THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

111TH SESSION.] FRIDAY, MARCH 3, 1865. [No. 641. VOL. XIII.

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Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings at 8 o'clock.

MARCH 8.—"On Cotton Gins." By ZERAH COLBURN, Esq.

MARCH 15.—"On Marine Engines from 1851 to the present time." By W. PROCTER BURGH, Esq., C.E.

CANTOR LECTURES.

The Second Course of Cantor Lectures, the subject being "The Applications of Geology to the Arts and Manufactures," by Professor D. T. ANSTED, M.A., F.R.S., is now being delivered on Monday evenings, at Eight o'clock, as follows :—

MARCH 6TH.—LECTURE 5.—On Stratified Deposits of Minerals, as Coal and Iron Ore, usually obtained by Mining Operations, and on Mining Methods for such Deposits.

MARCH 13TH.—LECTURE 6.—On Metalliferous Veins or Lodes and their Contents, and on the Extraction of Metalliferous Minerals from Lodes.

These Lectures are free to Members (without ticket), and every Member has the privilege of admitting ONE Friend to each Lecture.

ART-WORKMANSHIP PRIZES.

In reply to the letter addressed by the Council to the principal City Companies, the following has been received from the Salters' Company :—

Salters' Hall, 14th Feb., 1865.

SIR,—The application made to the Master and Wardens of the Salters' Company, for aid in forwarding the endeavour of "The Society for the Encouragement of Arts, Manufactures, and Commerce," to improve the artistic taste and skilful manipulation of the art-workman, by giving prizes for the best works executed from examples provided by the Society, was laid before the Court of Assistants at their recent meeting. The application was favourably entertained, and I have the pleasure to inform you that the Salters' Company resolved to become annual subscribers of ten guineas in aid of the fund for granting prizes for improving the artistic taste and skilful manufacture of the art-workman, and I enclose a cheque for the first year's subscription. I am, &c.,

EDW. THOMPSON,
Clerk of the Salters' Company.

To P. Le Neve Foster, Esq.

Proceedings of the Society.

CANTOR LECTURES.

SECOND COURSE.—FOURTH LECTURE.—MONDAY, FEB. 27.

STONES USED IN CONSTRUCTION, &C.

Professor ANSTED commenced by stating that from the consideration of materials obtained from superficial accumulations, not regularly stratified, we pass to stratified and igneous rocks, removed either by quarrying or by mining, and he proposed to bring under notice the facts determined concerning stones used for constructive purposes. So far as their uses extend, these minerals may be grouped in many ways. They are required for constructive purposes—(1) as squared or rough stones, fit for building walls of houses, churches, and palaces; (2) for paving and roofing; (3) for road-making; (4) for the finer kinds of construction; and (5) for artistic purposes. The same kind of stone is often used for two or more of these purposes, but, as a rule, the less perfectly crystalline kinds, being cheaper and more easily worked than the others, are used for commoner purposes; the harder kinds, capable of receiving a high polish, being reserved for more artistic purposes. Commencing with building materials, we may regard them as of three classes—granite, sandstones, and limestones; but there is another division into two classes, namely, those worked by the pick or by wedges, and those worked by the mallet and chisel. The latter are freestones, and include marbles, limestones, and sandstones. The former include granites, quartz rocks, conglomerates, &c. Granites are procured on a large scale from Cornwall and Devonshire, where they are worked with facility and cheapness; others are from Peterhead and Aberdeen. Others, harder than either and of a darker colour, are from Guernsey, Malvern Hills, and Leicestershire. Granite consists of crystals of quartz, felspar and mica in crystalline quartz. The mica is frequently replaced by hornblende, the result being syenite. The felspathic portion of the stone also is sometimes *albite*, in which the alkaline element is chiefly soda instead of potash. Granite may be coarse or fine grained. Some kinds are brittle and others tough; some break along lines of natural fracture, while others resist regular fracture. Chemically, granite is a silicate of alumina and potash, with a little iron and lime, soda sometimes replacing the potash and magnesia the lime. To a certain extent, granites are mixtures of crystalline minerals in various proportions, and an average variety contains from two to three-fifth parts of crystals of quartz or crystalline quartz, about the same of felspar, and the

remainder mica. Granite possesses a mean specific gravity of 2·66, so that the cubic foot weighs 166¼ lbs. Fourteen cubic feet to the ton is the usual estimate. Its toughness is great, and varies much in different samples. Fresh unweathered granite will bear any direct crushing weight to which it can be exposed. Granite contains about 0·8 per cent of water, that can only be driven off by continued exposure to heat. In its ordinary state, and containing this quantity of water, it is still capable of absorbing about one-fourth more (or 0·2 per cent.), when placed in water for a few hours. Expressed in another way, a cubic yard of granite contains something more than 3½ gallons of water, and can absorb nearly a gallon more on being placed in pure water for a short period. To a small extent granite is soluble in pure water and hydro-chloric acid. The solubility of granite in pure water and hydro-chloric acid is among the tests of its value. A specimen was found to lose 0·25 per cent. of its weight in water, and 5 per cent. in acid. For various public works, as bridges and harbours, and for some public buildings granite is adapted, but its hardness and the cost of working, limit its use to works of practical utility where durability is essential. But good varieties require to be selected, and some granites are not more proof against weather than limestones. Basalt is a material used for rough walls and road material. In this rock a large percentage of iron is a prevailing feature, while the percentage of potash and soda is not excessive. The tough nature of this rock, and the mode in which it weathers, leaving round lumps, separated by powdery rubbish, are due partly to composition and partly to the mode of formation of the rock. The columnar form of basalt is due to the same causes. Greenstones are varieties of basalt, and *trap* is a name given to rocks of this kind. All are useful for road metal. Of other rock not freestones, quartzites and quartz conglomerates, are rarely used for other than rough walls. Indurated schists are durable, but not ornamental, and very difficult to work into any convenient form. Indurated sandstones are more valuable and are occasionally employed in engineering works. Flag stones are valuable for paving, but not available for other purposes, except that they are sometimes used for party walls. These materials are hard, dense, non-absorbent, and resist atmospheric influences. They are, however, difficult to manipulate, and cannot be recommended except for special uses. Paving and road material must be considered among these. In quarrying granite the nature and position of the system of joints and natural fractures that affect the rock are important considerations, and depend on the geological axis of the district and the direction of elevation of the rocks. In granites only certain veins are valuable. These are of small extent compared with the mass of the stone, and are enclosed on either side by walls of inferior material. Granite is irregular in its composition; but the larger the mass the less are the irregularities perceived. In England the fine and durable qualities occur larger in Cornwall and Scotland than in Guernsey or Charnwood Forest, and the granite for extensive works should be sought for rather in the former than the latter localities. Freestones are stones that may be worked with mallet and chisel, and sculptured without difficulty. Of these some are crystalline, as the varieties of marble, dolomites, alabaster, malachite, spars, serpentine, &c. Of fine marbles only Carrara yields great supplies. Carrara marble is obtained from a quarry nearly midway between Leghorn and Genoa, and close to the bay of Spezzia. The quarries are very accessible. The veins of marble are in the Apennines, and include many varieties. The marble is quarried by first loosening the large masses by blasting, after which wedges are applied until the blocks are detached. The finest blocks are removed in the rough, but the others are shaped into oblong squares. From two to three thousand men are employed constantly in the quarries now in work, which number from thirty to forty for common kinds, and ten or twelve for fine marbles. The annual production exceeds 50,000 tons. Marbles of inferior quality are quarried like limestones. The best black are found in Derbyshire, where they form part of the carboniferous series. Red are rare and valuable. Yellow are chiefly found in Italy. The mixed colours are more common. There are numerous varieties found in England, chiefly in Derbyshire and Devonshire. Ireland also contains many. India is rich in marbles. On the continent of Europe, Belgium, France, Spain, Portugal, and many parts of Germany all yield excellent varieties, worked cheaply for ordinary purposes. Serpentine is used as a kind of marble. It is a silicate of magnesia, coloured by metallic oxides, of iron, nickel, and chrome. The Lizard rock contains veins of extreme beauty, remarkable for its brilliant colour contrasted by the purest white. The Italian serpentine (*ophite*) is different and far less brilliant. Irish Connemara marble is a variety of serpentine. Alabaster, of pure white or grey colour, and transparent, is a very beautiful material, very easily worked, and inexpensive, but it will not stand exposure. It is obtained in large quantities in England, but the largest and best supply is from Italy and Greece. Ordinary freestones are either limestones or sandstones; the former consisting of two groups—the limestones properly so called and the magnesian limestones, or dolomites. Of sandstones, the Craigleith is one of the best. It is obtained from the carboniferous rocks in the neighbourhood of Edinburgh. The colour is lightish grey, and the grain fine. The cement is siliceous. It contains 98 per cent. silica. The beds vary in thickness, the thickest being ten feet. The number of workable beds is very large. A cubic foot of the stone weighs 146lbs., and absorbs four pints of water. It resists crushing weights to the extent of 5,800lbs. to the square inch. It darkens by exposure to a smoky atmosphere and frost. It is an expensive stone. Other coal grits are good, but not equal in colour or composition to Craigleith. Stones from the old red sandstones, on the east coast of Scotland, are dark-coloured and flaky, but hard, and resist atmospheric action. Of these Dundee stone is dark-brown, owing to the presence of iron oxide. Arbroath is greenish grey; not objectionable. Very large blocks of uniform appearance may be obtained, for building and pavements. Yorkshire sandstones of the millstone-grit series are durable both for building and paving. The Stenton quarries, near Durham, have supplied good stone. The Park-spring stone, from near Leeds, and others from the neighbourhood of Halifax and Huddersfield, are good. These may be described as fine-grained stones, cemented with argillo-siliceous cement, coloured by oxide or silicate of iron, the colour varying from bluish green to pale brown. They weigh about 145lbs. to the cubic foot, and support a crushing weight about equal to Craigleith; but they absorb water readily and part with it freely, and are apt to peel when placed in walls. They are unsafe when in contact with damp earth, or where there is no circulation of air. Sandstones of the lower new red standstone series, consisting of fine siliceous grains with magneso-calcareous cement, are quarried at Mansfield, in Nottinghamshire. There are two varieties; one red, weighing 148½lbs. to the cube foot, and the other white and heavier. Both are absorbent, taking up from four to five pints of water to the cubic foot. They wear well, but are not safe in a moist, smoky atmosphere. At Liverpool much stone from this rock is used. A sandstone of the lower secondary period, better than most of the varieties from contemporaneous beds, is worked near Whitby, in Yorkshire, and largely exported. Of other sandstones, those of the Wealden period are irregular in their composition and easily acted upon by weather. Some of the sandstones of the cretaceous series are better. The Godstone and Maidstone fire-stones and the Chilmark siliceous limestone are very valuable for certain purposes. Chilmark is rather a siliceous limestone than a sandstone. It is heavy and non-absorbent. Sandstones, consisting of detached grains of indestructible material, cemented to-

