 more than the sum mentioned to be expended (£5000),[1] and the second only submitting a pen and ink perspective view of what he considered the building ought to be, instead of sending plans, sections, and elevations as expected from the other competitors. I must say I am much surprised at such a termination to a competition which I hoped, knowing the high characters of the parties who had to make the selection, would have proved itself a pattern of justice and impartiality, and can only attribute it to a want of knowledge of business on their part, and must in conclusion call upon the profession generally to come forward and appeal to the Institute of British Architects to take the necessary steps to put an end to a system marked with such gross injustice. The Institute is an incorporated body possessing a royal charter, and it is scarcely necessary to add that public bodies can easily accomplish that which a private individual would not venture to attempt.

Unless some remedy is found for this crying evil, these repeated acts of inconsistent conduct must necessarily tend to lower the profession in the eyes of the public, and will end by destroying its respectability altogether, when they see such treatment as it constantly suffers borne with impunity, and without any measures being taken to remedy the evil, and at the same time protect professional men from wasting their money and valuable time in such an unprofitable manner.

By inserting the above in your very useful paper you will put others on their guard in future, and at the same time oblige your obedient servant,

A Constant Reader.

London, Nov. 25, 1844.

[1] This amount was not specified in the printed instructions, but that can be no excuse, for of course on so essential a point application would be made to the bursar of the college, who named £5000 immediately as the sum to be spent on the proposed new building.

THE CAMBRIDGE CAMDEN SOCIETY.

The Ecclesiologist.

The present age is characterized by a retrospective spirit, which prevails at once in literature, in science, and in art. At a time confessedly favourable to the progress of knowledge, and to the discovery and development of new ideas, there exists a mania for resuscitation, a general anxiety that old intellectual treasures should not be forgotten or neglected by reason of the abundance of new wealth. A feeling of this nature cannot be objectionable *per se*, and if ever liable to objection, it will be only when exhibited in an intemperate manner, or on unworthy objects. It is an almost universal feeling, and has manifested itself in ways strangely various, and by effects most ludicrously discrepant. It has produced, for instance, the various societies which republish obsolete and forgotten books, it has renewed a taste for old music, resuscitated Bach and Jomelli, stimulated the study of the older dramatists, and effected the public performance of the plays of Massinger. To this same endemic we owe the revival of the harpsichord, and to it the fashion for frescoes and cartoons, Flanders chimes and encaustic tiles; and unconsciously influenced by one and the same spirit Fanny Ellsler and Doctor Pusey have introduced, she the minuets of the old French court at the opera, he the *all-but* system of theology at Oxford; at Cambridge the disease has assumed a milder form—it has terminated in a Camden Society.

The Camden Society, most of our readers are aware, is a collection of amateur architects, reverend tectonick enthusiasts, modern Nehemiahs, who, under the somewhat pagan motto *Donec templa refeceris*, aim at a radical reform of church architecture, send their younger members flying about the country with "lead-tape" to copy mouldings, and with "heel-ball" (of the nature of which composition, as well as the orthography of its name, we own ourselves profoundly ignorant,) to rub away at old brass monuments and obtain delineations of them; also hold monthly meetings with honorary president, honorary secretary, and all complete; restore churches and drive the incumbents out of their senses by their modern-antique zeal, and finally publish the somewhat flippant, and occasionally ungrammatical, but withal, in many respects, excellent periodical before us—the "Ecclisiologist."

That this publication has done much to revive the true spirit of Christian architecture, to protect the old memorials of that art from the injuries of time and the still more ruthless attacks of officious ignorance, to give back to the cathedral its grandeur, the village church its simple beauty, none but the biassed will deny. But, alas, the unprejudiced observer will too often have reason to grieve that in a cause so noble, and so worthily advocated, zeal has degenerated into intolerance, confidence into dogmatism, boldness into bigotry, that assertions have been made without proof, and maintained in defiance of it; that accidental accessories of the art have been mistaken for its fundamental principles, and mere architectural rules have been confounded, or at least intimately connected, with religious doctrine.

If anything of human art may elevate the soul to noble purpose, cheer it when exanimate, solemnize it in its careless or impassioned moods, it is those venerable records of olden piety the stately minster lifting itself up, sternly and alone, speaking though silently, and telling ever wondrous stories of the dead and of the past; or the sweet simple country church, moss-grown, time-stained, which raises its beautiful head above its coeval trees, the simple and touching memorial of ancestral faith.

If anything of human ignorance may excite indignation, instead of pity or contempt, it is the meddling barbarism of churchwarden architecture, which mars the reverend piles more hopelessly than the ravages of the elements, and still worse, far worse, the Wesleyan Gothic of modern sciolism, which apes the ancient Christian architecture accurately enough to travesty it, and copies it in the letter with a fatal fidelity by which its spirit is violated or altogether concealed. How, then, must the lover of beauty grieve that they who betake themselves to remove these detestable evils should perform their task with such hot zeal as to defeat their own purpose, and by intemperance and excess awaken the fears, and influence the prejudices of ignorance, and so perpetuate the very errors they strove to correct?

That we may not be accused of bringing unsupported charges, we intend to consider some of what we believe the erroneous doctrines of the "Ecclesiologist," as exhibited in the last two or three numbers of it, and we may do so with the greater facility, as the editors usually exhibit in each successive part, in one form or another, the whole of their somewhat scanty stock-in trade.

Commencing with the number of the "Ecclesiologist" last published (in September), we find it opening with a paper on the arrangement of chancels.

We suppose then a Chancel raised a single step of six inches' depth at the Chancel-arch, and, considerably Eastward of this, on two other steps at least; that it has a plain Altar of substantial material placed lengthwise under the East window, and well furnished with changes of hangings and with Sacred Vessels of proper shape; that the south wall is furnished with a single Piscina to carry off the water in which the Priest has washed his hands before Celebration, and westward of this with three Sedilia, or seats for the Celebrant, Epistler, and Gospeller, constructed, if possible, in the masonry of the wall, if not, consisting of oaken tabernacle-work of appropriate pattern; that the north wall is provided with a Credence, resembling either a table, or a niche or bracket; and that in all other respects our Chancel is entirely free, open, and unoccupied: what more does it require?

