NAVAL ARCHITECTURE AT THE NORTH-EAST COAST EXHIBITION.

THE department of naval architecture, forming as it does an almost complete representative collection of models of old and new vessels both for war and commerce, supplied by nearly every large firm of shipbuilders and shipowners in the United Kingdom, as well as by many corporations connected with naval matters, is perhaps the most interesting, as well as one of the most instructive, maritime exhibitions ever thrown open to the public. It is quite safe to say that such a complete collection of models has never been brought together before; and notwithstanding some rather important mistakes in the reference numbers in the catalogue, which, however, will doubtless soon be put right, the display is singularly good and effective. Although contributions are to be found from almost every shipbuilder of eminence in Great Britain, it is only natural that those in the northern district should be the largest exhibitors; and it is no doubt a matter of congratulation to the promoters of the undertaking, who for the most part reside in the three north-eastern counties, that in every class of vessel the builders on the Tyne, Wear, and Tees appear to be quite able to hold their own against those on the Clyde and other districts.

Within the space at our disposal it is quite impossible to attempt anything like a complete description of what may be found in this section; and we propose, therefore, to draw special attention only to those exhibits possessing interest either from their historical associations, their bearing on the important advances recently made in ocean navigation, or from some other cause.

Following the order in the catalogue, almost the first standis that of Messrs. R. Napier and Sons, of Glasgow, who, among other models, show that of H.M.S. Black Prince, which recalls to mind the not very distant days when 4½in. iron armour was considered a sufficient protection against the ordnance employed in naval warfare. The same firm also exhibits photographs of the triple expansion engines of the s.s. Propontis and Aberdeen, designed by Mr. Alex. C. Kirk, and illustrated in THE ENGINEER, in which the three steam cylinders are placed side by side with their piston rods, each acting upon a separate crank. Fifteen models are shown by Messrs. W. Denny and Bros., of Dumbarton, many of which, notably that of the P. and O. Company's steamer Clyde, are remarkable for their excellence of finish and completeness of detail. The capacities of this firm are too well known to require further comment.

A little further on Messrs. Walker and Emley, of Newcastle-on-Tyne, exhibit a part interior of a saloon for first-class passenger vessels, the marble panelling and decorations being of the type supplied by this firm to the Peninsular and Oriental Company and a number of other leading passenger lines. Marbles of two or more colours are employed, and the only ornamentation, beyond the forming of the mouldings, pilasters, &c., is a plain, gilded, incised pattern, which is very effective. Special steam heaters and various forms of cabin chairs and other ship's fittings are also shown.

A magnificent series of half and whole models is sent by Messrs. C. Mitchell and Co., of Walker-on-Tyne, vessels of almost every type and character being represented. Especially interesting are the models of the unarmoured gunboats of the Staunch type, designed by Mr. George Rendel, and built for Sir W. G. Armstrong and Co. The whole stage of development is shown, from the original Staunch, with 156 tons displacement and carrying one 12½-ton gun, to the one last built, the Lambda, which is armed with one 35-ton muzzle-loading gun, besides several smaller ones. From another point of view also the exhibit is interesting, for now that the two firms of Sir W. G. Armstrong and C. Mitchell are about to combine—a fact which was announced by Sir William in his address at the opening of the Exhibition—it is more than probable that the manufacture of unarmoured gunboats and cruisers of great speed and capability of manœuvring and carrying one or two heavy pieces of ordnance, will receive considerable development. Models of floating batteries, powerful steam ram cruisers, cable ships, floating docks, &c., all testify to the great reputation enjoyed by this firm.

Of a somewhat different character, though none the less interesting, is the display made by Messrs. A. Leslie and Co., of Hebburn-on-Tyne, who are well known as builders of first-class passenger and trading vessels. It will be remembered that the Calais-Douvres was made by this firm; and though this vessel cannot be said to have solved the Channel difficulty, as some at the time supposed it would, yet it must be acknowledged that even on the one plea of comfortable accommodation its addition to the Channel passenger fleet has been a great boon.

A whole model of the cable steamer Faraday is lent by Messrs. Siemens Bros., of Westminster. This vessel is remarkable as being the largest ocean steamer yet made with bow and stern of precisely the same form, including a rudder at each end, to admit of steaming ahead as easily as astern when laying cables—an arrangement which, it is stated, has given great satisfaction in working.

The enterprising firm of shipowners, Messrs. Fisher, Renwick, and Co., of Newcastle-on-Tyne, who have taken the lead in the employment of steam up to a pressure of 150 lb. per square inch for the engines of ocean-going steamers, show a half model of the s.s. Claremont. This vessel presents no very special feature apart from its machinery, but, as is stated in the catalogue, is of interest through having caused considerable excitement in November last by breaking away from the tug while being towed from the Tyne to Kirkcaldy for the purpose of receiving her engines, in consequence of which she drifted about the North Sea for six days. Photographs of the triple expansion engines of the steamers Claremont and Albertina, designed by Mr. Alex. Taylor, and manufactured by Messrs. Douglas and Grant, of Kirkcaldy, are also shown. The boiler pressure is 150 lb. per square inch, and it is stated that not only has very great economy in coal consumption been attained, but that after several years' working with this type of engine there has been no more trouble than with the ordinary double cylinder compound and 60 lb. steam.

Palmer's Shipbuilding Company, of Jarrow-on-Tyne, has sent a set of models of six vessels. The most noteworthy are those of the troopship Jumna, built for the Indian Government in 1868, the gunboats Dee and Don, now doing duty in Egypt, and the passenger steamer China, with a dead weight carrying capacity of 4500 tons on a mean draught of 23ft. 6in.

A half model of the steamship City of Rome, originally constructed for the Inman Company, but now belonging to the Anchor Line, is shown by her builders—the Barrow Shipbuilding Company, Limited. One of Batchelor's excellent moving diagrams of the engines for this vessel is also exhibited, showing very clearly the action of all the working parts.

The series of models sent by the Lords of the Admiralty form an instructive and interesting exhibit, and the visitor to this section has here ample opportunity to study not only the external forms, but also to a considerable extent the construction of modern fighting vessels, as well as to examine models of the now obsolete man-of-war. Of this latter class there is the Royal George, launched at Woolwich in 1756 and wrecked off Spithead in 1782 with the loss of a crew of 800 men, and the Howe launched at Pembroke yard so late as the year 1860. Of more modern vessels there are the Monarch, launched at Chatham in 1868; the ill-fated Captain, built by Messrs. Laird, of Birkenhead, and lost at sea in 1870 with Captain Cowper Coles and 454 of the crew; and the twin-screw turret ship Devastation, with 12in. and 14in. armour and engines developing nearly 7000 indicated horse-power. There is also a model section of this latter vessel showing the structure and arrangement of frames, plating, &c., to a scale of ½in. to 1ft.

The Orient Steam Navigation Company, Limited, exhibit a half model of the Orient, and also one of the Austral, the latest addition to the fleet, together with a set of five photographs and an oil painting. The Austral has a displacement of 9500 tons at load draught, and is built of mild steel.