gether by some foreign substance that has been held in water, depend on the nature of the cementing medium for their durability. Where this is calcareous or marly, or even irony, it is affected by weather, but where it is siliceous it is safe. When sandstone is laminated, water enters and ultimately produces disintegration. Many sandstones, ill-adapted for external walls and facings, are valuable as slabs, either for foot-paving, curbs, or other purposes, and also for party-walls. Limestones are better for ordinary constructions than sandstones; they are more easily worked, and therefore cheaper, more varied in quality and appearance; the useful kinds are more thoroughly distributed and the colour is more pleasing. Portland, Bath, Ketton, Barnack, and Caen varieties are the best known limestones in London and its neighbourhood. Their properties are very different. Many other stones are in local use, some from the carboniferous series and even silurian rocks. Even chalk is used occasionally for constructive purposes, in the interior of buildings. Portland stone is the hardest, the least absorbent, the most durable, and the most resembling marble of all English building materials. The upper member of the oolitic series in England, wherever it is developed, contains numerous bands of shelly limestone, partaking of that granular character which has been long known as oolite (eggstone). Some of these bands which are least shelly afford valuable building stone. The upper members of the Portland series pass into the Purbeck series (which contains "Purbeck marble"). Portland stone is heavy, weighing from 135 to 148 lb. to the cube foot. It absorbs about 6¾ pints of water per cube foot. It is composed of 95 per cent. carbonate of lime, with rather more than 1 per cent. of silica and carbonate of magnesia. It can be obtained in blocks of any size, and can be worked either by the chisel or the plate saw without difficulty. It is, however, expensive. It bears a pressure of 3,279 lb. without crushing. The heavier beds are the most durable for house architecture, but the upper beds, or roach, are preferred for some purposes, especially docks, piers, and other hydraulic works. The roach is less oolitic, and its cementing medium more perfectly crystallized than the other stone, and it resists alternations of dryness and moisture; but is less sightly, and could not be trusted in exposed situations in the air. The best quarries of Portland stone are on the eastern side of the island. Bath stones are next in importance to Portland, and their cheapness, facility of working, abundance, and pleasing appearance, have caused them to be adopted throughout the south of England, wherever they could be conveyed at small cost. There are numerous quarries, and the qualities differ a good deal. They occur at intervals in a series whose total thickness is from 60 to 120 feet. The series is as follows:—

1. Upper rag stones.....	thickness	25 to 50 feet.
2. Fine freestones or building bed	,,	10 ,, 30 ,,
3. Lower rag stones.....	,,	25 ,, 80 ,,

Bath stone is of a rich cream colour, and so soft that it can readily be cut with a tooth saw. It is lighter than Portland, weighing 123 lb. to the cube foot. It is absorbent, taking up 8½ pints of water to the cubic foot, or more than one-sixth of its bulk. It bears a crushing weight of 2,000 lb. per square inch of surface. The upper ragstone is coarse, shelly, and irregularly-bedded, and contains no workable beds. Immediately below are fine-grained building beds. The lower ragstone includes numerous well-defined shelly beds, resting on the Fuller's earth. The importance of determining the geological limits of the freestone beds renders this identification of the lower and upper ragstone important. The lower beds have the appearance of fine-textured oolitic limestones, but are singularly liable to injury from exposure. At Box and Corsham quarries they are 40 feet thick. Bath stone decays very rapidly, but by allowing the surface to harden it is much improved. The consumption of Bath stone at the present time exceeds 100,000 tons annually. Caen stone resembles Bath in colour, texture, and facility of working. It weighs 120 lb. to the foot cube, and its resistance to crushing weights is superior to Bath. It is also harder and less absorbent. It is obtained near Caen, with other stones from the neighbourhood, of inferior quality. These are extensively used. Only small blocks of the best qualities can be obtained. Buckingham Palace and several London mansions were built of poor Caen stones. All these stones are remarkably pure and not very shelly. The carbonate of lime is sub-crystalline, and threads of calc spar traverse the stone at intervals. The inferior oolites yield good building stones in the west of England, but they are not superior to Bath stone. Barnack, Ketton, and Ancaster are midland oolites that have reputation; the first named is now replaced by stone from the Casterton quarries. This stone is of a lightish brown colour and compact oolitic structure, and is made up chiefly of fragments of shells and corals. It is heavy, weighing more than 130 lb. to the foot cube. Its resistance to crushing weights is not more than 1,500 lb. Barnack stone has been used in Cambridge, and also in Suffolk. Casterton is believed to be equally good. Ketton stone is brought to London, and some modern buildings of it seem to stand well. Its colour is warm cream. It is lighter than Barnack, and rather superior in resistance to crushing weights. Ancaster is superior in some respects, and equally durable, but has not been much used in London in important works. All these stones are absorbent, taking up about one-sixth of their bulk of water. They are expensive to work as compared with Bath stone, but considerably cheaper than Portland. Excellent oolitic building stones, of bluish tint and fine grain, are found and worked in Yorkshire for engineering purposes. It is not easy to ascertain the value of oolites. In the quarry or immediate neighbourhood they wear well, but when removed, and used carelessly, they resist frost very badly. The number of quarries is large, and the stones of the adjacent quarries are by no means of the same quality. Careful selection is necessary, made with a knowledge of the peculiar properties of the stone. Thus some coarse stones absorb little water, while others, far superior in appearance, suck in water like a sponge and soon decay. In quarrying the oolites, operations are carried on resembling those required for mining; but as large blocks are the most valuable, some difficulties arise which do not occur in mining. In working for stone, it must first be decided whether the stone is to be reached by drifts or by open cuttings. If there is a thick covering of upper hard beds, open quarrying is impossible, and in that case the work is carried on by tunnels. Open quarries, however, are common enough, but there is always a large quantity of waste material, whose removal is a matter of consideration before opening a quarry. In getting Bath stone the quarryman commences operations at the roof, picking it out six or seven feet back. The width of the stalls depends on the nature of the stone. The stone is afterwards cut with a saw, and removed with great care. Besides the limestones used for building purposes, at Bath there are also bands of more compact stone fit for roofing and paving. These flags are inferior to those found in Yorkshire, and to the slates from Cumberland and Wales. Stonesfield slate is one of these. The evenly-splitting flaggy structure is the only important fact. Lithographic stones are worked in large quarries in Bavaria. They are in thick beds, and are remarkable for the extraordinary smoothness and fineness of grain of the surface, and its delicate cream colour. They belong to the upper division of the oolites. Other lithographic stones of inferior excellence are obtained from liassic limestones. Limestones of the tertiary period are not met with in England, but excellent qualities are worked in various parts of the Continent. In and around Paris the limestones of the older tertiaries are opened in extensive quarries, from which the capital is supplied. The stone is of good colour, even texture, and easily and cheaply worked, but does not resist perfectly even the

comparatively pure and dry atmosphere of Paris. Chalk becomes hard and adapted for building purposes in the south of France, and hard white cretaceous limestones are found throughout the middle and south of Europe, available for construction. Many of these are compact and very durable. Compact carbonates of lime in England are chiefly members of the carboniferous series, and pass into marbles. Good lias supplies compact material, usually argillaceous, but the middle beds or "marlstone" yield a limestone. All the stones are absorbent, and are rapidly injured by exposure to moist air in changing temperatures, and especially when there is frost. Magnesian limestones occur in the middle and north-east of England. They consist of a variable proportion of carbonate of lime and carbonate of magnesia, and have been used in recent important buildings in London. Their colour is light brown, of warm tint; their density is greater than that of the oolites; the labour on them is intermediate between gritstones and Portland, and they can be obtained of any required size. They are four times stronger than Portland; certain parts of Derbyshire, Nottinghamshire, and Yorkshire, yield this kind of stone. It was used for the Houses of Parliament and the Museum of Economic Geology in Jermyn-street. The stone in the latter building is extremely good. It is well known how great is the failure in the other building. Whether from more trying exposure, or from the quarries ultimately worked not yielding stone like the sample, it is too late to discuss. The best magnesian limestones are those in which there is at least 40 per cent. of carbonate of magnesia and 4 or 5 per cent. of silica. But the composition alone is of less importance. Where this is complete the stone resists attack, but it is an unfortunate peculiarity of the admixture that it is never the same for many yards together, even in the same quarry. It is desirable to obtain a test of the relative value of stones to be used for building purposes. An attempt was made by M. Brard to determine the relative durability of limestones and sandstones having calcareous cements. This method consists of boiling small cubes in a saturated solution of Glauber's salts (sulphate of soda), and exposing the cubes in the air. The effect of expansion by the efflorescence of the salts, as the water evaporated, tested by weighing the amount of material removed from the stone in a given time, measures the effect of frost. It has not been found that the result can be depended on for practical purposes on a large scale, and it is now seldom resorted to. Slates belong to argillaceous minerals, and are completely metamorphosed so as to have lost all external marks of mechanical origin. In them bedding is replaced by cleavage. They split into thin plates, in planes parallel to each other, independent of original stratification. Those that split into the thinnest plates are used for roofing purposes, and those which yield slabs, for paving and walls. Slates of good quality are not very common, and unless accessible by sea, and there are means of getting rid of the rubbish resulting from the workings, they cannot be quarried with profit. They are limited to certain veins of comparatively small dimensions, in the midst of a considerable mass of schistose rock. Slates are generally from rocks of very ancient geological date, but this is not invariable. The best slates in the London market are obtained either from North Wales, from the north coast of Cornwall, from the west coast of Scotland, or from Valentia, on the coast of Ireland. Very good sorts are found in France, in the Ardennes, in Western Germany, and in the east of Europe. America also yields supplies. Slate hardly weathers when placed horizontally, unless exposed to foot-wear. In the better qualities of slate there is little or no pyrites, and the veins and joints are so arranged as to assist in the working. The best slates are obtained from some depth within the quarry, and in valleys rather than on hills. Exposed and weathered slates seem to have lost much of their fissile properties. All stones are injured by long exposure to the weather; and in considering the best method of keeping back decay, the composition and state of aggregation of the rock must enter into calculation. The causes of decay are partly chemical and partly mechanical, and include—(1) the action of rain-water, either by friction or dissolving parts of the stone; (2) disintegration of the stone by the action of frost. Rain-water again acts in two ways, decomposing by acids or disintegrating by efflorescence. All deserve consideration, and depend on the absorbent nature of stones. It is by capillary attraction that water is sucked into stones, and there are limits to this attraction. Together with the water its contents enter, but are left behind near the surface. When evaporation takes place from the surface, it is only the pure water that passes off. The foreign substances are left behind, and produce their effect in time. Rain-water contains carbonic acid gas and ammonia, and, however small the proportion may be, everything that can be affected by these substances will yield in time. Thus, even in granite, the silicates become decomposed and the felspar destroyed by the constant action of rain-water, and when the felspar is gone the rock will become rotten. Such is the case in the islands of Alderney and Jersey, in the British Channel. But if granite is destroyed, much more so are sandstones with calcareous cements and limestones. Owing to the quantity of coal burnt, and the impurity of the coal, there is always a certain proportion of sulphurous acid in the air in towns, and this becomes dissolved in the rain as it falls, and rapidly affects the carbonates of lime. This action going on every day, with every change of weather, the surface of the stone, bruised by the action of the tool, and deprived of the only protection nature is able to give, very soon disintegrates. The less homogeneous the stone, the more injured is it by this kind of action. The disintegration by the action of acid vapours would be slow were it not for the alternate expansion and contraction of the moisture contained in it. And this result is obtained in its maximum when the stone is so placed that the moisture is nearest the surface, which will happen when the stone is placed at right angles to this natural direction. Great care should therefore be taken by the builder to place the stones as nearly as possible in their proper position. The injuries that take place in absorbent stones from chemical reactions, are not easily traced, but are not inconsiderable. The various substances accidentally present in stones may become changed by the chemical action of salt contained in the absorbed water, and thus injure the stone and increase its tendency to decay. Many stones suffer efflorescence due to this cause. Loamy clays, places where sand has been used in mortar, or where salt can in any way have been absorbed, and stones in which an unusual quantity of organic matter is present, are liable to this cause of mischief. Efflorescence, from whatever cause, is certain to bring away detached fragments of the stone loosened by weathering. Whatever be the cause of the destruction of stones, it may generally be traced to the absorption of moisture, and thus any contrivance that will check the admission of water will be the most likely to succeed in preserving the material from decay. Many such contrivances have been proposed; they all involve some of these principles:—(1) closing the pores of the stone by some kind of paint; (2) coating the stone by some insoluble mineral substance; (3) defending the stone by causing it to absorb a chemical solution, which, on the application of another solution, becomes decomposed and deposits within the stone an insoluble coat. Paint, by preventing the absorption of water, preserves stone so long as it remains undecomposed. In London this hardly amounts to three years. The injection of oily and fatty matters acts in the same way and lasts only a little longer. There have been cases, where the exposure is not severe, and where the treatment has been adopted before the absorption of moisture, where the result has seemed permanent; but for buildings intended to last, such treatment is useless, as it can only stave off the evil day for a time comparatively very short. About