We do not think this a fitting place to stop to ask whether the above passage tends to aggravate the fears of those who charge this work with favouring Roman Catholicism. We confine ourselves to the architectural tenets, and we wish to show that the doctrines so earnestly advocated respecting the form and position of chancels are, at least, not inexpugnable. We may commence by observing that the above suppositions are wholly at variance with many existing models —for instance, the Temple Church, and the Camden Society's pet church, St. Sepulchre's at Cambridge, even if we concede the position of the "Ecclesiologist," that in both of these the whole building eastward of the circular part be considered a chancel, the aisles of which are alone to be occupied by the laity, who are consequently excluded from (in the former instance at least) the greater part of the sacred edifice. The alleged absolute necessity of a distinct and spacious chancel leads to a difficulty, owing to the general insufficiency of church accommodation, which the conductors of the "Ecclesiologist" cannot have overlooked, but they defend themselves against the difficulty by "many and sound reasons," of which the principal seem to be that a distinction of structure must be made between churches and "conventicles" or "preaching-houses," and next that the ancient churches were all built in the manner they are prescribing. To which last argument we have merely to object, first, that even *if* all the ancient churches were built in the manner asserted; that *alone* is not a sufficient argument for so building modern churches: secondly, that the ancient churches were *not* all so built; thirdly, that there is reason to believe that in ancient churches the arrangement of the chancel was altered at the time of the reformation.

With respect to our first objection, which may be termed the theoretical, we must consider on what principles it is deemed absolutely necessary to follow the ancient models of Christian architecture without the slightest deviation. Obviously on two only; first, that the *present purposes* of churches could not be obtained without so doing; secondly, that all changes of structure must lead to architectural errors. Now it can hardly be said, that the present purposes of churches cannot be adequately obtained without excluding the laity from a large part of them, since such an assertion would lead to the conclusion, that the rites of the church had never been celebrated according to the rubric in any one church in the kingdom for centuries. And if it be contended that the absence of a distinct chancel is necessarily an architectural error, the *onus probandi* lies with those surely who make the assertion, to show how it is that the fundamental essence, spirit, and principle of pointed architecture are so indissolubly connected with the existence of the chancel as to be incapable of vitality without it. This difficult task the Camden Society have never undertaken, or at least, only by the *petitio principii* of quoting ancient authorities.

We consider that simple considerations such as the above, successfully dispose of this incessantly urged "necessity of a spacious chancel;" and our opinion will be much confirmed by reflecting that the ancient churches were built of every form and under every variety of circumstances; that the laws of Christian architecture, unlike those of Grecian architecture, are susceptible of almost endless adaptation and modification of structure; that in many instances the eastern part of the church was built first, and even in the times of Roman Catholicism, filled by the laity, until the western part of the church was erected, and that in many instances the western parts were not completed at all. The supposition respecting the Temple Church in London, we consider preposterous, and should probably pronounce the same opinion respecting the Round Church at Cambridge, had not the Camden Society so altered it as to render it impossible to remember its original form. Their alterations in that building they can scarcely call *restorations*, in the ordinary acceptation of the word, since they themselves will scarcely assert, that it ever has since its foundation, presented anything like its present appearance. They have destroyed *real* perpendicular architecture of the time of Henry VII., and built up perpendicular architecture of the 19th century; they have paved the interior with plain brown crockery; feloniously insinuated a table of prothesis; forced the minister into a litany desk; brow-beaten the parishioner into the endurance of a communion table made of stone; and when complained of, make much the same answer that the lion in the fable did to the stork, who pulled the bone out of his throat.

But we promised to show that there were grounds for believing that the arrangement of church chancels was altered at the Reformation. The canons of the Church require, that "the commandments shall be set up at the *east end* of every church where the *people may best see and read the same.*" The writers of the "Ecclesiologist," fairly confess themselves in a difficulty respecting this canon, and suggest various means of rendering it inoperative—in their own words "considerations which may help to explain (!) this ordinance." The first of these suggestions is that the east end of every church means the east end of the nave! Now, supposing for an instant, the east end of the nave to be meant, where can the commandments be placed so that "the people may best see and read the same." The "Ecclesiologist" candidly owns "it can only be above the chancel-arch; so high, in most cases, as to be out of people's sight." This admission forces us therefore to believe that when the canon speaks of the east end of the church, it really means the east end of the church. A dangerous assumption truly! For the reformers were such imperfect churchmen that they are seldom allowed to have said what they meant, or to have meant what they said. If, however, the commandments *must* be placed on the eastern wall of the chancel, and that be the best place for seeing and reading them, we suppose the people *must* be admitted into the chancel.

We shall now notice, briefly, a few more of the arrangements which the "Ecclesiologist" would have in their chancel:—

The entrance-arch must be crossed by a screen. This will be composed of an unequal number of arched compartments, of which the middle one will span the main alley of the church: that alley, which commencing from the font at the door stretches along the pathway of a life of meek devotion, and passing at this poin the gate of death, conducts into the blessed mansion of the church invisible

This in the nineteenth century!

The recipe for making stalls is excellent:—

"Prayers are to be said, we therefore need a prayer-desk. But an injunction of King James directs that a convenient seat be made for the minister: at the back of our desk we must therefore have a chair. And putting these two parts, the desk and chair, together, we get a complete stall. But it appears in the contemplation of the prayer-book that more than one person shall take part in the performance of divine service—there will be more stalls than one. But since confirmation and visitations are, or ought to be held periodically in every parish church in the kingdom, and on these occasions there will be present a bishop and many priests, it may be stated generally, that *every chancel will be furnished with rows of stalls*—say six or nine on each side, and returned against the eastern side of the roodscreen."

There is something quite dramatic in all this. How the plot thickens.

The simple innocent "prayer-desk" multiplies and increases as if it were a trick in a pantomime, till at last we have "complete rows of stalls" and, oddly enough, arranged *just* in the Roman Catholic manner. Singular coincidence! Quite accidental of course, but curious notwithstanding.