Messrs. Caird and Co., of Greenock, have sent twenty-six models, many of them being of great beauty and perfection in workmanship. We may specially mention the whole model of the steamers Ballarat and Paramatta, now in course of construction for the Peninsular and Oriental Company.

Mr. James Laing, of Sunderland, is represented by a set of models, chiefly of passenger vessels, a whole model of the steamship Mexican, now building for the Union Company, showing that the Wear is at least receiving a share of the orders which most of the leading shipping companies have recently been giving out.

Messrs. J. L. Thompson and Sons, and W. Doxford and Sons, both of Sunderland, are also exhibitors, the former having sent models of both sailing vessels and steamers, and the latter models of eight vessels, among which are some made for the Government and the Peninsular and Oriental Company.

A whole model of the Peruvian ram Huascar, built in 1866 is shown by Messrs. Laird Brothers, of Birkenhead. This was the first armour-clad turret vessel on Captain Cowper Coles' system to make a long voyage, and, as will be remembered, it performed very important services in the war between Peru and Chili, being finally captured after a two hours' engagement.

Twenty half models, chiefly of medium-sized passenger steamers, are exhibited by Messrs. Wigham, Richardson, and Co., of Walker-on-Tyne, who occupy the whole of the wall space at one end of the Winter Garden, the arrangement being very tastefully made, and surmounted by a device illustrative of the name of the works.

A number of shipbuilders from West Hartlepool and Stockton-on-Tees show neatly-made models of both sailing vessels and steamers, which though presenting no special features, indicate the important part played by these districts in the production of iron shipping.

The models and paintings exhibited by the Peninsular and Oriental Steam Navigation Company illustrate in a comprehensive manner the great strides which have been made in steam shipping since 1837, the year in which this company commenced to run its contract mail service between Falmouth and the Peninsular ports. The vessels in use at this period were two little wooden paddle-wheel steamers, William Fawcett and Royal Tar, paintings of both being shown. The former was of about 80 tons measurement and 60-horse power, and the latter about 570 tons and 260-horse power. At the time the Peninsular Company expanded into the Peninsular and Oriental Steam Navigation Company in 1840, their fleet consisted of eight wooden paddle steamers, the largest of which was of 1670 tons and 450-horse power, and the entire fleet measured but 7180 tons and 2330-horse power. It is now composed of forty-eight iron and steel screw vessels, measuring upwards of 160,000 tons and 150,000 effective horse-power. The model of the Tanjore will serve to illustrate the type of mail steamer prior to the opening of the Suez Canal in 1869, other models representing the transitional period up to the latest additions, the Ballarat and Paramatta, now in course of construction by Messrs. Caird and Co. In addition to models of vessels, this section contains a number of more or less interesting models of patent devices for propelling ships, steam engines, and other miscellaneous matters.

Passing to the galleries, specially erected for this Exhibition all round the Winter Garden, the visitor will find a good show of all kinds of optical, horological, and other instruments, of Sir William Thomson's improved mariner's compass and navigational sounding machine, and a number of pulley blocks, stores, and other ships' fittings impossible to enumerate.

Mr. John Thompson, of Newcastle, shows a model of a slipway for repairing ships, on the system designed by himself and Mr. T. B. Lightfoot, of London, to which is added an apparatus for enabling two vessels to be taken on one slipway for repairs at the same time, but which is too complicated to describe without drawings.

A small exhibit is made by Mr. Alex. Taylor, of Newcastle-on-Tyne, to illustrate the action of his stability indicator, a new instrument he has just brought out for enabling the captain of a vessel to make easy tests for stability after the taking in of a cargo. In principle this indicator is merely a water level with a graduated scale for showing the amount of heel. A tank capable of holding some 5 tons of water is placed at one side of the vessel as a test weight, and it is intended that after such loading an observation should be made as to the amount of keel produced by the weight. It is obvious that as the centre of gravity of the hull and cargo is higher or lower so will the effect of the weight be greater or less, and the ready means is thus given for the captain to ascertain if the stability of his vessel is too little or too great.

The Master and Brethren of the Trinity House, Newcastle-on-Tyne, show a good many old trophies and pictures, some of them exceedingly interesting. They also exhibit a model of Lord Nelson's flagship Victory, made by English seamen from beef bones during their imprisonment in France.

It only remains to add, in regard to this section, that all the exhibits are well and tastefully arranged, plenty of room being left between each set of cases. The room is prettily decorated, and everything has been done to render a visit as attractive as possible.

THE NORTH-EAST COAST EXHIBITION OF MARINE ENGINEERING AND NAVAL ARCHITECTURE.

No. II.

THE Tynemouth Aquarium is so situated on the top of the great sand cliff as to command a magnificent view of the entrance to the Tyne. The Aquarium is a large building of two storeys, the upper one, with its terraces and ante-rooms, being designed to meet the requirements of a Winter Garden, while the lower is fitted up with tanks for the reception of fish, and to do duty as the Aquarium proper. The Winter Garden has been prepared for the reception of, and is now occupied by one of the finest collection of ships' models which has ever been brought together, a collection which surpasses even exhibitions that have been only devoted to this one branch. Our readers will remember the Exhibition of the Shripwrights' Company recently held in London, and many will no doubt be surprised to hear that the models now shown far outnumber those displayed at the Fishmongers' Hall, while their interest is certainly as great for naval architects and the public at large. We have referred at length in another page to this department.

On the same level with the Winter Garden, but possibly a hundred yards to the north, is the skating rink, and the intervening space has been covered in with a substantial roof. The great space thus formed, together with the skating rink and a still further annexe beyond the rink, are devoted to the exhibits which come under the heading of marine engineering. Below the Winter Garden is, as we have said, the Aquarium proper, and within it have been arranged all the exhibits which come under the sections of life-saving appliances and fisheries, and this may be said to be the most unsatisfactory department of the entire Exhibition, for on account of its darkness and dinginess it is difficult to see anything. This section should certainly have been brilliantly illuminated from the first; but the electric light has not yet made its successful appearance, and the few gas jets simply tend to make darkness visible. Running round the Winter Garden Hall a substantial gallery has been erected, in which exhibits of a light character have been placed. At the north end of the great hall is situated the organ, and on the platform in front of the organ, as well as on the terraces which run along the seaward side of the building, military, orchestral, and string bands play alternately during the hours of the afternoon and evening. On the same level as the Aquarium a great temporary dining hall has been erected, which is capable of seating upwards of 500 guests, but which was on the opening day taxed to nearly twice its capacity.

On the sands in front of the Aquarium, but within the bounds of the Aquarium grounds, many exhibits of a heavy or lofty nature, as, for example, steam cranes and dredgers, are shown in action continuously, while here also a large square tank of wood, lined with lead plates, has been sunk into the ground for the purpose of showing divers and diving apparatus. This was not ready for use during the first few days, nor can we look for much success from such an arrangement. The entire building is lighted by different systems of electric lamps, none of which have up to the present given much satisfaction—the Swan, the Pilsen, the Joel, the Maxim, the Hammond-Brush system, are all represented, and have allotted to them different sections, but the complaints of the exhibitors on this score have been many and loud, and in their interests it is to be hoped that either the engines or the lamps themselves will be speedily put into permanent working order.