twenty years ago Professor Kuhlmann applied fluid silicate of potash to harden chalk and porous stone. On soaking chalk with the fluid silicate, a change took place, the face of the chalk becoming converted into silico-carbonate of lime. In practice, this method failed when applied to buildings, because the weather cannot be depended on, and a dry atmosphere is needed during the whole period of hardening. Not long after this had been done in Germany, Mr. Frederick Ransome, of Ipswich, attempted to deposit an insoluble wax, by means of another solution, which should act by double decomposition. He found that by following the silicate by a dose of chloride of calcium the chlorine parting from the calcium attacked the soda of the silicate, forming common salt, while the silicic acid combined with the lime and formed with it silicate of lime, a mineral nearly insoluble, very hard, and adhering with great tenacity to foreign substances. The effect of this treatment on stones that have not already been inserted into buildings has been very favourable, but applied on a large scale to buildings that have already shown symptoms of decay, the result is less satisfactory. A combination of Kuhlmann's process with a temporary wash of bituminous substance, has been tried on the Houses of Parliament by M. Szerelmy. It remains to be seen whether this result will be more satisfactory than that of Mr. Ransome. Besides the varieties of schist and slates used in construction, there are slates loaded with hydro-carbons to so great an extent that the rock will take fire on being exposed to heat and flames. Such rocks are generally called *bituminous shales*. They occur in rocks of all ages, are of various thickness, and exist under very different conditions, but in a general way they may be regarded as clay bands in sandstone rocks, into which a large infiltration of hydro-carbons, and occasionally much iron, has taken place subsequent to the deposit of the rock. Till lately these shales have been of little value, and have attracted no attention for commercial purposes, only those being valued in which the iron was sufficient to enable them to be used as ores of iron. Since the manufacture of illuminating and lubricating oils has been carried on, such shales as yield a sufficient percentage of oils on distillation to be worth working are among the sources of mineral wealth in the neighbourhood where they occur. From the tertiary rocks we have the paper-coal, used for distillation in some works nearly opposite Bonn, on the Rhine. From the cretaceous beds other shales have been worked, though to no great extent. The oolites are richer in bituminous strata. In the Kimmeridge clay there is a band of highly bituminous shale, of dark brown colour, and without lustre, burning readily. Part of it is called "Kimmeridge coal." The lias is richer in shales of the kind, and the "Posidonia schist" has been brought into use for distilling in Wurtemberg. It is chiefly rocks of the carboniferous series that yield the richest of these deposits. In Scotland, near Edinburgh, there are varieties of coal that pass so nearly into shales, and shales that so accurately put on the characters of coal, that it becomes difficult to distinguish between them. The well-known Boghead coal, and the Torbane-hill mineral are examples. These are either shales or coals, according to the line that may artificially be drawn between coal and shale. They are rich in the products given off by distillation at a low heat, and are ill-adapted for fuel. Many other minerals, departing more widely from coals in appearance, are called in Scotland "parrots," or crackling coals, and in England "cannels." When once set on fire they burn freely, with a bright flame and much smoke. They are easily distinguished from coals, but are more valuable than coals themselves for distilling. In the coal-fields of Lancashire, North Wales, and the Potteries, many such bands have been recognised. Some of them are rich in iron, and the iron stones of these and other coal-fields, including the "black band," are highly bituminous. The bituminous shales hitherto made use of in England are almost entirely from these black and brown bands in the coal measures, but this is not the case elsewhere. In the east of France, near Autun, not far from Dijon, there has long been a large manufacture of oils distilled from schists, quite independent of the coal. They have no resemblance whatever to coal, but one of them resembles the Scotch Boghead. Other cases exist in the west of France, where similar shales have been distilled. Good bituminous shales rarely soil the fingers; they are brown when scratched with a sharp point, and they break with an irregular fracture. They are usually tough, and sometimes fissile.

Thirteenth Ordinary Meeting.

Wednesday, March 1st, 1865; Rear-Admiral Sir Edward Belcher in the chair.

The following candidates were proposed for election as members of the Society:—

Dibley, George, 72, Malden-road, Haverstock-hill, **N.W.**
Miles, Henry Thompson, 61, Strand, W.C.
Redman, Capt. Gabriel J., 6, Belsize-park, Hampstead, N.W.

The following candidates were balloted for and duly elected members of the Society:—

Reeves, Miss Sarah, Rectory Grove, Clapham, S.
Ridley, Rev. N. J., Hollington-house, Newbury.
Templeton, Archibald, 16, Argyll-road, Kensington, W.
Templeton, John, Budge-row-chambers, E.C.
Wallace, Hugh, Chemical Works, New-road, Battersea-park, S.

The Paper read was—

ON THE MEANS EMPLOYED IN TAKING FISH, ESPECIALLY WITH REFERENCE TO SUBMARINE ILLUMINATION.

By F. W. Campin, Esq., Barrister-at-Law.

Although to the fisherman's calling there attaches a special feeling of interest, arising from the fact that some of the most notable of the first Apostles of Christianity were fishermen, and that we have in the Holy Scriptures narratives as to their labours in pursuit of their temporal calling, yet, whilst nearly every other industrial avocation has received attention and undergone modification, improvement, and advancement at the hands of our inventors and improvers of useful arts and trades, very little has ever been done to improve that of the fisherman; hence it seemed to me desirable to endeavour to direct public attention to the real state of the case, with the view of demonstrating that there are now available, means and appliances by which fishing operations can be rendered more easy, safer, less destructive to the breed of fish, and more productive than the methods and means heretofore employed.

It is true that in former times public attention was much directed to the promotion of this branch of industry; but this promotion took the form of Acts of Parliament, passed both in Scotland and in England, granting special immunities and supposed advantages to persons engaged in fisheries; and the herring fishery in particular was guaranteed much of that kind of encouragement which was then in vogue, viz., the institution of monopolies and special privileges, though it appears that a somewhat sounder measure was brought forward when, in 1677 (King Charles the Second's time), a new royal company was established in England, at the head of which were the Duke of York (afterwards James the Second), the Earl of Derby, and other influential persons. This company, after being favoured with considerable success, was brought to an end by an unforseen and untoward event. Most of its vessels, termed "busses," had it appears been built in Holland and manned with Dutchmen, and, on the pretence that these were Dutch vessels, the French, who were then at war with Holland, seized a number of them,

and this, it is said, ruined the company. Attempts were afterwards made to revive the undertaking, but they came to nothing, the death of the king intervening. Soon after the Revolution this business was again resumed, and efforts were made to interest the public at large in the scheme, which do not appear to have been successful, as we have no further accounts of the matter. Since that time other attempts have been made to encourage our sea fisheries, as in 1749, when an association (the "Society of the Free British Fishery") was formed, and bounties were granted to all vessels employed in the fisheries; but it was found in the end that the Dutch kept the market, although in 1757 the bounty was made up to 56s. per ton. However, little has ever been done in the right way, viz., organization and improvement of the art of fishing and of the methods and appliances used in the art, though it ought to be here recorded that the Society of Arts gave much attention to the subject of increasing the supply of fish, and that it was due to the exertions of the Society and the rewards it offered, that the fish-vans or fish-machines used (until the railway system became developed) for speedy transport of fish from the coast to London were adopted. Further endeavours were made by offers of prizes to stimulate the supply of large fish, such as turbot of a certain size.

Before leaving this part of the subject, it may not be amiss to briefly allude to the importance, in a national point of view, of maintaining and improving our fisheries, as to which it has been well observed, that since "Providence hath so eminently stored the coasts of Great Britain and Ireland with the most valuable fish, and since fisheries, if successful, become permanent nurseries for breeding expert seamen, it is not only due to the Supreme Being not to despise the wonderful plenty he hath afforded us by neglecting to extend this branch of commerce to the utmost, but it is a duty we owe to our country for its natural security, which depends upon the strength of our Royal Navy. No nation can have a navy where there is not a fund of business to breed and employ seamen without any expense to the public; and no trade is so well calculated for training up these useful members of society as fisheries." Since the repeal of the Navigation Laws this point has become of greater importance than ever.

The situation of the British coasts has been said to be one of the most advantageous in the world for catching fish; the Scottish islands, particularly those to the north and west, the most commodious for carrying on the fishing trade to perfection; for no countries in Europe can pretend to come up to Scotland and Ireland in the abundance of the finest fish with which their various creeks, bays, rivers, lakes, and coasts are replenished. Of these advantages the Scots seem indeed to have been most abundantly sensible, and their traffic in herrings is noticed in history as early as the ninth century.

The ordinary methods and appliances used for fishing purposes are, it seems, these:—

Cod-fish, as a rule, are taken by means of hand-lines but at the approach of autumn and in winter, when the fish are at the lowest depths seeking "ground bait," long lines have to be resorted to, which are furnished at intervals with hooks, upon which wilks are fixed for bait, and these are sunk by being "shot," or paid out," and after lying nearly a day or a night are "payed in," and the fish, if any, are taken off and put into the well of the smack. In fine weather small cod-fish are sometimes swept into the trawl net, the trawl beam, to which the net is fastened, mostly dragging the bottom, which is very injurious, destroying young fish and ova; in fact, so great is the evil of this, that it is now under investigation by the Royal Commission appointed to inquire and report as to British fisheries.

Mackerel are taken at one season with nets constructed on purpose, as, being then blind, any bait which may be lowered can be of little avail, as it cannot of course be seen by them; but after this blindness has left them hand lines are employed.

Whitings are taken by hand-lines baited with mackerel, from April till August. They are taken by trawlers in great numbers; but, when caught by trawling, their market value is much lessened, by reason of their scales being rubbed and the elegance of the fish destroyed; whereas, by the ordinary line-fishing they are not damaged, and they fetch a high price in consequence.

Haddocks are taken by lines with mussels for bait, and are also taken by trawling, but are then, as is the case with whitings, very much lessened in value.

Gurnets are generally taken by lines, and frequently while fishing for whitings.

Skate are very frequently taken by the hand-lines, the same bait being used as for cod. They are also at times swept into the trawler's nets; many are taken on the Doggerbank fishing grounds by the long lines.