Before leaving this part of the subject, we may observe, that the principle which the earlier numbers of the "Ecclesiologist" warmly opposed, that Christian architecture may admit modifications in compliance with modern requirements, has latterly been distinctly recognized, for instance, in the following remarks on Lancet architecture:

"It cannot be denied, that there are circumstances attending church-worship at the present day which render a certain quantity of light indispensable." * * * "Additional light should be gained rather by the repetition and judicious repetition of single lancets. We have very small printed prayer-books to read, and very popular preachers to behold. We cannot follow old proportions. Then, we say, adopt a style in which you can [*do what?*] Do not abuse ancient designs, &c."

As far as we can understand this curiously-worded passage, it tacitly admits the expediency of adapting ecclesiastical architecture to our present wants—a principle absolutely the reverse of that so earnestly advocated in these papers at their commencement. If then, a year or two have converted the Camden Society so far, that they now contradict their own primary dogmas, may we not hope that at no distant period, they will apply the principle which they have admitted, and allow that it is well that a Protestant congregation should be so placed as to hear the minister as well as see him, and that it is *not* well, while our churches are already too small to contain even a fraction of the population, while so large a proportion of the people are suffering from spiritual starvation, are practically without a Sabbath, and never participate in the most ordinary rites of a Christian land that one-third of the existing church room should be taken away to satisfy a controverted antiquarian tenet.

We cannot better conclude these remarks on chancels and their uses, than with the following quotations from the paper under review. The restoration of the rood-screen being determined upon, the writers proceed:—

"Assuming it impossible to restore rood-lofts—we shall get as near as we can to the old position, by reading the epistle and the gospel on the eastern side of the rood-screen. And there will be this practical advantage gained, that the people will better hear *what as being addressed to them it is proper that they should hear*, namely, the epistle and gospel. [It is of no consequence whether the people hear the rest of the service.] We do indeed hope that the time will come when he that evangelizeth may again, as in ancient days, get him up into the high mountains."

That our readers may comprehend the dark sublimity of the above passage, we may inform them that the latter part of it refers to the known Catholic custom of reading the gospel from an elevated place. And here we leave the subject, with this simple question—If these be the uses to which chancels are to be applied, had we not better have no chancels at all?

We have not time to consider so fully as we hoped to have done, some other favourite doctrines of the Camden Society. We had intended, for instance, to have controverted their assertion, that galleries are wholly inadmissible in churches. We cannot give more than a mere outline of the course of argument which we should have pursued. That the galleries at present seen in most churches are hideous deformities cannot be denied. They disfigure the architectural beauty, and *therefore* diminish the fitness and true worth of sacred buildings, by cutting in half the shafts of pillars and the windows which were built to light an unbroken space. But, as we have before hinted, a distinguishing feature of pointed architecture is what may be termed, for want of a better word, its *adaptability*, that is the facility with which it may be applied under new circumstances and to new purposes. It therefore is by no means certain, whatever may be the defects of existing galleries, that in new churches galleries cannot be constructed without offending true taste and architectural propriety. Indeed, we may observe, that our cathedrals themselves suggest all the essential constituents of galleries in their beautiful triforia.

The number of the "Ecclesiologist" for August, commences with a cheerful chapter on church-yards. The following are said to be "the chief requisites of a well-furnished (!) church-yard:"—

"A low stout fence of stone, lych-gate, a church-yard cross, a yew tree, and a *well*." The object of some of these *articles of furniture* may not be obvious at first—the latter especially puzzled us not a little—however here is the explanation:—

"Their use is to supply water for holy baptism, and for the necessary purposes of the church, and likewise to afford refreshment to the weary pilgrim. *In some cases the water is said to have worked medicinal or miraculous cures.*"

Were they true cures?

Two or three pages further on we are treated to some speculations on the warming of churches; the ideas have certainly the merit of novelty. First, "cast-iron stoves are inadmissible." The reason for drawing invidious distinctions between cast and wrought iron is not assigned; the effects of the former, however, are stated to be "to stifle the sickly, scorch the strong, amuse the irreverent, and distract and unutterably disgust all who have the least sense of Catholic propriety." We never remember to have read a more incoherent sentence. Some nice inventions are offered as substitutes for cast-iron stoves; but the suggestions are made with evident reluctance, for "our religious forefathers required no artificial warmth. Moderns will make themselves comfortable in church." The first contrivance is an open brazier to be used "only on the coldest days," or "lighted for an hour or two before service, and afterwards extinguished." The great merit of this plan, it is stated, would be that the congregation would get a good view of the fire; though how they are to do so if the fire be extinguished before service, we do not clearly comprehend.

"It is well known that the look of a fire is almost as comforting as its actual warmth. Indeed, we have known instances in which old ladies declared themselves warmed by the sight of stoves, which on enquiry were found to contain no fuel at all."—p. 136.

Are the writers here alluding apologetically to themselves?

The next plan is to have "a simple ring of iron, say one of the size and kind *which encircles* a coach wheel," laid on the pavement and filled "with a bushel of hot coals from a furnace." This is one of the most comfortable plans we ever heard of; we confess, however, a prejudice in favour of heating by steam or hot water.

On a cold raw wintry day—say during a sudden thaw after a severe frost, when the snow lies in smooth half melted patches on the ground, and a high east wind is roaring and rumbling about the old church tower, there must be something extremely exhilirating, not to say healthful, in sitting for two hours cheered by a distant "simple ring, &c.," with feet damped by snow-water resting on a stone pavement. But "moderns will make themselves comfortable at church."

The grand recipe of all, however, the master device, is reserved for the last; it is—daily service, which is said to be sufficient of itself to render churches perfectly warm and comfortable. Concerning which substitute for the handiwork of Rippon and Burton, we will merely ask the Ecclesiologists whether they ever, when freshmen, attended the daily morning service in their college chapels during winter.