On the evening of the opening day, Wednesday 6th, a full dress *conversazione* was held in the various halls and annexes of the building. The band of the 1st Northumberland Artillery played on the Terrace, while inside the building an orchestral band was engaged. The number of visitors was comparatively small.

The illumination during the *conversazione* was provided by the various systems of electric light with more or less want of success, the machinery section being lighted by the Swan system, while the Maxim and Pilsen and Joel lamps were in other parts of the buildings. The Winter Garden was to have been lighted by the Hammond-Brush Company, but, owing to some little fault in the engine-room, the visitors were obliged to examine the models by the light of gas. Since the opening evening the defect has been remedied, and the Winter Garden, as well as the town, has been illuminated by this lamp. It is only right to say that the dynamo for this light was, on the opening night, driven by a Robey engine, and as this engine had only been placed in the building on the previous evening, allowance may be

made for the fact that everything was not quite in order. The entire Exhibition, which covers a space of upwards of 100,000 square feet, and numbers in all about 700 exhibitors, is being managed with success by an executive committee, having as its chairman Mr. J. C. Marshall. Of course an amateur management must find many difficulties in its way, and it is inevitable that some mistakes should be made; but in order that these mistakes, when made, should be promptly pointed out, and as promptly remedied, the exhibitors have formed a committee to look after their interests, and this committee, which is qualified by its great experience of exhibitions and the method of conducting them, is able to advise and, in a measure, direct the doings of the executive committee, with a result which is satisfactory to themselves and the visitors. The number of visitors on the opening day is roughly stated to have been about 9000, and the daily average attendance may be estimated at about 6500 since then; the season ticket holders numbering some 1200 are provided wiith a separate entrance gate, and as at this gate there is no register, it is quite impossible to say accurately what the daily attendance has been. A few words more on the general arrangements, and we shall then proceed to review some of the more important of the exhibits.

The catalogue, which we alluded to last week as being an eminently good one, and as having been closely modelled on that of the late Naval and Submarine Exhibition, just fails in one or two omissions which its compilers have made. In the original one—the Naval and Submarine—a subject matter index was included, by means of which visitors were enabled to find at a glance the names, numbers, and positions of the various makers of any specific exhibit, while in the catalogue now before us it is necessary that visitors should know the names of the different makers before they are enabled to find them out. and as the exhibits are by no means arranged to follow one after the other in the order of the numbers, this is not an easy matter to those who have no experience of exhibitions. Section 1 begins with exhibit No. 1, and ends with No. 181, and with this section is included a sub-section of workmen's models, numbering 27 exhibits, making a total of 208. The second section begins with exhibit No. 1, and ends with No. 247. The third section, with which is also included the fourth—fisheries and life-saving—for some unexplained reason begins with exhibit No. 500, and ends with No. 622; while the fifth and sixth sections are composed of 58 exhibits. Now, on first looking at the catalogue and noting the number at the end of each section, one naturally supposes that there are 1135 exhibits to be seen, whereas 635 is the real total. One reason for taking this much trouble to explain this particular matter is, that not having had a catalogue until the afternoon of the opening day, we were in the hurry of the moment lead into making a statement to the effect that the exhibits numbered upwards of 1100.

Taking advantage of the presence in the district of many eminent engineers, shipbuilders, &c., the River Tyne Commissioners issued invitations to a large number for a trip up the river and an inspection of their dock works on the day succeeding the opening of the Exhibition, Thursday, September 7th. Amongst those who accepted the invitation were Mr. Trail, of the Board of Trade; Mr. Manuel, engineer-in-chief Peninsular and Oriental Company; Mr. G. B. Rennie, London; the Committee of Lloyds, consisting of Messrs. Martell, McDonald, Green, Munro, Williamson, and Cornish; Mr. Davis Sewell, secretary, Shipwrights' Company, London; Mr. Inglis, Trinity House; Captain Carter, R.N., National Lifeboat Institution, &c. They embarked on board one of the river Tyne steamers at the extreme point of the North Pier, which is some 840 yards in length, after examining the great Titan, one of the largest of its kind in the world. It is constructed to set blocks of concrete weighing forty tons at a projection or overhang of 75ft. The jibs are 90ft. in length, and the tailpieces 80ft. From this the steamer proceeded to the point of the south pier, so that the building operations might be seen. This pier is now 4500ft. in length, and Mr. Messent, the engineer, is still adding to it at the rate of about 150ft. in the twelve months. The foundations, which are being set by a staff of divers, are some 21ft. below low-water. The next point touched at by the steamer was the new Coble Dene dock, which is in course of construction about two miles from the mouth of the river, and which, when completed next year, as it is hoped, will possess a water space of about twenty-seven acres, with a land space, upon which warehouses are being built, of about 160 acres. The entrance lock between the gates will be 350ft. long and 60ft. wide. The width of tidal entrance will be 80ft., and the depths on the sill 15ft. at low-water, 30ft. at high water. Leaving Coble Dene, the steamer proceeded on its way to Newcastle, passing all the well-known works and shipyards along the smoky banks of the Tyne. It is needless to mention these in order, but a passing word of compliment may be paid to the great new works which are just finished at Wallsend. They are an offshoot of the well-known North-Eastern Marine Engineering Works, Sunderland, and will bear the title of the Northumberland Marine Engineering Works. It is said that they will be one of the largest groups of marine engineering workshops in the world, and too much credit cannot be given to the North-Eastern Company and to the energetic general manager, Mr. Allan, for their enterprise in coming into the field to battle with such powerful opponents as Messrs. Wigham, Richardson, and Co., the Wallsend Slipway and Engineering Company, and Palmer's Iron Shipbuilding and Engineering Company. The steamer having proceeded up the river, and the visitors having admired the swing bridge, luncheon was eaten at Sir William Armstrong's works at Elswick, and afterwards one of the famous Tyne dredgers was examined as it worked. These dredgers are capable of removing as much as 11,000 tons per day each with an indicated horse-power of about 250, and the average daily take of one of these dredgers is about 8000 tons. An immense amount of money—close upon £4,000,000—has been expended by the Tyne Commissioners in improving their river, and during the last twenty years upwards of 60,000,000 tons have been dredged from its bed.

MARINE ENGINEERING AT THE NORTH-EAST COAST EXHIBITION.

No. I.

Under the heading "Marine Engineering, Section II.," some 247 exhibits are shown, and form to very many the most interesting section of the Exhibition. It is not our intention to note all these exhibits individually, for many of them are not of a sufficiently prominent or useful order to call for special remark; and a very large proportion of them has been seen in the Agricultural Hall during the Naval and Submarine Exhibition, and described in these pages already. For the present we shall select some of the most prominent exhibits at Tynemouth, irrespective of catalogued order, and describe them briefly.