Artificial baits are sometimes used, and are made of vulcanised india rubber—hollow—and in the form of a fish. They have been tried in several instances and found to be highly attractive. They are made by W. Warne and Co., of Tottenham, and are, for the following reasons, very economical: Being exceedingly tough, they are not destroyed by the teeth of the fish; entering crosswise, they are not swallowed, and are usable a second time; they are at all times ready for putting into the hooks, and can easily be taken off when out of use; wilks, being the chief bait for cod-fishing, cannot always be obtained—smacks often lose days waiting the arrival of wilk-boats, and wilks once used are mostly destroyed; besides all which, many are found to be dead when wanted for use; and such is the extraordinary facility these fish (cod) have for scenting dead wilks, that they instantly reject a "dead 'un." Taking all things into view, the artificial baits are, perhaps, more economical and advantageou than any other kind of bait.

It is a well-known fact that fish are to be attracted by light—a fact which was not unknown to the ancients; and it has been the constant practice of the Chinese, handed down from remote ages, to use apparatus for catching fish, consisting, as I understand, of a board or frame, having candles or other means of lighting placing thereon, with a frame or net hinged thereto, which is floated on the surface of the water, and when the fish have been attracted by the light to the frame or net it is thrown up on the hinges, thus taking the fish. Surface lights have also been in use for catching salmon, pilchards, and other fish. An attempt to render a surface light commercially available was made by a public company about the year 1826. It was not, however, persevered in, and I am not aware that its operations were attended with any degree of success.

In the year 1862, Mr. Henry Richardson Fanshawe obtained a patent for "Improvements in the mode and means for fishing in seas, rivers, and other waters;" and in the specification of his patent he thus describes his invention:—

"My improvements consist in the employment of a submerged or subaqueous light, for the purpose of alluring or decoying fish, thereby facilitating their capture, the light I employ being derived from electricity or from the ignition of oil or gas, or I may employ phosphorised oil or other luminous fluid or any means for producing or maintaining a light under or below the surface of the water; or I may obtain a sufficient volume of light for my purpose by reflecting light from above upon submerged reflectors."

Mr. Fanshawe further states that he uses "arrangements of globe, lantern, or reflectors, the decoy light or reflector being placed or disposed in such a manner at the required depth that the fish are attracted thereto by the light. The illuminating apparatus may be lowered to the required depth by any mechanical arrangement which will answer the purpose desired, but he constructs or fits boats with a well or wells at or near their centres, for the purpose of more conveniently superintending the working or adjustment of the decoy arrangement, and of seeing

when a sufficient number of fish are collected, so that the boat may be removed for the purpose of closing the net or nets. When the electric light is employed, the lantern may be sunk before ignition, and the light extinguished before its withdrawal."

After describing in detail the invention, Mr. Fanshawe's specification states:—

"In working the boat with the lantern and its lowering apparatus, I place it in the position assigned by previous arrangement with the fishermen, and having unbolted the top of the lantern and ignited the lamp, re-bolted the top on, and connected the two lengths of flexible tubing required, one to the inlet and one to the outlet pipe, I lower the lantern, by means of a windlass and chain, to the desired depth; this, in many cases, will be found to be about half the depth from the surface to the bottom. It will be obvious that tubes must be of such a length that, at all depths to which the lantern may be lowered, their ends may be above the surface of the water, and I prefer to maintain them in a position about eight feet above the surface of the water, bending their upper ends downwards to prevent water and spray from entering, and the wind from disturbing the current of air in the apparatus, as it may otherwise cause too great pressure on the ingress, and impede the escape of the bad air from the outlet pipe. In some cases the light may be required to be stationary, in others it may be found advantageous to move slowly in any one particular direction as may be previously agreed upon. In working or manœuvring the well boat and lantern, much must depend upon the nature of the bottom, the depth, and also the habits of the particular fish sought after, which will be best known by experienced fishermen. When a sufficient time has elapsed for the fish to congregate in the locality of the light, the boat can (after drawing up the lantern and air tubes) be moved, in order to enable the fishermen to carry out their operations.

"In line fishing similar operations are carried out, always taking care that the baited hooks are placed in a horizontal, or nearly horizontal, line, and to employ the reflector lanterns, as hereinbefore mentioned, so as to throw the light in the direction of the line or lines.

"In some cases, where it may be found desirable to employ more than one lantern, a buoy or buoys should be used to sustain the lanterns, and the tubes supported by a frame of wood or metal fixed upon the said buoy, the ends of the tubes being carried about eight feet above the buoy, and bent downwards, as in the case before mentioned. To assist in maintaining the steadiness of the light, which, when in use as a decoy, is important, I employ a strap or band of vulcanized india rubber between the end of the windlass and the ring on the handle of the lantern. This strap or band must be of sufficient strength and length to prevent, as far as possible, the communication of the undulating motion of the boat or buoy to the lantern by the extension (due to its elasticity) of the said strap or band. I protect the said strap or band by placing a chain or chains, of greater length than the said strap or band, in such manner that the chain or chains will hang loose, and upon any sudden snatch, or motion on the surface of the water, the chain or chains will limit the extension of the strap or band, and prevent its breakage. In moderately-smooth waters the use of this strap or band will not be necessitated.

"In all cases where india-rubber tube is mentioned in this specification, it should be understood that it must be vulcanized india-rubber tube, and must be of the description known as suction tube; and in all cases where glass is mentioned, the glass may be either plain or coloured, in any way that may be found to give the tone of light best suited for the purposes herein described, and for the particular kind of fish sought after.

"In some cases I employ a mirror or polished surface to act as a reflector of the sun's rays, or at night to reflect those of the moon, or of lamps or lights placed superficially above the water; and by means of cords or chains hereinafter mentioned, I regulate the angular position of the upper rays of light, whether of natural or of artificial light. It is found that in very clear water a lantern, similar to that termed a bull's-eye lantern, produces from the side of the boat or vessel a strong reflected ray of light upon the submerged reflector, but the plan of employing the reflectors answers well in very clear waters only. When the bull's-eye lantern is employed, the reflector therein should be placed higher, and at a more acute angle than is the case in the common bull's eye lamp, and the lens should be placed at the corresponding angle, so that there may be no necessity to interfere with the upright position of the wick or lamp. The reflecting submerged surface must be weighted, and have cords or chains as, hereinbefore-mentioned, leading up to a boat, and fastened to the gunwale, or to pegs or hooks."

Mr. Fanshawe made the first sea trial of his invention in May, 1864, in Rye-bay, on the fishing ground known as the Falls, and was very successful in decoying whitings and mackerel to the bait. As in most first trials, some difficulties presented themselves. From there being too little weight to sink the lantern and to keep it perpendicular in the under-currents, and also in consequence of the prevailing E. and N.E. winds, not so much success attended these efforts as was expected. However, a trial was made in August, off the coast of Scarborough, where, upon one occasion, several gentlemen of that town accompanied the *Hewitt* smack to witness the effects of the Patent Subaqueous Light, and were, as they expressed, equally surprised and delighted. A report was published in one of the papers of that town. Many of these gentlemen were provided with their own lines and hooks, and took large quantities of whitings.

The appearance of the sea during this trial has been described as very splendid—the reflection from the sunken light throwing up the bluish green tinge of the water from the valley to the crest of each wave. Even the sails and cordage of the vessel were thus lighted up with the resemblance of a ship afloat on a sea of gold. The silvery fish darting about, and ever and anon ascending nearly to the surface of the illuminated water, presented the appearance of dots of polished silver in a sea of gold and azure.

In the five voyages made by the above-named vessel, in which the light was placed, many whitings were taken to market. In fact, the experiment was deemed a most successful one.

In September, 1864, the smack *Hewitt* again left, but this time for the North Sea fishery, to take cod-fish by the aid of the subaqueous illuminator, and was very successful upon several occasions. She was accompanied by other vessels, which also were successful in taking cod-fish in the illuminated water, the largest quantities of fish being found at the verge of the light, or rather in the shadow, as many as thirteen score having been taken at one "take" by a smack so placed. As a rule the largest and finest fish are taken nearest to the light, the smaller and more timid fish being in the shade.

Oil lighting material has so far been employed, and there is no doubt that eight or ten fishing vessels could be worked round one light, especially if one of greater intensity—such as the electric light—were adopted.

Although Mr. Fanshawe's patents, both for Great Britain and for France, for the application of light to fishing purposes, were secured prior to the patent of Iodocius, whose name has been before the public in connection with this subject, he has most successfully used the electric light on the French coast, and under, it is said, the especial sanction of the French Emperor, has captured large quantities of fish, showing at once the certainty of the principle adopted, namely, that fish are unmistakeably drawn from the ground, at sea or in rivers, by the decoying action of light. The great object gained by the subaqueous illuminator, is that we descend so near to the fish as to induce them to leave and to take the bait, which is visible, whereas surface lights, when employed,

are only useful as decoys in isolated cases, and then only to a very inconsiderable depth.

As an instance of the magical effects of light upon fish, it is stated upon reliable authority that in cases where the diving bell has been employed in vicinities where fish are to be found, the water immediately around has been seen teeming with them.

The subaqueous light was tried in fresh water in the River Lea, at Tottenham Mills, and was visited by very many persons. The attractive properties were at once manifest, greatly to the admiration of the many people present. These displays took place during a period of several months, and previously to the display of the principle in salt water.

Mr. Fanshawe proposes to employ the light in fresh water for salmon-taking.

Mr. Fanshawe's system is said to be very advantageous for the following reasons:—

1. As economising labour on the fishing grounds.

2. Shortening the time now occupied in taking any given number of fish.

3. In the quantity of bait used, and in the necessary outlay for lines and gear—"long lines" being superseded —"hand lines" only being required in line fishing.

4. Increased safety for human life, the work being confined to the decks of the vessels.

5. In the conservation of the young fish, too small for market, and also of the ova; there being in ordinary trawling (numerically) more fish destroyed by the present trawler's "beam," and the necessarily great pressure of the "long lines," than are caught. By the patent decoy light this constant process of destruction of newly hatched and of unhatched fish is entirely obviated, as only fish worth taking rise from the bottom to the decoy light, and are there taken by the baited hooks; or, as in the case of trawling, within the range of the usual nets; trawling as usually practised being superseded.

6. Increase of fish supply. Independently of the advantages shown by the employment of this patent plan as regards the extra quantity of fish caught through its aid, there are many localities inaccessible to the ordinary modes, and whence fish may be decoyed to more favourable positions for capture; besides which, immense quantities of non-edible fish are attracted, all of which are valuable, either as manure, or as oil-producing material; and these fishes are voracious, and constantly feeding upon the edible fish, so that two ends are gained by their removal.

In concluding this, my imperfect essay to handle a subject doubtless second to none in national and commercial importance, I may perhaps be allowed to state that I have abstained from treating of the taking of fish by angling, as that is a method resorted to more as a sport or pastime than as a matter of trade, this latter being as it appeared to me what needed consideration. Further, it perhaps may be permitted to me to state that I have practically no acquaintance with fishing operations, all the statements that I have made on that head being derived from information obtained from Mr. Fanshawe and others; and in alluding to that gentleman, I hope I may be allowed to trespass further on your time, by referring to an incidental topic—one as I conceive of the very greatest importance—it is this:—that should Mr. Fanshawe's invention be found to be an improvement of public and commercial importance—it is without question one by which he would have no chance of obtaining any pecuniary remuneration, unless it were by interesting capitalists in the formation of a company (which I understand is his intention), securing them in the possession of the exclusive rights granted by the patents, or by the means of royalty payments for licenses under the patents; in other words, without the patent laws, Mr. Fanshawe would have no chance of reward.