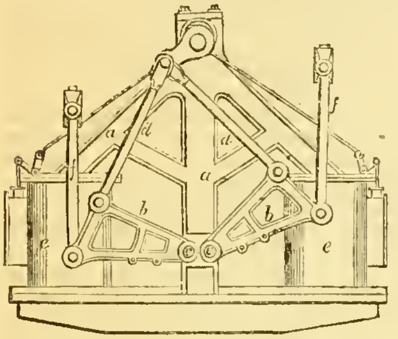
If we examine seriously the causes which have induced the gentlemen who "do" the "Ecclesiologist" to utter such absurdities on the subject of warming churches, we shall find the basis of their views to be two-fold. Dislike of innovation is the first reason for trying to supersede the various beautiful contrivances which have been invented from time to time for warming large buildings by steam, hot water, or hot air conveyed by pipes. But we have already shewn that this periodical itself admits the principle that change of requirements in buildings justifies corresponding adaptations of structure. This concession is made in the chapter on lancet architecture. But, even had no such concession been previously made, might we not fairly consider it virtually granted in the very paper under consideration, for to what else can we attribute the suggestion of *any* stove apparatus whatever, in compliance with the modern desire (founded undoubtedly on the most rational principles,) for increased warmth and ventilation. We may, therefore, fairly consider the first argument disposed of on the ground of inconsistency, as well as for causes already noticed in discussing the doctrine of architectural immutability.

The second reason of the "Ecclesiologist" in the present case appears to be, that the flue-pipes and stoves will, if unconcealed, be injurious to architectural effect, and if concealed, will violate the canon so strongly, and for the most part correctly, insisted upon by the Camden Society—that all imitative materials, deceptive concealment, and all illusive artifices are injurious to the dignity of architecture. We assent cordially to this opinion in the form in which we have expressed it; but we hold that it is not concealment merely, but *deceptive* concealment, which constitutes the real offence against correct taste. In a palace it would be ridiculous and intolerable to place in a conspicuous position the kitchens, cellars and sculleries; and surely the architect would not be open to the imputation of deception who kept these offices simply *out of view*. In the same way, pipes for conveyance of heat are perfectly allowable in churches, even when so arranged as not to be visible to the congregation. The real architectural offence would consist in making those pipes resemble shafts of pillars, mullions, or mouldings, or in sinking them into the walls and painting them over to imitate stone or wood. We therefore come to the conclusion that the above convenient methods of diffusing heat may be employed in churches, without offending the severest rules of architectural criticism, provided the metal pipes be so arranged as to perform their office successfully without being offensively prominent.

We must, however, content ourselves with these brief and imperfect considerations of some of the doctrines of the Camden Society. We have not space here to explain our views adequately and fairly, but we must hope to have hereafter an opportunity of amplifying and supporting them. For the present we take leave of this society with a sincere acknowledgment of the benefits they have conferred on architecture by labouring for its reformation. But while we cordially sympathise with their labours, we cannot but regret that they themselves have done so much to render their own knowledge and talents ineffective. They have shewn a disposition for severe criticism—but that might arise from honest zeal; they often display flippancy—but that may be caused by a good-natured effort at being amusing; they not unfrequently commit solecisms—but these, perhaps, are produced by sympathy with university prejudices; they cite decrees, and councils, and rubrics, in preference to Scripture—but this may be because the devil has taken to quoting the latter. But for using architecture as the insidious vehicle of tenets altogether incongruous there can be no excuse. They who wilfully conceal new doctrines in old garments are guilty of cowardice and dishonesty—cowardice in not avowing their sentiments, and dishonesty in disguising them.

EXPLOSION ON BOARD THE "GIPSY QUEEN."

It is our painful duty to record a frightful and fatal accident which occurred on Tuesday, Nov. 12, involving the death of Mr. Jacob Samuda (well known on account of his connection with the Atmospheric Railway), and nine other persons on board the steam-boat the *Gipsy Queen*, lying at the mooring buoy, off Brunswick Wharf, Blackwall; in consequence of one of the joints of the steam-pipe leading from the boilers to the cylinders giving way as explained in the evidence hereafter given. The *Gipsy Queen* is a new iron boat of about 500 tons burthen, recently built by Messrs. Jacob and Joseph Samuda, wih a pair of engines of the collective power of 150-horses (nominally) on the bell-crank principle as patented by Mr. Jacob Samuda, and reported in our *Journal* for January last, p. 37. For the sake of reference we again give the engraving.



It appears from the evidence that the explosion, was in no way connected with the construction of either the engines or the boilers, but simply in the method of making the joints, or rather in the fixing, of the steam-pipe leading from the boilers to the cylinders. On the day of the accident the vessel ran down the river to try the engines, which it is stated worked admirably and perfectly satisfactory to all parties present, that during the trip the steam was not more than 10 lb. pressure, although the safety valves were represented to have been loaded with 25 lb. on the square inch; after the vessel had made the trial trip, she was moored off Blackwall, when Mr. Jacob Samuda felt desirous to try what effect high steam at 25 lb. pressure would have upon the boiler; it was during this experiment that the fatal accident occurred. In order to render the evidence intelligible, we have borrowed of our contemporary, the *Mechanics' Magazine*, the four annexed engravings, showing the pipe and the joint.

Fig. 1 is a plan, or top view, of the pipe. Fig. 2 a side view. Fig. 3 a perspective of the bent pipe at the angle. A is the vertical pipe leading to the cylinder; B the steam-pipe from the boilers; C the intermediate steam-pipe; *b b* joints of the flange description; *c* and *d* socket or spigot and faucet joints. Fig. 4 is an enlarged view of the socket or spigot and faucet joint, *d*, being the one which is represented as having given way first; the part indicated in black is the place occupied by the ring or bead which was originally on the end of the pipe, and in the evidence stated to have been *chipped* and *filed* away; the joint was packed with hemp and tallow, and surrounded with a *gland* to prevent the packing being forced out by the steam. It is very evident from this description, that we have a packing very similar to that round a piston rod, and in consequence of the bead being cut away, a very low pressure of steam would lift the elbow pipe out of its place; if the pipe be 10 inches diameter the area is equal to 78$\frac{1}{2}$ inches, and with a pressure of steam at 10 lb. there would be an upward pressure of 785 lb., consequently, if the pipe was not strapped down, it is very evident that the elbow pipe would be lifted out of its socket in the manner the accident is represented to have occurred. There appears to be some astonishment exhibited by all parties at the inquest at the bead being cut away and filed, but not a word was said about the *gland*, if the latter was in one piece it is evident that the bead was cut away to get the gland on the pipe, but if the gland had been made with two hemicircles and a ring under, also in two pieces, and placed so as to break joint, it might then have been put on without the bead being cut away; if the annexed drawing be a correct view, of which we have no doubt, it is very evident that the gland was in one piece, and consequently it accounts for the chipping away of the bead on the end of the pipe. It is also stated in the evidence that the spigot and faucet joint is necessary to allow for expansion of the metal; for this purpose $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in a pipe 30 feet long, would be ample play, and in a vertical pipe 10 feet long $\frac{1}{4}$ of an inch; but the principal necessity of such joints is to avoid derangement when the vessel *takes ground*; in such case iron cement joints, as recommended by one of the witnesses, would give way and be perfectly useless. We, therefore, under all the circumstances, cannot see any objection to the socket or spigot and faucet joint, provided it be made with a bead on the end of the pipe, and a proper *gland*. To the defect of the latter do we attribute the awful accident; having offered these observations, we shall now proceed to quote the evidence given before the coroner, Mr. Baker, at the inquest held upon the bodies of the sufferers.