Among the most prominent of the stands are those of Messrs. John Spencer and Co., with whom is Mr. Wasteneys Smith, the Leeds Forge Company, Messrs. Wigham, Richardson and Co., the Wallsend Slipway and Engineering Company, Messrs. R. and W. Hawthorn, the Pulsometer Company, Sir W. G. Armstrong and Co., the Phosphor Bronze Company, the Durham-Churchill Governor Company, the Darlington Forge Company, Jessop and Co., Sheffield; Hawks, Crawshay, and Co., Hopkinson and Co., Huddersfield; Alexander Wilson and Co., Vauxhall; Douglas and Grant, Kirkcaldy; Messrs. Tangye Brothers, Messrs. Black, Hawthorn, and Co., Messrs. Cochran and Co., Birkenhead; Messrs. Higginson and Co., Liverpool; Messrs. Clarke, Chapman, and Gurney, and Palmer's Shipbuilding Company.

Messrs. John Spencer and Sons, Newburn Steel Works, Newcastle-on-Tyne, make a large display of their cast steel, the different objects being tastefully arranged, and so placed that each one of a large collection may be thoroughly examined. At the front of the stand are some cast steel dredger buckets, as adopted by the Tyne Commissioners, plain dredger bucket backs, and Bagshawe's patent dredger bucket back, and a cast steel girder for an Armstrong gun carriage. These beams are now adopted by Sir William Armstrong, instead of those of built-up wrought iron for all his guns. The beams made by Messrs. Spencer and Sons for the Armstrong 100-ton gun weigh 10 tons each, and are made in one casting. There are also to be seen some propeller blades, a worm shaft, rollers for swing bridges, a large and heavy hydraulic cylinder, levers for marine engines, torpedo balls, shot, crank shaft, forgings, &c. At the back of the stand is a great crank disc, 8ft. 1in. in diameter and weighing 6¼ tons. The most interesting part of the exhibit, however, consists of some cases of test pieces of cast steel, and the results obtained from these are sufficiently instructive as to justify us in publishing them *in extenso* on the next page.

In close proximity to Messrs. Spencer, at the other side of the passage way, is perhaps the finest stand in the entire Exhibition, that of the Leeds Forge Company. It consists of a complete set of flanged plates for marine boilers, and specimens of the now well known Fox's patent corrugated furnaces and fire-boxes for steam boilers. We find here Mr. Fox's first, or No. 1, corrugated flue; and it will doubtless interest our readers to hear that, within the last five years, upwards of ten thousand of these flues have been made. At this stand is also exhibited the first apparatus ever constructed for testing the resistance to collapse of flues of full working size. A large number of experiments have been made with it under the direction of the Board of Trade and Lloyd's, in order to ascertain the laws which govern the collapse of boiler flues. During a recent experiment a pair of flues—one of the ordinary kind and one of Fox's patent—both of the same diameter, material and weight, were tested. The collapse of the plain flue took place at 225 lb. per square inch, while the corrugated one withstood a pressure of 1020 lb. per square inch before collapse set in. These are no doubt startling figures, but Mr. Fox seems to be most anxious that all the truth should come out, and for this purpose he has arranged to hold, during the Exhibition, a public test, to which he has invited many scientific and practical men. On this stand will also be found a fine set of corrugated fire-box plates for a torpedo boat boiler; the same for a yacht boiler without the shell plates; and a front plate and corrugated flues fitted together. The front plate is 16ft. in diameter, and is made of mild Siemens steel, the ingot for which weighed 3 tons. There is also an excellent specimen of a corrugated steel flue, just as turned out of Mr. Fox's new rolling mills at Leeds. This flue is one of seventy-two ordered for the Guion Company's new steamer, a sister ship to the Alaska, —also fitted with these furnaces—which is at present being built by Messrs. John Elder and Co., Glasgow, and which when completed is guaranteed to cross the Atlantic at a speed of not less than 20 knots per hour. Another very interesting exhibit on this stand is a Fox's flue which was fitted in a boiler, and when at sea was allowed to get red hot through shortness of water. The flue collapsed but held on until the boiler was completely empty, except of steam, without causing injury to anyone. The company exhibits this to show the ductility of the material from which it is made, that is, the Leeds Forge Company's own make of best Yorkshire plates, as well as to show how a corrugated flue behaves under such circumstances.

The Pulsometer Engineering Company, of London, exhibits several sizes of its well-known pump, the hydrotrophe boiler feeder, the "Thames" filter, and a sectional model of a steamer showing pulsometer fitted for pumping ballast tanks, and bilges, washing decks, circulating through condensers, &c. The wearing parts of the pumps, which are very few, are also shown separately. A No. 2 pulsometer is fixed at work, with a very simple contrivance, to illustrate how bilges and tanks on board ship can be perfectly drained by the pulsometer being supplied from the sea with a sufficiency of water to keep it cool and working, while it will immediately take up any water which may be admitted to the mouth of suction pipe from time to time, through a sluice valve in a division in lower tank. A filter is also at work to show a system of rapidly clearing muddy water for boiler purposes.

Close to this stand is that of Messrs. Douglas and Grant, of Kirkcaldy, N.B., who show one of Lightfoot's patent dry-air refrigerators, in connection with an insulated cold room. The machine is of small size, compact, simple in construction, and of a somewhat novel design. It is arranged to be driven by a belt from any existing source of power, and is intended for use on board ship, or for provision dealers, fishmongers, butchers, &c., or for any purpose where a cheap and reliable cooling apparatus is desired. The compression and expansion pistons are both in one line, the piston and connecting rods being common to both. The air, after being compressed, is passed through a tubulous cooler, where the heat of compression is abstracted, and a considerable portion of moisture deposited. It is then delivered to the expansive cylinder, which has a trunk piston on Mr. Lightfoot's patented design, and is at first partially expanded to a temperature of about 35 deg. Fah., passed through the separator for the purpose of depriving it of a further portion of water, and then finally expanded to atmospheric pressure, and discharged into the cold chamber ready for use. Air refrigerators on this plan may be made of any size, and may be driven by belt or can have a steam engine attached. Owing to the thorough abstraction of the moisture as water, instead of permitting a very large part of it to be converted into ice, as in the older forms of machines, it is claimed that a greater efficiency is obtained, and that for the expenditure of a given power there is a much greater produce of cold; besides which there is no trouble from formation of ice, and no special devices have to be introduced for overcoming the difficulties which would otherwise accrue from its collection about the valves and delivery passages. The workmanship of the machine is all that can be desired, and the efficient action of the moisture-abstracting apparatus is demonstrated not only by the freedom of the cooled air from snow, but also by the streams of water continually flowing from the coolers and separator. In the cold chamber blocks of ice are being formed, and frozen fish is exhibited, a temperature of many degrees below freezing being maintained. The same firm also show photographs of larger-sized dry air refrigerators on Lightfoot's system; of their patent Corliss engines, which are so well known and so widely used both in this country and abroad; and of triple-cylinder marine engines on Mr. Alex. Taylor's system, of which they were the first makers.

CHARLES GEORGE NAPIER.