DISCUSSION.

Mr. STOVIN remarked that during the reading of the paper the question had been asked when this patent was taken out, and no doubt the length of time which had elapsed since the filing of the specification (1862) might, if unexplained, tend to throw some discredit upon the invention. The delay in the commencement of the operations was easily accounted for, In the first place, there were great difficulties attending the organisation of a system to carry this invention into practice, a great many experiments had to be tried, and various kinds of apparatus had to be constructed before that which would thoroughly answer the purpose was arrived at. Then again, Mr. Fanshawe himself was so much occupied with other business that he could not give his entire attention to this matter, and therefore it had been put off from time to time, and though experiments had been tried at intervals, they had not been carried on in such a manner as to attract public attention to the invention. From what he had seen of it himself, he fully believed it was calculated to confer great benefits on the community in the way of increasing the supply of fish to the markets, and cheapening that which might be made a staple article of food, so as to bring it within the means of the poorer classes. He believed that when a company had been formed to carry this invention into practical operation, the results would be of a highly satisfactory character; but, as far as the experiments had gone hitherto, they did not afford a fair criterion on which to form a judgment as to the real merits of the invention.

Dr. BACHHOFFNER (who had inquired the date of the specification) said he asked the question simply from curiosity, inasmuch as he had not heard of it before. There were many points in the system brought forward which struck him as ingenious, but they all knew that the plan of catching fish by alluring them with light was no novelty, though the light was most commonly employed above instead of below the surface of the water. At the same time he must be allowed, on the part of the finny tribes, to repudiate the idea of their being attracted by being enabled to see, through the means of this submerged light, the particular nature of the bait which was offered to them. For his own part he did not believe that fish were such epicures, although, like the moths, they might be attracted by a light to their own destruction. He apprehended that the invention was also applicable to deep sea fishing; and if that were so, he imagined that some means would be required for forcing air down the flexible tube in order to support combustion. The use of submarine light for facilitating operations beneath the surface of the sea was no novelty. At the time of the operations for blowing up the wreck of the *Royal George*, at Spithead, the late Sir Charles Pasley complained of the difficulty of carrying on the works when the water was in a thick and muddy state, when he (Dr. Bachhoffner) suggested that if the divers were supplied with two pieces of artificial graphite in connection with the wires used for firing the charges of gunpowder by electricity, the means of obtaining a submarine light would be furnished. The suggestion was acted upon, and the result was satisfactory, but he did not remember whether it was in that instance that the fish flocked round the divers in such extraordinary numbers. He had heard of an invention for introducing the electric light below the water in a vessel hermetically sealed, but he believed it was only intended for the purposes of submarine foundation works.

Mr. S. REDGRAVE confirmed the remarks made as to the antiquity of the practice of decoying fish by means of lights on the surface of the water. Mention was made in an old work of a lady at Twickenham, who was annoyed by the disturbances made at night by the salmon fishers in the Thames; and he had in his possession a drawing, eighty years old, representing salmon-fishing by torch-light in the river Tamar.

Mr. BISHOP mentioned that surface lights in fishing for salmon and other fish had been in use for many centuries on the coasts of Norway, more particularly on the Naze and at Christiansand.

Mr. VARLEY remarked, that many years ago Admiral Coffin introduced a method of catching fish in large quantities by means of glittering artificial bait, a plan which was particularly successful in mackerel fishing. For such a process he thought the proposed submerged light would be extremely applicable.

Mr. DE MORNAY said, in almost all parts of the world the practice of fishing with lights on the surface of the water obtained. In parts of America large quantities of fish were taken by attracting them in this manner, and then feeding them with a preparation made from the bark of a species of *mangue* tree, the intoxicating effects of which caused the fish to float helplessly on the surface, when they were taken in large numbers. In a short time they recovered, and no pernicious effects were produced in the fish by this drugging, so as to depreciate them as food.

The CHAIRMAN said, as an old fisherman of sixty years' standing, he might be able to tell the meeting a little about the subject under discussion. In the first place, with reference to the remarks in the early part of the paper, that the fishing trade of this country afforded a means of recruiting the naval service, he might say, after a very long association with sailors in Her Majesty's service, that he had very rarely found a fisherman in the navy; and he supposed that was a great deal owing to fishermen being exempted from impressment during the war. It was, however, often the case that old seamen who had served in the navy fixed themselves along shore and became fishermen, but these were worn-out men, and would, of course, be unfit for the service. The only really able fishermen were those in the North Sea, and they were too well paid for their work to enter the navy. As a naval officer, having to select a ship's crew, he would, as a rule, refuse fishermen; and he knew that was also, to a great extent, the feeling of French naval officers. On one occasion he was informed by a French admiral that, being forced suddenly to put to sea, he had been compelled to take a crew mainly composed of fishermen. The result was that he was obliged to reef topsails, and for many days dared not make sail, because his crew of fishermen were all sea-sick and unable to work. During the French war two fine ships sent to sea were captured, within a few miles of the French coast, by two small frigates—an easy conquest, in consequence of a great portion of their crews being sea-sick and unable to fight. The Newfoundland men were great fishermen, but their occupation there was merely to sit within a circular space, with a barrier to protect them from the water, and to clean and split fish, an employment which did not in any way fit them for service on board ship. In the days of his (the Chairman's) boyhood he was in the habit of running away from his home, and spending a good deal of time with the Mic-mac Indians, learning their secrets in fishing. One of the principal methods employed by semi-civilized tribes, as well as by savages, had always been the use of the flambeau at night, and at the present time that mode of fishing was a favourite amusement amongst the ladies of Nova Scotia, the prey being chiefly lobsters, which, being attracted by the light, were taken by prongs into the boat. He had fished in every part of the world, and was bound to say he could not give the preference to our English coasts in respect of the quantity of fish to be taken. It was in Newfoundland, on the coasts of Barbary, and in Southern Africa, eastward of the Cape of Good Hope, that the best fishing was to be found. There was no necessity for bait there; but with little pieces of bright metal, with hooks attached, fish were pulled up as fast as the line could be put in, by what was known in this country as "foul-hooking." On the west coast of Newfoundland a cutter, 25 feet long, would be filled with fish in two hours with ten lines. In the deep-water fisheries of that country lines of 70 fathoms in length were used, and the hooks were baited with the bright metal baits, until the month of June, when the caplins—small fish resembling the smelt—come in season, and then these were used. A great bait for fish in most parts of the world was the squid, or cuttle-fish. With respect to the delicate taste of fish in their bait, he had not much faith in this, for it was a common practice, after having caught one fish, to take what he had in his stomach for bait, and thus to catch a great many more. It was a very curious fact with regard to mackerel, that in some places the fish did not open their eyes till about the 22nd May, and in other places, such as on the coast of Ushant, in France, they did not bite till the first week in June. The bait most used for taking this fish on our own coast and in the North Sea was the lug-worm. Skate were principally captured with the trawl, but they were occasionally taken by bait in the North Sea. The trawl had of late years, from some cause, got into sad disgrace, and was now on its trial before the House of Commons; but he believed this was mainly due to a quarrel between the fishermen on the north-east coast and the Torbay fishermen, some of whom came to the north-east coast, and understanding the proper use of the trawl better than their brethren there, were consequently more successful in their takes of fish, and hence jealousy had arisen between them. For his own part, he thought the trawl, when properly used, was not open to the objections made against it. On the western coasts of South America the half-caste Spaniards were very successful in fishing with flambeaux, made of long, thin strips of a red resinous pine, bound together in bundles about as thick as the wrist. The boat, with the flambeau projecting over its bow, was kept in gentle motion, and the fish being attracted to the surface by the light of the flambeau, were readily speared in great numbers. In China and the West Indies fishing with lights on the surface was carried on to a great extent, but in this instance nets were used. He had seen fish go to the bait in 32 fathoms water. By throwing a little oil on the water a perfectly glassy surface was obtained, and it was possible to see very clearly to a great depth; and this was particularly the case in some of the lakes of Switzerland. He would now say a word or two with regard to the question of the production, by this invention, or by any other means, of an increased supply of fish as a food for the poorer classes. There were already large takes of fish, such as herrings and mackerel, at Tenby, which (although there was railway communication) it was not thought worth while to send to London or elsewhere for consumption by the people, and if this was so, what was the use of endeavouring to obtain still larger quantities? While the fish was disposed of on the coast at nominal prices, and used for manure, all kinds of fish remained very dear in London, and beyond the reach of the poorer classes. Our great want, therefore, was, that the fishermen should be compelled not to throw away large supplies of food when there was a glut of it in any particular locality, but that they should be forced to send it to market, where there was a great demand for it. It was a well-known fact that, years ago, in order to keep up the price of fish in the London market, the fishmongers stopped the smacks at the mouth of the Thames, and made them throw their cargoes overboard. With regard to the powers of Mr. Fanshawe's patent, it was well known that its powers did not extend more than three miles from the coast of Great Britain. Reverting to the question of the alleged destruction of small fry and ova by the trawling beam, the chairman remarked that he felt quite sure the objection to the trawl arose entirely from ignorance of the proper method of using it, and not from any fault in the apparatus itself. No fisherman, he said, who understood his business, would attempt to draw his trawl against the tide, for he would catch no fish. The boat must go with the tide, but a little faster, and then the trawling beam would rise up some little distance from the bottom, and the best fish would be caught. With regard to the alleged destruction of spawn by the trawl, no spawn was found in deep water. It was a fact well-known to naturalists that the spawning

of all descriptions of fish took place in the shallow water along the shores and creeks, where there was no trawling. The outcry against the trawl on the ground of the destruction of ova was not, therefore, justified by facts. The chairman concluded by proposing a vote of thanks to Mr. Campin for his paper.

The vote of thanks having been passed,

MR. CAMPIN acknowledged the compliment, and said if he had known that his efforts would have been subjected to the criticism of so experienced an authority as Sir E. Belcher, he should have hesitated in bringing this subject forward, having himself no claims to attention as a practical fisherman. Looking to the project of Mr. Fanshawe he thought, on the whole, some beneficial results in regard to an increased supply of fish as an article of food might be expected from its application. Judging from the remarks of Mr. Stovin, he thought that gentleman was too diffident with regard to the experiments already made, inasmuch as Mr. Fanshawe had reported that his apparatus had been the means of attracting very large quantities of fish. Whether it would be commercially successful or not was a question he would not now enter upon. With respect to the point raised by Dr. Bachhoffner as to the supply of air necessary for combustion at a great depth under water, he apprehended that was a mechanical matter which could easily be provided for, and he believed Mr. Fanshawe contemplated the use of some air pumping apparatus for great depths.

MR. HAWES said, as Chairman of the Council, he would venture to take the somewhat unusual course of giving the thanks of the Council, and he was sure he might add those of the meeting, to the chairman for having, in so able and entertaining a manner, communicated to them the results of his experience on this subject, extending over a great number of years.

Proceedings of Institutions.