Fig 1.

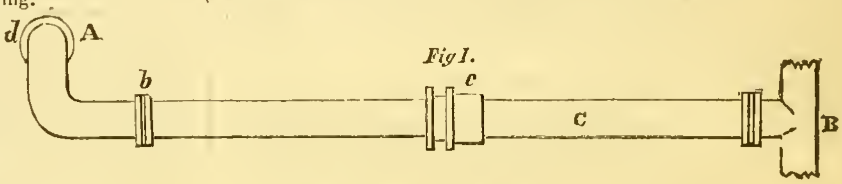


Fig 2.

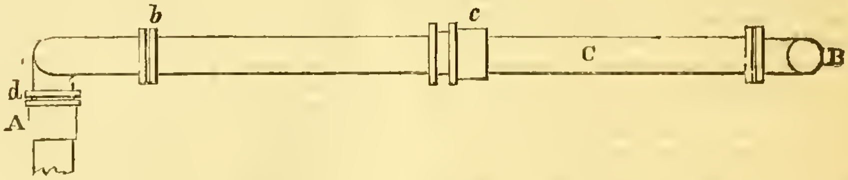


Fig 3.

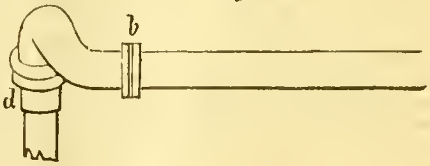
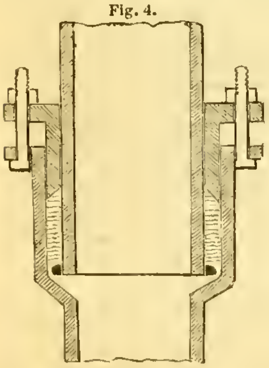


Fig. 4.



THE INQUEST.

Mr. G. Low, an engineer on board of the vessel at the time of the accident, stated that she had two engines worked with two cranks, without an intermediate shaft. They are different from ordinary engines. Are both direct acting engines, and beam-engines. The common beam-engine has cylinders standing athwart the ship, and are parallel with the shafts, but the engines in the *Gipsy Queen* stand fore and aft the boat, with the shafts at right angles, and not parallel at all. Thought that they were not more dangerous than the ordinary steam-engine. The beam of the common steam-engine oscillated in its centre, while the beam in Messrs. Samuda's engine had a motion at the end. In fact, there were two separate beams. He believed that Messrs. Samuda were, in making these engines, under contract to use all the serviceable parts of the engine of an old steamer which the new one was to replace. But whether portions of the old engine were used did not know. Could not say what they were called, as they were not worked up to the power they were intended to be worked at. They were condensing engines. The engines were never working higher than 10 lb. to the inch all the while he looked at the gauge, till they stopped at the East India Docks. The number of strokes she gave was from 20 to 24 per minute. The safety valve would not rise at a pressure of 10 lb. to the inch. The maximum pressure calculated to go before any mischief might be apprehended was stated by Mr. Samuda at 40 lb. to the inch. He (witness) supposed she was working on Tuesday at nearly 200-horse power. The diameter of the cylinder was 45 inches, and the stroke was (as the reporter understood) 4$\frac{1}{2}$ feet. The engines were tried on the Friday previous. She was tried at her moorings. Could not tell what caused the accident. The pipes are perfect at the joints. The pipe is not broken. It is one of the spigot and faucet joints that has been lifted out of its place. Mr. Samuda had no power over the weight in the safety valve; nor any one else. It was in a chest, secure from any person's interference. The weight upon the safety valve was set at 26 lb. Witness differed from Mr. Samuda as to the amount; Mr. S. said it was 26 lb. and he thought it was 27 lb. No steam could blow off at the valve till the pressure was at 26 lb. When Mr. Samuda sent him on deck a very little steam was just oozing out. The motion of the engines had ceased about 10 minutes. The main pipe is joined with what is called a spigot and faucet joint. This was lifted out of its socket. In answer to a question "was there no fastening to the joint? No bolt or screw at all?" witness said it had a packing of hemp. The joint is used to allow for expansion. They were cast-iron pipes, and all these pipes must have these joints for expansion and contraction. Had seen one twice the size. It is the customary mode of joining in all engines that are fitted with cast-iron steam pipes. As already stated, Messrs. Samuda were bound to work up parts of the engines of the old vessel, and the cast-iron pipes were parts of the old vessel. They used the cast-iron pipes, the air-pumps, and the cross-heads. The engines were in their places before he joined the work at all, and he could not speak at all of the quality of the work.

The Coroner said there did not, from the evidence of Mr. Low, appear to have been any fracture in the pipe from which the fatal explosion had taken place; therefore the solidity of the material did not become an important point in the inquiry. There was, therefore, on this head nothing to find fault with as far as the evidence had gone. He, however, thought further information should be obtained about the amount of security afforded by the description of joint that had given way. Judging from the evidence, it did not appear to him that there was anything like security against similar fatal occurrences, if the spigot and faucet joint were used under the pressure spoken of by the witness Low. He, indeed, did not see how, with so inefficient a mode for joining steam-pipes, or packing them, as the witness had described it, fatal accidents could be prevented.