Charles George Napier, C.E., M.I.C.E. of England and Ireland, and F.G.S., who died on Saturday week at the comparatively early age of fifty-three, was the eldest son of the late Captain Henry Edward Napier, R.N., F.R.S., and the nephew of the late Generals Sir Charles and Sir William Napier. He entered the profession of civil engineer, under the tuition of the late Mr. Hemans, in 1849, and after working under that distinguished engineer in various parts of Ireland, joined the Army Works Corps—third in command—on the outbreak of the Crimean War. On his return from that expedition he was again employed by Mr. Hemans, and constructed, among other works, the Athenry and Ennis Railway. He was for some years resident engineer in charge of the southern portion of the Great Southern and Western Railway of Ireland; and for three years subsequently employed in the construction of the Government Railways under the Cape Government in the Cape Colony. His last employment was in Dublin, under the Local Government Board, as an inspector. He was widely known and universally respected in Ireland by his professional brethren. We may add that a very serious strike, which had already commenced on the northern portion of the Great Southern and Western Railway of Ireland, and threatened to assume gigantic proportions, was arrested and stopped entirely by his influence, energy, and decision.

TENDERS.

SUTTON COLDFIELD SEWERAGE WORKS.

Mr. E. Pritchard, engineer, 27, Great George-street, Westminster, S.W., and 37, Waterloo-street, Birmingham. Quantities by Mr. E. J. Purnell, Coventry.

Contract No. 3.—Cast Iron and Earthenware Pipe Sewers and other Works.

	£	s.	d.
Macrea and Macfarlane, Dublin	24,090	0	0
J. Bush, Ulverstone	16,569	10	10
W. R. Green, Ilfracombe	16,350	0	0
Baker and Sons, Barbro'	16,267	4	7
J. Garlick, Saltley	14,916	0	0
Fotherby and Son, Burnley	14,656	15	7
Dovener and Son, Sowerby Bridge	14,540	0	0
Jos. Evans, Aston	14,180	0	0
David Shanks, Kirkcaldy	13,850	0	0
Jno. Fell, Leamington	12,750	0	0
Geo. Law, Kidderminster—accepted	11,777	0	0
A. Palmer, Birmingham	11,585	0	0
Engineer's estimate	12,500	0	0

Contract No. 4.

Mr. George Law's tender for the house connections and private drainage works has been accepted.

PORTMADOC SEWERAGE.

For sewerage of Tremadoc and Borth for the Ynyscynhaiorn Local Board. Mr. Thomas Roberts, Assoc. M. Inst. C.E., engineer.

	£	s.	d.
Davies and Jones, Festiniog	2313	9	11
Hughes, Portmadoc	1837	0	0
Owen, Portmadoc	1800	0	0
Davies, Portmadoc—accepted	1762	2	0
Engineer's estimate	1949	0	0

Technical Education.—The following is a list of candidates who have been successful in obtaining Royal Exhibitions of £50 per annum each for three years, and free admission to the course of instruction at the following institutions:—1. The Normal School of Science and Royal School of Mines, South Kensington, and Jermyn-street, London: Christopher J. Whittaker, age 22, occupation, engineer, of Accrington; George Gibbens, 19, student, Leytonstone; Isaac T. Walls, 22, painter, Accrington; John H. Tomlinson, 20, apprentice, Newcastle-on-Tyne. 2. The Royal College of Science, Dublin: Arthur Adams, age 23, occupation, engineer, of Birmingham; Abraham Firth, 21, assistant teacher, Stockport; Sidney A. Sworn, 16, student, Southampton.

THE STRENGTH OF STEEL AND IRON CRANK SHAFTS.

A VERY valuable series of experiments on the strength of steel and iron crank shafts was carried out at the Newburn Steel Works, by Messrs. J. Spencer and Sons, on May the 26th and August the 30th. The experiments were intended to determine the resistance of the specimens tested to tensile, transverse, and torsional strains. The following Table I. gives the results of the Test-office series of experiments, of which those with an * were conducted in the presence of representatives from the Board of Trade, and from Lloyd's and Veritas' Registers, to illustrate the comparative merits under tensile stress of bars cut from crank shafts and crank webs :—

TABLE I.

	Forged iron.						Steel castings.						Steel forgings.				
Mark of test	H 13*	H 14*	H 15*	H 16*	H 17*	H 11	O 191*	O 192	O 193	O 194	O 195*	O 196*	Q 95	Q 96	Q 99*	Q 100*	Q 102
Section of specimen .. .. inches diameter	·755	·755	·755	·757	·757	·755	·754	·755	·754	·750	·754	·85	·754	·755	·754	·754	·754
Direction in which test piece was cut ..	A	A	B	B	C	C	—	—	—	—	—	—	A	C	A	B	C
Original area .. .. .. square inches	·4477	·4477	·4477	·4500	·4500	·4477	·4465	·4476	·4465	·4417	·4465	·5674	·4465	·4476	·4465	·4465	·4465
Fractured area .. .. .. ,,	·2827	·3097	·4477	·4277	·4026	·3793	·3771	·2042	·3028	·2480	·3837	·2818	·2642	·2560	·2281	·3287	·2290
Permanent set induced .. tons per sq. in.	10·00	11·30	nil	8·90	—	10·1	18·20	16·70	15·9	12·29	19·70	13·00	13·50	11·30	14·2	13·50	14·00
Maximum stress .. ,,	17·95	19·45	1·99	8·90	15·87	17·5	35·00	28·3	28	27·8	31·60	27·15	30·00	29·50	28·99	28·60	29·49
Breaking stress on fractured area ,,	34·74	41·95	1·99	9·39	17·74	20·57	41·43	50·2	39·2	44·46	36·76	46·73	45·40	44·81	56·75	38·84	57·50
Contraction of area .. .. .. per cent.	36·85	30·82	nil	4·93	10·53	15·25	15·54	54·7	32·18	43·86	13·84	50·33	41·82	43·03	48·96	26·38	48·71
Elongation in length of 10in. ,,	—	—	—	1	6	9	—	—	—	—	8·5	—	24·75	22·5	20·5	16·75	22·50
Elongation in length of 8in. ,,	—	—	—	1	6	9·25	—	—	—	—	9	—	27	24	23·25	18·25	25·00
Elongation in length of 5in. ,,	23·5	25	—	1·5	6·5	10·25	13	34·75	24	26	9	24·5	30	29	29	21	29·25
Elongation in length of 2in. ,,	32	29	—	4	8·5	12	14	49·5	35	36	11	37	41	40	43	27·50	40
Mechanical work exerted in breaking bars:																	
Appearance of fracture: Crystalline .. per cent.	—	—	—	100	30	15	—	—	—	—	—	—	—	—	—	—	—
Granular .. .. ,,	—	—	—	—	—	—	50	—	2	—	96	—	50	—	—	50	—
Fibrous .. .. ,,	100	100	16	—	70	85	50	—	—	—	—	—	—	—	—	—	—
Silky .. .. .. ,,	—	—	lamina	—	lamina	—	—	100	98	100	—	100	50	100	100	50	100
Flaw .. .. .. ,,	—	—	84	—	—	—	—	—	—	—	4	—	—	—	—	slight	—

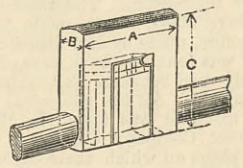
H bars were cut in the directions indicated in sketch from a forged iron crank shaft passed by Lloyd's; block cut from between the web was sent here by makers for testing purposes.