BACUP MECHANICS' INSTITUTION.—The Report of the Directors, presented at the twenty-sixth annual soirée, January 3rd, 1865, records the continuance of the prosperity of the Institution. In their efforts to promote the cause of education, the directors have received abundant help from friends of every religious denomination, and a spirit of kindly sympathy has been displayed by the members. The finances of the Institution are in a healthy state. The receipts have been £399 15s. 6d., the balance in the treasurer's hands at the end of the financial year being £12 10s. 1½d. In the first quarter of the year there were on the books 275 members; second ditto, 225; third ditto, 200; fourth, 287, being an average of 246 members per quarter. The directors regret that many of the members are in the habit of discontinuing their subscriptions during the summer quarters. The effect of this narrow policy is to cripple the funds of the Institution to a very considerable extent. During the year about 90 volumes have been added to the library. An increase over the previous year has taken place during the last twelvemonths in the issue of volumes, the number being 7,038, or an average of 41 volumes for every member whose name is on the librarian's register. The news and reading-room is much frequented. The receipts of the Wednesday evening lectures, which terminated in March last, were a little short of defraying the expenses of the course. The third series of lectures and entertainments commenced in October last. Amongst them may be mentioned the Rev. Arthur Mursell, of Manchester, "Wanderings at Waterloo;" Mr. Robert Dodwell, C.E., of Manchester, lecture entertainment, entitled, "Two Hours in a Telegraph Office," illustrated by apparatus, &c.; Mr. Samuel Wimpenny, of Holmfirth, "The Life and Travels of Dr. Livingstone," illustrated; Messrs. Ellis and Cavanah, of the Manchester Shakesperian Society, "An Elocutionary Entertainment;" Mr. W. A. Abrams, of Blackburn, "The Literature of the Lakes;" and Mr. T. Hastings Ingham, of Skipton, "The Philosophy of Shakespeare." A manuscript magazine, consisting chiefly of original contributions by members and their friends, was commenced in April, 1864, and has been successfully continued monthly to the present time. It has proved valuable as a treasury of institutional and local information. The character of the evening schools has, during the last twelve months, been fully maintained. The increase in attendance at the evening classes has been considerable. In efficiency, as tested by the Local, Society of Arts, Science and Art, East Lancashire, and Lancashire and Cheshire Union Examinations, the School has made decided progress. It is a source of regret that in some of these examinations the candidates are almost entirely from the younger members of the classes, while the older ones make no attempt to compete in them. The establishment of the science classes, in which chemistry and physiology are taught, has been attended with the best results. The directors regret that the female classes are not so numerously attended as they deserve to be, seeing that they offer a good opportunity for young women to acquire a serviceable education at an inexpensive rate. The day school has been well attended during the twelve months, but as work has been scarce and unremunerative, many parents have not been able to pay the full fees. The number of children on the day school book is 232, and on the night school book 119, making a total under tuition at the Institution of 351.

FARNHAM YOUNG MEN'S ASSOCIATION.—At the recent annual general meeting of the members, the committee for 1865 were elected. From the balance-sheet it appeared that the expenditure for last year was £134 2s. 7d., the balance due to the treasurer being £29 2s. Several important alterations were made in the rules of the Association. Since this meeting the debt of the Association has been kindly paid off by the Bishop of Winchester, President.

DIGEST OF PARLIAMENTARY PAPERS.

Notice having been given by Mr. William Ewart, in the House of Commons, "To call the attention of the Government to the public advantage which would result and the saving which would accrue from the publication of an abridgment or digest, to be issued from time to time, of all the Parliamentary Blue Books, and similar documents, on the same plan as that of the 'Statistical Abstract' issued by the Board of Trade since the year 1854" (Friday, 10th March), the following statement of facts on this subject may not be uninteresting:—1. The Parliamentary Papers consist of (1.) Votes and Proceedings of both Houses of Parliament, Journals, &c.; (2.) Bills as presented in both Houses, and in their various stages; (3.) Papers presented by command, viz., Correspondence on Diplomatic Subjects—Reports of Permanent Commissions and Public Departments, such as Revenue Boards, Poor-law, Judicial Statistics, &c.—Reports of Temporary Commissions, such as Patent Law, State of Education, &c.; (4.) Returns ordered by both Houses; (5.) Reports of Committees of both Houses; (6.) Acts of Parliament. 2. On an average, there are upwards of 1,000 documents published yearly, the greater part of which are in folio, and altogether they extend over not less than 50,000 pages per annum. The cost of printing papers for both Houses of Parliament was given in 1864 at £67,500, independent of the large amount expended in printing, &c., for the several departments of Government, amounting in all to upwards of £300,000. 3. In the publication of such documents there is necessarily, and in many cases unnecessarily, a constant repetition of facts, a great diffusion of details, and an evident want of system.* 4. Such papers are not much read by the

* In illustration of this fact it was shown in evidence before the Committee of the House of Commons in 1862, by Professor

members themselves, for want of time during the Session to wade through them; nor are they read by the public, for want of facilities for getting at them. 5. Setting aside the sale of these documents singly at the Parliamentary Paper Offices, which is comparatively very small, the public at large have no means of consulting such Parliamentary Papers in a collective form, since, on account of their bulk and expensiveness, no private gentleman and no public institution can conveniently afford the space required to keep them. Apart from the British Museum and other National Libraries (three or four in number), very few other libraries possess a full collection of all Parliamentary Papers. 6. Hence the greater bulk of such Parliamentary Papers, which would be well calculated to diffuse solid and valuable information on all political, financial, and economic subjects, is sold and used up as waste paper. 7. The Committee of the House of Commons on printed papers, of 1835, originated by Mr. Joseph Hume, in their report, p. 24, recommended that the printing committee should have power to classify such papers, and to direct the manner and form of printing the same, either *in extenso*, or by way of abstract, as may be most calculated to convey to the House the requisite information. 8. In 1852, the Society of Arts, and Mechanics' and Literary Institutions throughout the country, petitioned Parliament for the gratuitous distribution of many of these reports, alleging that such a diffusion of useful knowledge would be attended with very great public advantage; and on the motion of Mr. Tufnell a Committee of the House of Commons was appointed to inquire into the expediency of distributing *gratis*, under certain regulations, a selection from the reports and returns of the House of Commons among Literary, Scientific, and Mechanics' Institutions throughout the United Kingdom. The committee recommended that on the receipt of any applications certain reports or papers should be granted. But it does not appear that the resolutions were at any time carried out, from the difficulty of making any selection, and from the want of accommodation in such institutions for such a mass of heavy volumes. 9. In 1854 the Board of Trade began to issue the statistical abstract, comprising a collection of all the facts recorded in all the public documents for the previous fifteen years, and this has been eminently successful, in consequence of the easy reference it affords for a considerable amount of varied information hitherto unattainable except from numerous sources; but the statistical abstract is confined to economical facts, and gives none of the circumstances which give rise to such facts. It only culls out the figures, which, though instructive in themselves, do not sufficiently indicate all the lessons they are intended to teach. 10. Attempts were made to supply this want in 1856 by Professor Leone Levi, in his "Annals of British Legislation," being a summary or digest of all public accounts, papers, reports, &c., of both Houses of Parliament, classified under the following eight series, each comprising all the papers published on the respective subjects:—Series A, Finance, Commerce, and Agriculture; B, Diplomacy and War; C, Ecclesiastical Affairs and Education; D, Railway Shipping, and Postal Communication; E. Law, Justice, and Crime; F. British India, Colonies, and Dependencies; G. Population, Municipal and Parliamentary; H. Health and Miscellaneous. 11. The work is published by Messrs. Smith, Elder, and Co., in monthly parts, forming two volumes a year of about 500 pages octavo each, and gives within this limited compass, and for two guineas per annum, all that is most valuable or needful to be preserved for reference, as regards the general reader, out of the large number of volumes published every Session. 12. The "Annals of British Legislation" have now been in existence for seven years, and fourteen volumes of the same have already been published; but whilst its utility has been fully recognised by many of our most eminent statesmen, experience has shown that a work of this kind cannot be sustained as a commercial operation, not possessing those advantages which are enjoyed by works issued by public authority. 13. Having regard to the success of the "Statistical Abstract," and to the appreciation which has attended even the private enterprise above described, it cannot be doubted that the publication of a Digest of Parliamentary Documents by the Board of Trade would be attended with great benefit; not only by the diffusion and preservation of most valuable information now practically buried and lost, but by the direct saving of a large sum of money—since it would render unnecessary the publication of many copies of papers now printed by both Houses of Parliament, and would greatly extend the circulation of those of which the publication is necessary.

Leone Levi, that the state of the finances is given in the quarterly accounts of the revenue, the finance accounts, the statistical abstract, the miscellaneous statistics, the reports of the respective boards, and Mr. Williams's returns; the Customs Revenue being, moreover, given in the Board of Trade accounts, both monthly and annually. The reports of committees generally contain evidence repeating again and again the same facts and opinions. The reports of the Civil Service commissioners give all the examination papers. The treaties with foreign powers are published in English and in the languages of the countries with which they are concluded. As to bulk, it is quite usual to publish folio volumes of 800 pages. The report on the Endowed Schools (Ireland) comprised 1,884 pages.

Fine Arts.

PARIS SCHOOL OF BEAUX-ARTS.—The Council of the school has fixed the annual competition and exhibition of the works of the students for the grand prize of Rome a month earlier than usual this year. The decisions are to be made on the 11th of August, and, for the first time, the exhibitions of the works in architecture, painting, and sculpture will take place at the same time. In addition to this annual competition for the privilege of studying at Rome—the Roman scholarship—there are quarterly exhibitions in the school, when honorary prizes are awarded to the pupils; but another kind of competition has just been set on foot, which deserves attention from its novelty and liberality, and which, it is said, promises to work well. The authorities have offered a certain number of silver medals to be awarded by the pupils amongst themselves once a year. The method adopted is as follows:—Each professor selects from amongst the works of his own pupils those which he deems the best. The pupils of each of these schools then elect five out of their own body, and the works of each school are judged by the delegates from its rivals. The pupils in painting of M. Cabanel and of M. Pils obtained in each case a first, second, and third-class prize, while those of M. Gérôme received first and second, but no third prize. In sculpture, M. Durant's school obtained all three; M. Duret's second and third-class prizes only; and M. Jouffroy's one first-class medal. The three architectural schools each earned prizes in all three classes. This is certainly a novel experiment, and of course highly gratifying to the pupils themselves, who are thus formed into a kind of mutual jury.

M. HEBERT, a very charming painter, is said to have been appointed to succeed M. Schnetz as director of the French Academy at Rome.

SCULPTURE FOUND IN CANDIA.—In digging foundations for a mosque near the village of Hicropetros, in the island of Candia, on the site of the ruins of some ancient buildings, three statues have been brought to light. One of these is of colossal size, and represents a warrior; it seems to be unfinished, but admirably executed. On the cuirass are various emblems, amongst which, and in the centre, is a figure of a man standing by two winged creatures who are placing a wreath on a youth's head. The right hand of the statue is missing. Another of these works is supposed to represent Oceana, and has a small stag crouching at the feet. The third is the statue of a man, without any special attributes.

STAINED GLASS.—The works at Metz are in full activity, and the Belgian journal of the beaux-arts speaks very highly of a window just completed for the cathedral of that town. The subject is the ascension of Saint Barbe and Saint Catherine, supported by archangels, the figures being all larger than life. M. Maréchel, the artist, has availed himself of all the means calculated to give richness and variety to his work, such, for instance, as the use of double glass in parts, and the superposing of one shade or tint over another. The style is that of the fifteenth century, the Augustan age of painted glass.