Mr. Low's examination continued—The joint which had given way was 14 or 15 feet (as was understood) from the boiler. Had the pressure never been more than 8 or 10 lb. to the inch, at which the engine worked on her trip, there would not have been any danger, but the additional pressure put upon her required something more than that fixture (viz. the spigot and faucet joint.) The vessel started with the steam pressure at 6 lb. and while working her they were unable to get it higher than 10 lb. Had no doubt that the occurrence was entirely accidental. Mr. Pim, treasurer of the Dublin and Kingstown railway, here asked permission to put, through the coroner, two or three questions to the witness. He (Mr. Pim) was a friend of the deceased gentleman, Mr. Samuda, and being in town he had taken the opportunity of attending the inquiry to elicit facts upon one or two points. I think, Mr. Low (continued Mr. Pim), you said the cause of the accident did not arise from any peculiarity in the construction of the engine itself? Witness—The primary construction of the engines had no connection with the accident at all. Neither did it arise from any peculiarity in the construction of the boiler. Neither had the material of which the steam-pipe was composed anything whatever to do with the accident, because the pipe is whole yet, but were I to make the same pipe of the same material I would not make it in the same form. The material of which the steam-pipe was composed did not at all contribute to the accident.

With the view of having the evidence of other practical men the inquest was adjourned till Saturday, Nov. 16.

The Coroner said that Mr. Hensman, a draughtsman, on board at the time of the accident, and Mr. Low, the engineer, had given some additional evidence on the inquest held on Friday on the bodies of those who had died after their removal to the London Hospital, which would be repeated. The great question was, how to prevent such accidents occurring in future. A brother of one of the men who had died at the hospital, named Riley, and who was on board at the time, was satisfied that this was an accident: but if accidents from similar causes were to occur again, it was desirable for persons to know that death from such a cause would then amount to manslaughter. In a case "The King v. Carr," reported in Carrington and Payne, it was held that where a man made a cannon which burst, and it was sent back to him and repaired, and it burst a second time, that death from such repeated accident amounted to manslaughter. So in this case, if an accident from the same cause were repeated, he should have no hesitation in directing a jury to find a verdict of manslaughter. But Mr. Samuda, the engineer and chief owner, having paid the penalty of his life for this imperfectly constructed joint in the steam-pipe, he thought it would be harsh to bring in such a verdict against the younger brother and partner in the firm.

Mr. Low then gave additional evidence, that if a collar or ring had been on the end of the spigot pipe, it would have allowed for contraction or expansion, without permitting the pipe to be withdrawn from the socket. It was customary to have such a collar. Its own weight would keep the pipe in its place (?) at a pressure of steam of 10 lb. to the inch, but a pressure of 26 lb. to the inch lifted the pipe out of the socket.

Mr. Henry Hensman corroborated the testimony given by Mr. Low in all respects, except this, that he thought the same pipe, if it had been joined with iron cement, would have been perfectly safe. He did not think that provision for the expansion and contraction of this joint was so absolutely necessary, the expansion of the middle joint being sufficient. The joint as made and packed, would have been perfectly safe, if there had been a stay between it and the deck, or if it had been strapped with an iron strap to the engine, so as to prevent the pipe rising from its socket.

A Juryman—Do you happen to know whether this pipe was new, or was part of the machinery of the old *Gipsy?* Mr. Pim—We shall be prepared in a few minutes to show that it was a new pipe cast for the purpose. A Juryman said it appeared to him, on examination, that the head of the spigot pipe had been chipped off. Mr. Low said, it also appeared so to him. He was perfectly satisfied if the late Mr. Samuda had known it, he would have condemned the pipe as unsafe. It must have been done without orders, and ought not to have been done. The Coroner—Might it have chipped itself in coming out? The Juryman—No; that was not the case evidently.

The Jury then retired to consider their verdict, and returned in about half an hour, having found a verdict of "Accidental death." They also expressed an opinion that the deaths of the deceased were "caused by the false and improper construction of the joint of the main steam-pipe, in its not being sufficiently secured; and they express this opinion in order that due caution may be used to prevent similar accidents in future, which, it appears to the jury, may be effected by a collar or ring to prevent the severance of the pipes."

At another inquest held on the bodies of Riley, Donovan, and Mills, who died after their removal to the London Hospital, the Coroner remarked that he thought there was decided blame with respect to the fatal occurrence, inasmuch as that the steam had been put to 25lb. to the inch, when it was stated that from the parting of the spigot and faucet joint, it was not capable of resisting steam of that power. The following evidence was given.

Mr. Low was asked one or two questions as to the position of the steam-pipe, and the place of its separation. He explained that the pipe went up from the boiler vertically, then on a line over where Mr. Samuda was standing at the time of the explosion, and turned down to the cylinder. It was in the centre of the longitudinal portion that the spigot and faucet joint was placed, the parts were forced from each other by the pressure of the steam against the elbow. Witness attributed the yielding of the spigot and faucet joint to the great pressure; but he believed if there had been a collar or ring on the end of the spigot, that being encased in the faucet six or seven inches, allowing for expansion and contraction, it would have prevented it from being withdrawn.

Mr. Henry Hensman, corroborated in all points the testimony of Mr. Low but he would go further than he had done, and say that the same pipe, if joined by iron cement, would have been perfectly safe.—Mr. Low, being here asked if that was also his opinion, answered in the affirmative.—Mr. Hensman did not think any allowance for the expansion or contraction was absolutely necessary. Being asked by Mr. Pim, who attended on behalf of the friends of Mr. Samuda, whether the joint, as made and packed, would not have been perfectly safe, if there had been a stay upon it to keep it in its place, he replied certainly. There were two U ties to hold up the horizontal portion of the pipe; and if the pipe with the joint as made and packed had been strapped to the engines, it would have been perfectly safe, as the pipe would have been prevented from moving either way.—Mr. Pim—Was not the spigot and faucet joint introduced by Mr. Samuda rather as a refinement to avoid accident, and as an improvement? Mr. Hensman—Yes. And in answer to inquiries if there had not been a ring or collar originally to the pipe which belonged to the old engines, the witness said, he believed there had, but that it was cut off probably because the pipe was too long, without Mr. Samuda's knowledge; and if Mr. Samuda had known that the joint had been fitted in the way it was, he would have had it altered. Mr. Samuda could hardly look at every joint fitted by his workmen, although he was always exceedingly anxious personally to see the work was done in a proper manner.