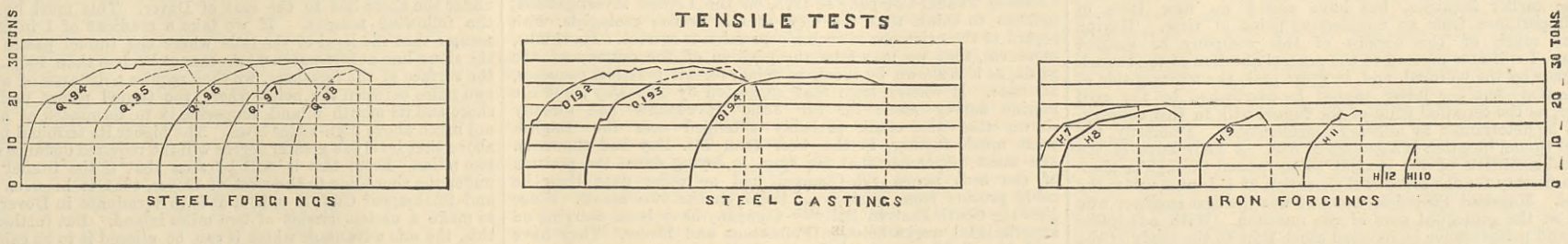
Q bars were cut in the directions indicated out of a block from a forged steel double-throw crank shaft—9⅝in. diameter, made under 8-ton hammer by Messrs. J. Spencer and Sons—passed by Lloyd's.

O 191 was cut from "git" of a crank web cast in steel—S 61.

O 195 was cut from a block of mild cast steel—S 73—but imperfectly annealed.

O 192, O 193, O 194, and O 196, "annealed," were cut from material of steel crank webs=S 72—cast for Mr. J. Dickinson, Sunderland, by Messrs. J. Spencer and Sons.





Horizontal length of each Diagram indicates the elongation.

TABLE II.

Results of Test-office series of experiments, of which those with an * were conducted in the presence of representatives from the Board of Trade, and from Lloyd's and Veritas' Registers, to illustrate the comparative merits under transverse stress of bars cut from crank shafts and crank webs. The angle given is 180 deg., less the arithmetical mean of included and external angles of test-piece. Distance between supports=10in.

	Forged iron.				Steel castings.						Steel forgings.					
Mark of test .. .. Δ	H 1	H 11*	H 4	H 16*	O 38	O 41*	O 42	O 43	O 44	O 45	Q 1	Q 3*	Q 9	Q 22*	Q 2	Q 11*
Length of specimen, 14in. section .. inches	1·25×1·25²	1·26×1·26²	1·24×1·24²	1·24×1·24²	1·1×1·26²	1·25×1·22²	1·25×1·25²	1·23×1·23²	1·47×1·4²	1·5×1·45²	1·24×1·24²	1·25×1·22²	1·19×1·2²	1·25×1·25²	1·24×1·24²	1·24×1·24²
Breadth by depth squared	1·9531	2·00	1·9066	1·9066	1·7463	1·8605	1·9531	1·8608	2·8812	3·153	1·9066	1·8605	1·7136	1·953	1·9066	1·9066
Direction in which bar was cut	B	B	C	C	—	—	—	—	—	—	A	A	B	B	C	C
Elastic limit, load on centre of bar .. actual tons	2·32	2·245	2·098	2·112	2·5446	2·977	2·723	2·142	5·580	4·630	2·5446	2·678	2·009	3·0357	2·455	2·8571
Maximum load on centre of bar .. .. ,,	2·32	2·589	3·93	4·643	4·77	5·714	7·589	5·803	11·160	8·918	7·41	6·294	5·625	6·25	5·71	6·294
Maximum deflection .. .. inches	·19	·2	3·04	2·1	3·1	6·7	1·68	5·15	4·33	6·44	4·21	7·0	3·64	6·8	7·0	5·29
Maximum angle through which bar was bent ..deg.	·5	4	71	56	71·25	122·5	—	100·5	98	118	102·5	120·5	83	120·5	118	111
Elastic stress.. .. .. tons per sq. in.	17·8	16·84	17·03	16·62	21·85	24·0	21·95	17·26	29·05	22·03	20·02	21·4	18	23·4	19·32	22·1
Maximum transverse stress .. .. ,, ,,	17·8	19·41	30·90	36·5	41·03	46·06	58·28	46·78	58·10	42·43	58·3	50·76	49·34	48·08	44·96	49·5
Mechanical work exerted in bending bars..inch-tons	1·92	2·68	86·87	61·92	116·32	230·24	97·81	204·64	225·44	214·75	181·68	257·15	149·6	252·63	238·71	216·86
Result—br., broke ; nbr., not broken	br.	br.	br.	br.	br.	nbr.	br.	nbr.	br.	nbr.	nbr.	nbr.	br.	nbr.	nbr.	br.
Appearance of fracture: Coarsely crystalline .. .. per cent.	—	—	70	70	—	—	—	—	—	—	—	—	—	—	—	—
Finely granular .. .. .. ,,	—	—	—	—		100	100	—	98	—	—	—	90	—	—	79
Fibrous .. .. ,,	—	—	30	30	1	—	—	—	2	—	—	—	10	—	—	20

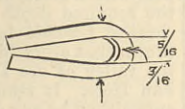
O 41*, Q 3*, Q 22* were taken to a 2-ton hammer, and were submitted to repeated blows.

O 41* broke after having had its ends hammered together until they were 2½in. apart; fracture was finely granular.

Q 3* broke after having had its ends hammered together until they were 1¾in. apart parallel; fracture was finely granular.

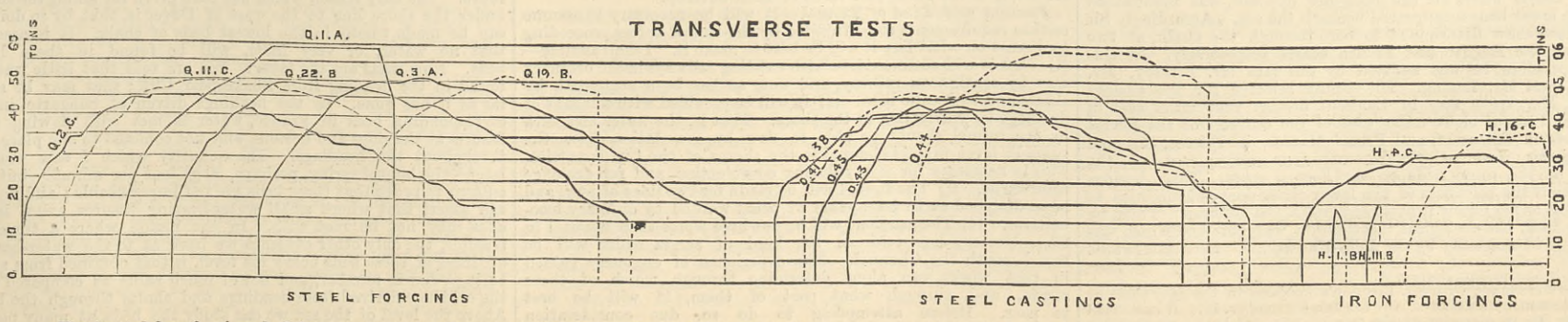
Q 22* held together although its ends met, and it then was hammered at ⊥ until the clear space was reduced to $\frac{5}{16}$in., when the bar tore partly, opening about $\frac{5}{16}$in. on outside of bend.