PUBLIC MONUMENTS IN FRANCE.—A competition has just been opened in Paris for a statue of Marshal Massena, to be erected at Nice, the place of his birth. It is to consist of a bronze statue, about ten feet high, to stand on a pedestal with bas-reliefs. The judges are to be appointed by the administration of Fine Arts. The sum of 25,000 francs is to indemnify the fortunate artist for the whole of his work, statue, bas-reliefs, casting, conveyance, and erection. The pedestal is to be supplied by the authorities, and it is announced that 10,000 francs will be expended upon its ornamentation irrespective of the masonry itself. The sums of 1,000 francs and 500 francs are to be awarded to the second and third designs in the order of merit.—A monumental statue of the famous astronomer Arago, lately modelled by the sculptor Oliva, has just been cast in bronze, and is to be erected at Estagel in the department of the Pyrénées-Orientales, where the illustrious savant was born.—The Municipal Council of Madrid has commissioned the sculptor Medina to execute a statue of the painter Velasquez, which is intended to be appropriately placed in front of the public Gallery of Painting in that city, as a companion to that of Murillo recently erected there.

Forthcoming Publications.

THE APPLICATIONS OF GEOLOGY TO THE ARTS AND MANUFACTURES. Foolscap 8vo., cloth, illustrated, price 4s. By Professor D. T. Ansted, M.A., F.R.S. (*Robert Hardwicke, Piccadilly.*)—This work will consist of the course of six Cantor lectures now in course of delivery before the Society, of which merely abstracts are published in the *Journal*. It will appear as soon as the course is concluded.

Correspondence.

CANTOR LECTURES.—WATER SUPPLY.

SIR,—In the Cantor lecture delivered on the 13th inst., of which an abstract appears in your *Journal* of the 17th inst., on "Springs and Water Supply," I observe that the learned lecturer, Prof. Ansted, is reported to have said—"The two rocks that yield the largest quantity of water are chalk and soft sandstone, and in neither of these cases can more than a million gallons per day be expected from a single well. To yield this maximum such wells must be more than a mile asunder." Many popular delusions exist on the subject of wells, and as the above statement, circulated in your *Journal* on such authority, is likely to further mislead the public if left unnoticed, I am sure the professor and your readers will be glad to know that very many wells have been sunk, both in the chalk and red sandstone formations, that readily yield much larger quantities than one million gallons per day, even when situated, as sometimes happens, only a few yards distant from other wells. By way of practical illustration, I may mention the following wells yielding more than one million gallons of water per day, sunk in the chalk, the water being used for domestic consumption:—

Hull, Yorkshire.—A well with bore holes sunk in chalk, near the town of Hull, yields three and a-half to four million gallons of water per day.

Croydon, Surrey.—Two wells with bore holes in chalk, distant only twenty yards apart, yield one and a-half million gallons per day each, or three million gallons collectively.

Brighton, Sussex.—One well, with adits connected with same, sunk in chalk, yields two and a-half to three million gallons per day.

Amwell, Herts.—The Amwell Hill well, sunk in chalk, belonging to the New River Company, yields two and a-half million gallons per day.

Deptford, Kent.—Two wells, situated not fifty yards asunder, yield about five million gallons per day collectively.

The following wells, sunk in new red sandstone, yield more than one million gallons per day:—

Liverpool, Lancashire.—Green-lane well, sunk in new red sandstone, yields more than three and a-quarter million gallons per day.

Birkenhead, Cheshire.—Well in new red sandstone, yields two million gallons per day.

Pendleton, near Manchester, Lancashire.—Well in new red sandstone and permian, found to yield more than four million gallons per day; not in constant use.

I may add, practical experience has taught me that in suitable situations, by the aid of improved modern appliances and machinery, wells and bore holes may now be sunk, at a very moderate cost, to yield very much larger quantities of water than was at one time possible.

I am, &c., SAMUEL COLLETT HOMERSHAM.

19, Buckingham-street, Adelphi, London, W.C.,
February 28, 1865.

THE MUNICIPAL ORGANIZATION OF PARIS.—SIR,—There is a slight inaccuracy in the report of the remarks I made at the meeting of the Society on the 22nd ult. I am reported to have said, "With respect to the great improvements carried out in Paris, they had been told that a taxation of £3 15s. per head of the population had been the result; whereas the whole rates in respect of the main drainage and improvements of London did not amount to more than 9d. in the pound, or about 10s. per head of the population." What I stated was, that the annual sum raised by the Metropolitan Board of Works for main drainage, new streets, parks, and general purposes, including the coal duties appropriated for the Thames Embankment, did not exceed in amount a rate of 9d. in the pound, and that the whole local taxation of the metropolis for municipal purposes was not more than 10s. per head of the population.—I am, &c., W. H. DALTON.

28, Cockspur-street, February 25th, 1865.

VOLUNTEER FIRE BRIGADES.—SIR,—I very much regret to find that, in my endeavour to be as brief as possible in my remarks on Mr. Young's paper, I omitted to do an act of justice to the London Fire-Engine Establishment, and my remarks being still further condensed makes it appear that I have stated a positive untruth. I therefore beg space to correct this. In the report I am made to say that my brigade never received a penny from anyone for their services. This requires explanation. I stated that Mr. Young appeared to forget that nearly all the Volunteer Fire Brigades were equipped and supported by voluntary contributions. . . . . That the brigade I had the honour to represent was more strictly volunteer than any other, as the engines and plant were found by the firm (Brown, Lenox, and Co.), and the uniforms by the men themselves, without subscriptions from anyone, neither had they ever taken a penny for their services; I ought to have added—as all monies received for such service go to a fund in case of accidents or sickness through attending fires. I believe I am quite correct in saying it is the invariable custom of the London Fire-Engine Establishment to reimburse all volunteer brigades the cost out of pocket, and something in addition when

they are really of any service in extinguishing a fire. The late hour at which I was called upon to speak prevented me from going so fully into the question as I should have wished; but I trust that in consideration of the importance of the subject, you will allow me to make a few further remarks, particularly as lately there appears a tendency to underrate the services of the regular brigade; and I exceedingly regret to see my friend Mr. Young getting into the same track, for he says—"It is constantly said that paid firemen will work better than volunteers. . . . If paid men are best, how comes it that volunteers are always asked for when it is desired to do anything difficult or very perilous, say spring a mine—storm a fort—lead a forlorn hope—rescue a shipwrecked crew?"—This sounds very fine, but my friend appears to have forgotten that the volunteers for the above services are always taken from the class that are trained, aye, and often paid for such work, the soldier for springing the mine, and the sailor for rescuing a shipwrecked crew. Would Mr. Young send a party of Deal boatmen to spring a mine or soldiers to man a life-boat? I venture to say he would not; neither would he ask a fireman or fire-escape man to stand on one side and let some volunteer from the crowd enter a building to rescue life or property. I should very much like to see the volunteer movement spread all over the country; and I believe it is in outlying districts they will be most useful, but many years' experience has convinced me that it will not do to depend upon volunteers to protect London or any other large town from fire. I have formed a very strong opinion as to the best means of protecting such places, and shall be glad at some future time to explain my views either by a short paper or letter in the *Journal*, but I feel at present that I have occupied enough of your space.—I am, &c., WM. ROBERTS.

January 31, 1865.

MEETINGS FOR THE ENSUING WEEK.

MON. ...Society of Arts, 8. Cantor Lectures. Professor Ansted, F.R.S., "On the Applications of Geology to the Arts and Manufactures." (Lecture V.)
Entomological, 7.
British Architects, 8.
Medical, 7. Annual Election.
Asiatic, 8.
Royal Inst., 2. General Monthly Meeting. 3 o'clock, Prof. Tyndall, F.R.S., "On Electricity."
R. United Service Inst., 8½. Mr. John Latham, "Some Early Breech-loaders."

TUES. ...Civil Engineers, 8. Mr. H. B. Hederstedt, "An Account of the Drainage of Paris."
Pathological, 8.
Photographic, 8.
Ethnological, 8. 1. Mr. Travers, "On the Destruction of the Aborigenes of Chatham Island by a Maori Invasion." 2. Mr. Hyde Clarke, "On the Inhabitants of Asia Minor, previous to the time of the Greeks."
Anglo-Biblical Inst., 7½. Mr. John Mills, "The Archæology of Palestine and Biblical Criticism."

WED. ...Society of Arts, 8. Mr. Zerah Colburn, "On Cotton Gins."
Geological, 8. 1. Mr. P. Duncan, "On the Echinodermata from the South-east coast of Arabia, and from Bagh on the Nerbudda." 2. Mr. G. Busk and the late Dr. Hugh Falconer, "On the Fossil contents of the Caves and Fissures at Windmill Hill, Gibraltar." Communicated by the Secretary of State for War. 3. The late Dr. Hugh Falconer, "On the Asserted Occurrence of Human Bones in the Ancient Fluviatile Deposits of the Nile and the Ganges, with comparative remarks on the Alluvial Formation of the Two Valleys."
Graphic, 8.
Microscopical, 8. Dr. Greville, "On Diatomaceæ."
Literary Fund, 2. Annual Meeting.
Medical, 5. Anniversary Oration.
R. Society of Literature, 8½.
Archæological Assoc., 8½.

THURS. ...Royal, 8½.
Antiquaries, 8.
R. Society Club, 6.
Royal Inst., 3. Prof. Hofmann, F.R.S., "An Introduction to Chemistry."

FRI. .....Astronomical, 8.
Royal Inst., 8. Prof. Ramsay, F.R.S., "On Eozoon (the earliest known Fossil)."
Royal United Service Inst., 3. Col. G. Balfour, C.B., "The Indian Military Establishments, their Organisation and Cost."

SAT. .....R. Botanic, 3¾.
Royal Inst., 3. Prof. Marshall, "On the Nervous System."

PARLIAMENTARY PAPERS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 9th February*, 1865.

2. Bank of Ireland—Correspondence.
Colonial Statistics (Part IX.) (1862)—Statistical Tables relating to the Colonial and other Possessions of the United Kingdom.

Delivered on 10th February, 1865.

New Zealand—Further Papers.
Colonial Possessions (Part 1. West Indies and Mauritius)—Report.
Japan (No. I.)—Correspondence.
Japan (No. 2.)—Despatch respecting the Murder of Major Baldwin and Lieutenant Bird.
Turkey (Protestant Missionaries—Correspondence.
Greece—Correspondence.
Denmark and Germany—Correspondence.
North America (No. I.), 1865—Correspondence respecting the Attack on St. Albans, Vermont, and Naval Force on the North American Lakes.
India and Turkish Telegraph—Convention.

Delivered on 11th and 13th February, 1865.

1. Bills—Mortgage Debentures.
2. ,, Qualification for Offices Abolition.
9. ,, Land Debentures (Ireland).
4. General Committee of Elections—Mr. Speaker's Warrant.
1. Public Income and Expenditure—Account.
3. Railway and Canal, &c., Bill—Board of Trade Report.
3 (1 to 29). ,, ,, Further Report (1 to 29).
Poor Relief (Scotland)—Nineteenth Annual Report.
British Kaffraria and Cape of Good Hope—Correspondence.

Delivered on 14th February, 1865.