Mr. Pim observed, that the inefficiency of the joints arose from an error of judgment, and not from a want of care, and a juror observed that Mr. Samuda evidently thought it safe, or he would not have placed himself in the dangerous position that he did.

The jury having expressed themselves satisfied with the evidence, returned a verdict of "Accidental Death."

Cyanogen.—M. Wöhler has shown that when nitrogen gas containing moisture is passed over a mixture of potash and charcoal, cyanide of potassium is formed, but if the gas be dry no cyanogen is formed.

ATHLONE NEW BRIDGE.

On Saturday, the 9th November, a new bridge crossing the Shannon, in the town of Athlone, erected under the Shannon Commission, was opened to the public at one o'clock, p. m. and the old bridge, erected in the days of good Queen Bess, closed for ever at three o'clock. The ancient structure, which was placed at the lowest point of the town, and shallowest portion of the river, was a long range of small semi-circular unequal arches, carrying a stripe of roadway so narrow as scarcely to allow a single carriage to pass, with recessed parapets, and of that inconveniently picturesque character which marked the work of early bridge builders. It was directly under the guns of the citadel or ancient fort, and was the scene, or connected with the events of some of the most stirring passages of Irish history. An ancient inscription stone, now presented to the Royal Irish Academy collection of antiquities, recorded some of those, and alluded to others in a style which the present town council of Athlone did not consider sufficiently complimentary for its re-erection on the new bridge. The site of the new bridge is higher up the river, to the northward of the old; it is wholly from the designs of Thomas Rhodes, Esq., civil engineer to the commissioners, who has judiciously placed the roadway at such a level as will avoid hereafter that tremendous descent into the bowels of the lower town as all who have passed the old bridge will recollect. The new bridge consists of three noble elliptic arches, each of 63 feet span, together with a cast iron swivel bridge, resting on heavy abutments, of 45 feet span, and 24 feet width of roadway; the general width of roadway is about 30 feet, with flagged footways of six feet at each side. The material is limestone of the finest colour, scantling, and texture, and the style of execution of every part, and the skill with which difficulties of no ordinary character in constructing the underwater work were met and overcome by the contractor, Mr. John M'Mahon, are in the highest degree admirable. The average depth of water under the bridge is about 18 feet, and when it is stated that the large coffer dams were driven and staunched upon a bottom of coarse open gravel, admitting water like a sieve, these difficulties will be appreciated by those acquainted with practical engineering. The swivel bridge was constructed and erected by Messrs. John and Robert Mallett, iron founders and engineers, of Dublin, and its execution has met the highest approbation from the engineer and commissioners. Although the width of roadway is so great, and the weight of the mass of framing, upwards of 300 tons, either leaf of the bridge can be opened or closed by a single man in about a minute. The largest castings probably ever made in this country occur in this structure; each of the traverse rings, which measure 24 feet across, weighs about 16 tons. Four of these rings, each of this large diameter, were turned in a lathe constructed for the purpose in the foundry, in order to render the bearing surfaces for the rollers true and polished. The style of the bridge is of the massive Roman order, and viewed from the ancient one bears much of that aspect of repose and grandeur which pre-eminently characterise London Bridge, that noblest building of its class which the hand of man has yet constructed.

INSTITUTE OF CIVIL ENGINEERS.

The Council of the Institution of Civil Engineers have awarded the following Telford and Walker Premiums:—

Telford Medals in Silver to William Fairbairn, M. Inst. C.E., for his Paper "On the properties of the Iron Ores of Samakoff (Turkey), &c."—To John Murray, M. Inst. C.E., for his "Description and Drawings of the removal of the Lighthouse on the North Pier, at Sunderland."—To James Bremner, M. Inst. C.E., for his Papers "On Pulteney Town Harbour," "Sarclet Harbour," "A new Piling Engine," and "An Apparatus for floating large stones for Harbour Works."—To Andrew Murray, Assoc. Inst. C.E., for his Paper "On the construction and proper proportions of Steam Boilers."—To Alexander Angus Croll, Assoc. Inst. C.E., for his Paper "On the purification of Coal Gas, &c."—To James Braidwood, Assoc. Inst. C.E., for his Paper and Drawings descriptive of "The means of rendering large supplies of Water available in cases of Fire, &c."—To Jacob Samuda, Assoc. Inst. C.E., for his "Account of the Atmospheric Railway."—To Charles Hutton Gregory, Grad. Inst. C.E., for his Paper "On Railway Cuttings and Embankments."—To Captain William Scarth Moorsom, Assoc. Inst. C.E., for his "Description and Drawings of the Avon Bridge at Tewkesbury."—To Thomas Grissell, Assoc. Inst. C.E., for his "Description and Model of the Scaffolding used in erecting the Nelson Column."—To Charles Manby, Secretary and Assoc. Inst. C.E., for the translation and arrangement of the "History of the Canal and Sluices of Katwyk," and the "Description of the Works of the Amsterdam and Rotterdam Railway," by the Chevalier Conrad, M. Inst. C.E.

Walker Premiums of Books, suitably bound and inscribed, to the Chevalier Conrad, M. Inst. C.E., for his "Description and Drawings of the Works of the Amsterdam and Rotterdam Railway."—To James Leslie, M. Inst. C.E., for his "Description and Drawings of the Iron Lock Gates of the Montrose Docks."—To John Geale Thomson, Grad. Inst. C.E., for his "Description and Drawing of the Landslip in the Ashley Cutting, Great Western Railway."—To John Timperley, for his "Account of the building of the "Wellington Bridge, Leeds."—To George Willoughby Hemans, Grad. Inst. C.E., for his "Description and Drawing of a wrought iron lattice Bridge on the Dublin and Drogheda Railway."—To William Evill, Jun., Grad. Inst. C.E., for his "Description and Drawings of the London Terminus of the Eastern Counties' Railway."—To Arthur John Dodson, Assoc. Inst. C.E., for his "Description and Drawings of the Hydraulic Traversing Frame, used on the Great Western Railway."—To James Forrest, Jun., for his "Drawings and Diagrams illustrative of numerous Papers read at the Meetings."

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM OCTOBER 29, TO NOVEMBER 23, 1844.

Six Months allowed for Enrolment, unless otherwise expressed.