H bars were cut in the directions indicated in sketch, Table I., from a † forged iron crank shaft, passed by Lloyd's; block cut from between the webs was sent here by makers for testing purposes.



Q bars were cut in the directions indicated out of a block from a forged steel double-throw crank shaft—9⅝in. diameter, made under 8-ton hammer by Messrs. J. Spencer and Sons —passed by Lloyd's.

O bars were cut from material of steel crank webs, cast for Mr. J. Dickinson, Sunderland, by Messrs. John Spencer and Sons.



Horizontal length of each Diagram indicates the actual deflection. Vertical lengths indicate transverse stress in tons per square inch. All the Diagrams drawn to same scale

THE CHANNEL TUNNEL.*

By Mr. J. Clarke Hawkshaw, C.E., M.A., F.G.S.

This year the Channel Tunnel Company sought to obtain powers from Parliament to enable it to make a tunnel to connect this country with France, by a railway beneath the Channel, and it deposited plans and prepared a Bill for the purpose. The South-Eastern Railway Company did likewise. Neither company obtained a hearing before Parliament, but there have been preliminary inquiries by the Government, the results of which are that they have announced their intention of submitting the whole question to a Select Committee of both Houses, to be appointed early in the next session of Parliament. The Channel Tunnel Company had proposed to make a tunnel, beginning in Dover and passing beneath the shore line, about two miles eastwards of that town, at Fan Hole, near the South Foreland. The South-Eastern Railway Company's plans showed a tunnel beginning at the west-end of the undercliff which lies between Folkestone and Abbot's Cliff, and which was to pass beneath the shore line, near Shakespear Cliff, to the west of Dover. A Submarine Continental Railway Company was incorporated this year to purchase certain works belonging to the South-Eastern Railway, consisting of two shafts, sunk on the foreshore, near Abbot's Cliff and Shakespear Cliff, in the lower beds of the chalk, and a mile or thereabouts of headings driven in the lowest beds of the same formation. Nearly everything that has been heard during the last twelve months about a Channel tunnel has emanated from this company, who maintain that the part of the coast on which the South-Eastern Railway Company's works lie is the only place from which the tunnel can be made. The Channel Tunnel Company has remained silent, relying on an opportunity of proving its case before a Parliamentary Committee. That, hitherto, has been denied to it; but the following facts may show that the Channel Tunnel Company's proposal is worthy of consideration, and that the question has not at all been settled by the South-Eastern Railway Company's operations. The Channel Tunnel Company was incorporated ten years ago—in January, 1872—when it had already existed in the less ambitious form of a Committee for four years, viz., from 1868 to 1872, and it comprises among its supporters and advisers those who, nearly seventeen years ago, carried out the first practical investigations, both geological and engineering, which were undertaken with a view to ascertain where and how a tunnel could be made beneath the Channel. Geological surveys were then made which determined the identity of the beds on the two sides of the Channel. The continuity of the same beds across the bottom of the Channel was determined by a sounding apparatus, which brought up specimens from the bottom. The thickness of the chalk was ascertained by borings 500ft. deep, made through it on the two coasts; and a machine, made by Mr. Brunton, for excavating chalk was tested, and was found to work as rapidly and as efficiently as the machine lately used between Folkestone and Dover, of which so much has been said. All the geological work was done in the years 1865-7; the machine was tested in 1870.† Moreover, this same Channel Tunnel Company originated the French Company, and supplied the plans on which their concession was obtained in 1875. Investigations which have since been made have confirmed the results of these earlier inquiries, but have added no new facts of much importance from an engineering point of view. Having given so much of the history of this company as seemed necessary, I will now proceed to the general question of the tunnel. I shall pass by the political, and, in great part, the military side of the question—but the latter cannot be overlooked by the civil engineer, as the terminal point of the tunnel will, in this country, have to be determined by military considerations. Primarily, the Channel tunnel question is a geological one. A knowledge of the geological condition of the ground to be passed through is absolutely necessary for the successful execution of a tunnel under the Channel. Monsieur Thomé de Gamond was the first engineer who worked at the geological part of the question. With admirable energy and perseverance he devoted much time to the study of the geology of England and France, not confining his labours to the coast line, but continuing them inland. Unfortunately he failed to realise the insuperable difficulties of making a tunnel under the Channel through the formations below the chalk. The result of his labours was the proposal to make a tunnel under the Varne from Folkestone to Cape Grisnez, through the Wealden and oolitic formations. Monsieur Thomé de Gamond had not neglected to consider the possibility of making a tunnel through the chalk further to the east. He was led to select the line under the Varne, in the belief that, by sinking a shaft on the Varne, the tunnel could be attacked at four points instead of two, and so the work could be more quickly done. In this, I think, most engineers will now agree he was mistaken, and that a tunnel is not practicable on the line which he adopted. In later years M. Thomé de Gamond was associated with those who proposed a tunnel through the chalk, and he signed the plans for such a tunnel, on which the French concession was obtained in 1875. It was in the year 1866 that he proposed a tunnel under the Varne. For some years before this time, Sir John Hawkshaw had been considering the practicability of a tunnel under the Channel. His large experience in tunnelling led him to see the facilities which the chalk would offer for making such a tunnel. Early in 1865 he obtained the services of Mr. Day, an accomplished geologist, who possessed a knowledge of surveying. Mr. Day spent several months in that year in examining and surveying the cretaceous and underlying beds on the English and French coasts, and prepared for him a geological map, showing the position of those beds along the two coasts. He, moreover, made a conjecture as to their position on the bed of the intervening sea. This survey confirmed the fact, in so far as it was then known from the writings of W. Phillips, De la Beche, and others, that the chalk strata overlying the gault are almost identical, bed for bed, on the two coasts. To supplement Mr. Day's work, in so far as it related to the Channel, Sir John Hawkshaw employed Mr. H. M. Brunel, who was then his pupil, to take soundings across the Channel, and to ascertain as far as possible the nature of the material forming the bottom of the sea. An apparatus was devised for the purpose, by means of which specimens of the sea bed were obtained. It was found that instead of the sea bottom being composed of loose transported material it was mostly formed of rocks, *in situ*, similar to those seen on the adjoining coasts. This marine survey, carried out in 1865 and 1866, determined the continuity of the upper cretaceous beds across the Channel. It did not confirm Mr. Day's conjecture as to the position of the beds throughout. Specimens of chalk brought up from the bottom showed that the outcrop of the gault near the English coast lay further to the west than Mr. Day had shown it. It was still necessary to ascertain whether the thickness of the lower beds of chalk, which had been measured in the cliffs on both coasts where all the beds are exposed, was maintained after the lower beds disappeared beneath the sea. Accordingly Sir John Hawkshaw determined to bore through the chalk, at two points, on the English and French coasts respectively. In this costly operation he was assisted by the late Mr. Brassey, Mr. Wythes, and Mr. Easton. The points selected for the borings were St. Margaret's Bay in