5. Bills—Courts of Justice Building.
8. ,, Criminal Cases (Evidence).
10. ,, Smithfield Market (Dublin).
11. ,, Courts of Justice Concentration (Site).
Canada—Letter relative to Defences by Lieut.-Colonel Jervois.
British North American Provinces—Correspondence.

Delivered on 15th February, 1865.

6. Bills—Court of Chancery (Ireland).
7. ,, Private Bill Costs.
16. ,, Game Licences (Ireland).
17. ,, Dublin International Exhibition (1865).
10. Reformatories, &c.—Return.
11. East India (Civil Service)—Regulations.
15. Banks—Return.
16. Excise Duties, &c. (Ireland)—Returns
17. Spirits (Scotland)—Return.
24. Charitable Funds—Account.
25. Maynooth College—Report.
32. Police (Counties and Boroughs)—Reports.
Russia Company—Further Correspondence relating to Dues.

Delivered on 16th February, 1865

12. Bills—Bank Notes Issue.
13. ,, Small Benefices (Ireland) Act (1860) Amendment.
14. ,, Bank of Ireland.
19. ,, Elections Petitions Act (1848) Amendment.
20. ,, Law of Evidence, &c.
21. ,, Felony and Misdemeanour Evidence and Practice.
5. Public Works (Manufacturing Districts)—Report.
12. Orders of Removal—Return.
22. Naval Receipt and Expenditure—Account.
40. Arts Schools, &c.—Minute.

Delivered on 17th February, 1865.

3. Bill—River Waters Protection.
19. Russian Dutch Loan—Account.
20. Sardinian Loan—Account.
21. Greek Loan—Account.
23. Navy—Statement.
39. Private Bills—Rules.
Clerical Subscription—Report of Commissioner

Delivered on 18th and 20th February, 1865.

4. Bills—Sewage Utilisation.
18. ,, Land Debentures.
26. ,, Juries in Criminal Cases.
15. ,, Prisons.
24. ,, Insolvent Debtors.

27. Bills—British Kaffraria.
28. ,, Pilotage Order Confirmation.
29. ,, Civil Bill Courts Procedure (Ireland) Act (1864) Amendment.
3 (30 to 39). Railway and Canal, &c., Bills—Board of Trade Reports, Parts 30 to 39.
9. Annuity Tax (Edinburgh)—Returns.
18. Irish Reproductive Loan Fund—Accounts.
31. Drunkenness—Return.
36. Duchy of Lancaster—Account.
38. Russia Company—Return.
45. Bank of England—Account.
60. Army Estimates.
Fisheries (Ireland)—Report of Special Commissioners.

Patents.

From Commissioners of Patents Journal, February 24th.

GRANTS OF PROVISIONAL PROTECTION.

Acids, manufacture of citric and tartaric—307—F. Row.
Air cushions, mattresses, &c.—317—A. H. Robinson.
Alarms, apparatus for giving—392—C. West.
Billiard tables, cushions for—316—J. L. Hancock.
Blowing apparatus—427—S. R. Freeman and A. Grundy.
Boots and shoes—381—G. Coles, J. A. Jaques, and J. A. Fanshawe.
Brooches, manufacture of—385—G. C. and J. B. Haseler.
Buildings, ventilation of—332—C. Beard.
Cables, metal chains for—431—W. H. Brown.
Candlesticks—339—A. I. L. Gordon.
Cane juice, &c., treatment for evaporating, &c.—418—A. Fryer.
Cannon shot and shells—346—R. Brandon.
Carriages, construction of—215—S. L. and A. Fuller.
Cartridges—426—B. Thompson.
Clarinets—308—J. Park.
Clog soles, &c., manufacture of—416—R. J. Jones.
Cupolas and blast furnaces—397—H. H. Grierson and J. M. Rigby.
Doors, windows, &c., fastenings for—369—G. E. Meek and W. H. Howes.
Driving bands for machinery, manufacture of—300—G. and D. Hurn.
Embankments, sea-walls, &c., formation of—380—W. E. Newton.
Fibrous substances, breaking the stems of and preparing—336—H. B. Barlow.
Fire-arms, breech-loading—253—W. Clark.
Fire-arms, breech-loading—299—T. Joyce.
Fire-arms, breech-loading—358—E. Lindner.
Fire-arms, breech-loading—421—J. von der Poppenberg.
Fire-arms, breech-loading—424—J. Purdey.
Fire-arms, lever powder and shot charger for—302—W. Bartram.
Fire-arms, locks for—368—J. P. Lindsay.
Fire-arms, patched balls for—367—M. Peck.
Fire-places—407—E. B. Wilson.
Fish-hooks—428—W. A. Hackett.
Furnaces and boilers—395—J. Cass.
Garment, combined—423—R. P. Barrett.
Garments—355—J. Singer.
Grain, apparatus for separating—348—W. E. Newton.
Grain, mills for grinding—333—W. P. Wilkins.
Grease for lubricating, manufacture of—354—J. Desmontils.
Gunpowder—402—L. H. G. Ehrhardt.
Guns, breech-loading—265—C. H. Russell and J. Needham.
Hair brushes—214—C. Roques.
Hair-pins—325—R. A. Brooman.
Hops, obtaining the concentrated extract of—306—J. R. Webb.
Hydraulic lifting apparatus—328—A. Steven.
Hydro-carbons, supplying a regular pressure of air to burners for consuming—408—E. J. C. Welch.
Ink, typographic—330—A. A. Hulot.
Iron, cast and wrought—419—E. H. Newby.
Iron safes and strong rooms—364—J. Chubb.
Jacquard apparatus for weaving—329—W. Cockburn.
Jacquard machines, protector for the needles and cards used in—429—W. C. Ridings, sen.
Keys, removing dirt from inside the barrels of—238—R. Helsham.
Lead, purification of—310—J. A. Phillips.
Leys, treatment of spent or used—297—T. Routledge.
Life belts, swimming belts, &c.—341—C. Kilburn.
Looms—293—J. Maynes.
Looms—377—R. G. Hazard.
Looms, healds for—347—A. A. Larmuth.
Mathematical compasses—235—J. E. F. Ludeke.
Metallic casks and drums—327—G. Duncan.
Metal pipes, mode of making—356—W. Anderson.
Miners' safety lamp—353—R. C. Thorp and P. Young.
Money, tickets, &c., apparatus for counting—383—J. Schneuhr.
Mooring anchors—420—J. Trotman.
Motive power, obtaining—331—J. I. Watts.
Netting, manufacture of wire and other—360—R. A. Brooman.
Oil for machinery, production of—388—J. Hall.
Ores, extracting gold and silver from—391—W. Crookes.
Ores, furnaces for smelting iron—374—E. Leigh.
Ores, furnaces for smelting or reducing—411—H. J. Walduck and E. Barton.
Paper-hangings, manufacture of—322—J. Booth.
Peat for fuel, manufacture of—319—R. M. Alloway.
Pencil cases, manufacture of—298—W. Vale.
Pencil-holders and pen-holders—352—W. E. Wiley.
Penholders, manufacture of—406—F. C. Vannet.
Presses, fly or embossing—208—J. Bailey.
Pressing irons heated by gas, ventilation of—350—S. E. Rosser.
Pumps—436—G. T. Humphris.
Railway chairs, &c.—318—R. Richardson.
Railway engines, &c., bogie trucks for supporting—404—W. Adams.
Railways, ships, &c., signal applicable to—357—A. W. Banks.
Railway switches, &c., working and controlling—432—M. Lane.
Resinous wood, extracting turpentine and tar from—403—J. A. Pastorelly.
Rivetting, machinery for—400—H. M. Kennard.
Satin white, substances to be used in place of—371—J. Dale.
Sewing machines—304—W. Clark.
Sewing machines—430—A. V. Newton.
Sewing machines, operating the working parts of—370—A. V. Newton.
Sewing machines, single thread—396—A. V. Newton.
Sheep shears—294—J. Ball.
Ships and vessels—337—R. Brassens and F. A. Le Mat.
Ships, apparatus for discharging coals and other cargo from—359—G. Elliot and H. Coxon.
Ships, armour-plated—438—G. T. Bousfield.
Ships, forts, &c., armour-plated—292—C. Lungley.
Stamps and labels, apparatus for affixing—379—H. W. Hart.
Stay busks, &c., fastenings for—349—G. Twigg.
Steam, application of hydro-electricity to—273—J. Fletcher and D. Hamer.
Steam boilers—401—R. W. Themson.
Steam boilers, combustion of fuel in the furnaces of—311—F. C. Hills.
Steam boilers, preventing the explosion of—305—J. Westerby.
Steam engines, expansion gear for—415—W. F. Batho.
Steam generators—345—J. Lake.
Straw, &c., machinery for cutting, sifting, &c.—340—J. Cornes and W. Simpson.
Strained wire or rod fencing, standards for—76—W. Bayliss.
Telegraphs, insulating material for—362—W. A. Marshall.
Textile fabrics, rendering uninflammable—313—E. Hottin.
Tooth powder—301—B. L. Mosely.
Vermin traps—312—R. S. Baker.
Vessels, &c., armour-plated—296—J. S. Jeffreys.
Water, apparatus for heating—390—A. McLaren.
Waterproofing skins, &c.—413—G. Harton.
Wearing apparel, skirt borderings and linings for—361—W. Staats.
Window safes—326—R. Shaw.
Wood, &c., varnish for preserving—315—R. A. Brooman.
Wooden surfaces, preservation of—363—J. C. C. Halkett.

PATENTS SEALED.

2119. J. Cheetham.
2120. W. Rowden.
2121. F. W. Armitage.
2127. J. Packer.
2129. J. Shanks.
2133. C. W. Harrison.
2136. A. E. Peirce.
2141. Sir J. Macneill.
2145. T. Wilson.
2146. J. White.
2153. J. H. Wilson.
2159. P. M. Parsons.
2173. M. A. F. Mennons.
2299. M. A. F. Mennons.
2343. J. Todd.

From Commissioners of Patents Journal, February 28th.

PATENTS SEALED.

2158. A. M. J. Count de Molin.
2160. M. Barland.
2161. R. A. Brooman.
2162. W. W. Burdon.
2163. J. Ivers and T. Ogden.
2168. T. E. Symonds.
2177. D. Walker.
2192. J. S. Crosland.
2215. J. Holding.
2235. A. C. Kirk.
2278. F. Yates.
2286. D. Tamet.
2304. W. P. Struvé.
2337. H. Vale.
2341. A. V. Newton.
2379. T. Powell.
2383. J. Jongen.
2437. G. Haseltine.
2578. W. Clark.
2604. F. Martin.
2618. H. Bird.
2690. J. Solomon and A. G. Grant.
2843. N. Bailly, C. Durand, G. H. Mesnard, and Z. Poirier.
54. H. Ames.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

532. G. Torr.
464. E. S. Crease.
479. D. B. White.
480. G., S., and J. Blakey, and B. White.
492. T. N. Kirkham and V. F. Ensom.
509. J. Imray.
510. J. Whitworth.
824. T. Guibal.
489. R. Waller.
494. T. Partridge, sen.
499. J. Carnaby.
585. J. Gjers.
504. E. Bliss and H. Lamplough.
530. J. Medhurst.
546. A. W. Makinson and W. F. Batho.
552. J. Parker.
584. F. B. Houghton.
587. B. Standen.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

329. W. Thomson.
365. J. Petrie.
621. J. F. Brinjes, jun., and H. J. Collins.