George Ferguson Wilson, of Belmont, Vauxhall, gentleman, George Gwynne, of Princes-street, Cavendish-square, gentleman, and James Pillans Wilson, of Belmont aforesaid, gentleman, for "Improvements in the manufacture of night lights."—Sealed Oct. 29.

Alexander Parkes, of Birmingham, Artist, for "Improvements in the manufacture of certain alloys or combinations of metals, and in depositing certain metals."—Oct. 29.

George Robert D'Harcourt, of Old Jewry, London, gentleman, for "Improvements in ascertaining and checking the number of checks or tickets which have been used and marked, applicable for railway offices and other places."—Oct. 29.

Thomas Squire, of Warrington, County of Lancaster, Tanner, for "Improvements in tanning hides and skins."—Oct. 29.

Thomas Fuller, of Manchester, Engineer, for "certain Improvements in machinery, tools or apparatus for turning, boring, and cutting metals and other substances."—October 29.

William Crofts, of Lenton, Nottingham, lace manufacturer, and James Gibbons, of New Radford, machinist, for "Improvements in the manufacture of figured or ornamented lace, or net of various textures."—October 31.

George Ferguson Wilson, of Belmont, Vauxhall, gentleman, George Gwynne, of Princes-street, Cavendish-square, gentleman, and James Pillans Wilson, of Belmont aforesaid, gentleman, for "Improvements in treating fatty and oily matter, and in the manufacture of candles."—October 31.

George Beadon, of Taunton, Somerset, gentleman, for "Improvements in life-boats or rafts, and in apparatus for raising or lowering the masts of vessels, which improvements in raising or lowering are applicable to other purposes."—October 31.

William Newman, of Birmingham, brass founder, for "a certain Improvement or certain improvements in window-blinds."—November 2.

Charles Smith, of Newcastle-street, Strand, gentleman, for "new and Improved methods in the construction and application of a variety of cooking, culinary, and domestic articles and utensils, some of which are applicable to cleaning and a variety of similar useful purposes."—November 2,

Jean Baptiste Maniquet, of Sablionere Hotel, Leicester-square, gentleman, for "Improvements in doubling, twisting, and reeling silk, cotton, and other substances."—November 2.

William Bewley, of Dublin, gentleman, for "Improvements in fastenings for doors, windows, and other places where fastenings are used."—November 2.

Thomas Brown Jordan, of Cottage-road, Pimlico, mathematical divider, for "Improvements in the manufacture of blocks or surfaces for surface printing, stamping, embossing, and moulding."—November 2.

William Brunton, jun., of Pool, Cornwall, engineer, for "Improvements in apparatus for dressing ores."—November 2.

Thomas Unsworth, of Derby, silk weaver, for "an Improved manufacture of elastic fabric."—November 2.

Joseph Thomas, of Finch-lane; publisher, for "a new and Improved tube." Being a communication.—November 5.

Henry Atkins, of Nottingham, lace manufacturer, for "certain Improvements in the manufacture of net lace."—November 5.

John Groom, of Oldham, Lancaster, for "certain Improvements in the machinery or apparatus for preparing, slubbing, or roving cotton, wool, and other fibrous substances." —November 7.

Stephen Geary, of Hamilton-place, New-road, architect and engineer, for "certain Improvements in the machinery, apparatus, and arrangements for the supply and distribution of water for public and private uses, but more particularly in cases of fire."—Nov. 7.

Henry Berriskill Taylor, of Piccadilly, lamp manufacturer, for "Improvements in apparatus for transmitting light from lamp and other burners."—November 7.

Daniel Chandler Hewitt, of Hanover-street, Hanover-square, musical instrument maker, for "Improvements in certain stringed and wind musical instruments."—November 9.

David Auld, engineer, of Dalmarnock-road, and Andrew Auld, of West-street, Tradestown, Glasgow, for "an Improved methods or methods of regulating the pressure and generation of steam in steam-boilers and generators."—November 9,

William Prosser, jun., of Windsor-terrace, Pimlico, gentleman, for "Improvements in the construction of roads, and in carriages to run thereon."—November 9.

Richard Harris, the elder, of Leicester, manufacturer, for "Improvements in machinery employed in the manufacture of looped fabrics."—November 9.

Charles Derosne, of Rue des Batailles Chaillot, near Paris, gentleman, for "an extension of an invention for certain Improvements in extracting sugar or syrups from cane-juice and other substances containing sugar, and in refining sugar and syrups." (For the term of six years from the expiration of the original grant.)—November 9.

John Dearman Dunnicliff, of Nottingham, lace manufacturer, William Crofts, of Penton, lace manufacturer, and John Woodhouse Bagley, of New Radford, mechanic, for "certain Improvements in the manufacture of lace and other weavings."—November 13.

Mark Freeman, of Sutton, esquire, for "Improvements in working or dressing the surface of stone."—November 14.

Frederick Steiner, of Hyndburn Cottage, Lancaster, turkey-red dyer, for "A new colouring matter to be used in dyeing certain colours on cotton, woollen, silk, and linen fabrics."—November 14.

William North, of Stangate, slater, for "Improvements in covering roofs and flats with slate."—November 14.

Isaac Farrell, of Great Brunswick-street, Dublin, architect, for "certain Improvements in machinery, whereby carriages may be impelled on railways and tramways by means of stationary engines or other power, including certain apparatus connected with the carriages to run on the same."—November 14.

Francis Watteen, of Finsbury square, merchant, for "Improvements in preventing incrustations in steam-boilers and steam-generators."—November 16.

Joseph Maudslay, of Lambeth, engineer, for "certain Improvements in steam-engines." —November 16.

Francis Higginson, of Rochester, lieutenant in her Majesty's navy, and Edward Robert Coles, of the same place, merchant and ship-owner, for "certain Improvements in the construction of buildings generally."—November 21.

David Metcalf, of Leeds, dyer, for "A new mode of manufacturing or preparing a new vegetable preparation, applicable to dyeing blue and other colours."—November 21.

John Spencer, agent of the Phœnix Iron Works, West Bromwich, Stafford, for "Improvements in manufacturing or preparing plates of iron or other metal for roofing and ther purposes to which the same may be applicable."—November 23.