England, distant four miles east of Dover, and about eight miles east of the outcrop of the lowest chalk beds on the coast, and Ferme Mouron in France, two and a-half miles west of Calais, and four miles east of the outcrop of the same beds on the French coast. These borings showed that the thickness of the lower chalk does not diminish to any extent as we follow it eastwards from the outcrop. Thus, by the year 1867, the geological information was obtained which was thought to be necessary by Sir John Hawkshaw. Soon afterwards he prepared plans for the Anglo-French Committee, in conjunction with Mr. Brunlees and M. Thomé de Gamond, showing a tunnel through the chalk from St. Margaret's Bay in England to Ferme Mouron in France—line A on plan. In 1868 the Anglo-French Committee applied for a concession from the French Government, and a Commission was appointed that year in France to examine the question. After various inquiries, and a long correspondence between the two Governments, a concession was obtained in France. A further series of geological investigations were then begun. These were made by French geologists and engineers. I may here remark, that before granting the concession, which imposed very onerous conditions on the French Company, their Government obtained a declaration from the Government in this country that the latter did not object to a tunnel in principle. They, moreover, waited until our Parliament had passed a Channel Tunnel Bill authorising the Channel Tunnel Company to carry out certain preliminary investigations. The French Company were bound by their concession, obtained in 1875, to spend £80,000—2,000,000f.—in preparatory works of all sorts, such as investigations, pits, galleries, borings, &c. The conduct of these operations was entrusted to a committee, presided over by M. Lavalley, so well known in connection with the Suez Canal works. The geological work was assigned to MM. Pottier and Lapparent, mining engineers and able geologists, and they were assisted by M. Larrouse, hydrographer to the French Navy. They began by repeating and extending, on a more elaborate scale, the marine survey made ten years before by Sir John Hawkshaw. Using an apparatus of the kind already mentioned, they succeeded in bringing up a great number of specimens of the rocks forming the sea bed. These soundings confirmed, in all material points, the old survey. In addition, owing to the great number of soundings that were taken and to the number of specimens from the bottom that could be identified, it became possible to plot, with some accuracy, the junction of the lower chalk and gault from shore to shore, except for a short distance where those beds pass beneath the sands of the Varne. In addition to the marine survey, a second boring was made at Sangatte, and the results of this work—done in 1875-6—were published in 1876-7, in the form of reports, with maps and sections. Since then the French Company—acting under the advice of M. Lavalley and M. Raoul Duval—have sunk two shafts a little to the west of Sangatte, and have driven some short headings in different directions through the lower beds of the lower chalk, and they are now driving two longer headings by machinery. This is being done for the purpose of defining the position of the gault and lower beds of chalk. The researches by the French company have as yet brought no very novel facts to light, such as to disturb the main conclusions which had been previously arrived at in this country, but they have made our knowledge more definite in several particulars. Their survey shows that there is no break in the line of the outcrop of the gault, such as would be caused by any large fault. It attempts to define the position of the outcrop of the various divisions of the chalk. The position of these outcrops, on the plan accompanying the French report—1875-6—indicates a considerable depression in the chalk beds, extending along and not far from the English coasts. Mr. Topley, of the Geological Survey of England, who reported to the Channel Tunnel Company in 1878, on the French investigations, inclines to think that the view of the French geologists, with regard to the existence of such a depression is correct. He thinks, moreover, that we may take the position of the outcrop of the gault, as it is shown by them, as being, for all practical purposes, accurate. It differs from that suggested by Mr. Day; but the marine survey made for Sir John Hawkshaw had already shown that the chalk probably extended near the English coast much further to the west than Mr. Day had shown it. We must remember that Mr. Day, in laying down the position of the beds across the Channel, had no other data than he could procure from a study of them on the two coasts. Since 1880 the South-Eastern Railway Company have been carrying on experimental works between Folkestone and Dover. They have sunk two shafts, one near Abbot's Cliff and one near Shakespear Cliff. A third shaft is being sunk to the east of the Shakespear Cliff. Headings have been driven from the first two shafts, in directions more or less parallel with the cliff, in the lower beds of gray chalk. The above account is a brief summary of the geological work done up to the present time in connection with the Channel tunnel question. As English and French geologists do not employ the same terms in describing the principal divisions of the chalk, I have given a comparative table, showing the divisions recognised in the two countries. Before leaving the geological part of the question, I will refer briefly to the information that is available, and may be of use in discussing the question of the tunnel, but which has been collected by geologists, not for that purpose, but in furtherance of their own science. Early in this century the attention of geologists was given to the chalk cliffs forming the south coast of England. Mr. W. Phillips read a paper before the Geological Society of London, in 1818,* describing the various beds of chalk, showing how constant they were in character and composition at points far apart, and, moreover, that corresponding beds were found on the French coasts of the Channel. These views were confirmed by De la Beche, in 1821.† Mr. Hopkins, in 1857, in his account of the structure of the Wealden district and the Bas Boulonnais, deals with the disturbances which affected these beds, as well as others in the south-east of England. The eastern boundary of his "disturbed district" passes from Abbot's Cliff to Cape Grisnez, just missing the area which any tunnel through the chalk must traverse. Mr. F. G. H. Price contributed a valuable paper, in 1876, on the gault and upper chalk near Folkestone; but it is to Mr. Whitaker and Mr. Topley, of the Geological Survey, that we are indebted for most of the facts which have been acquired during late years respecting the beds in question, which facts have been published in the memoirs of the Geological Survey and elsewhere. In France, Prof. Hébert, Dr. Barrois, M. Potier, and others have added much to our knowledge of the cretaceous beds in that country. In a few words, the following is a summary of our geological knowledge of the question, as regards the chalk. This is the only formation we need consider, for no other offers equal advantage for the construction of a tunnel. Indeed, through no other formation is a tunnel practicable, taking all things into consideration. Identical beds of chalk are exposed above the gault in the cliffs on the two sides of the Channel. These beds are, on the two shores, similar in composition, contain similar fossils, and vary but little in thickness. Taken as a whole, they have a slight dip to the north-east. They have been found to pass uninterruptedly across the bed of the Channel, on which sections cut obliquely through them are exposed in bands stretching from shore to shore. Borings have shown that the lower beds increase rather than diminish in thickness as they dip below the sea-level, to the north-eastwards of their outcrop.

Position and Line of Tunnel.—It will be necessary to assume certain requirements to be fulfilled by the tunnel before proceeding to discuss on what line it will be best to make it. I shall assume—(1) That it will communicate with existing railways in the ordinary way by continuous railway, and not, as has been suggested, by shafts and hydraulic lifts. (2) It will be provided with a means of drainage by gravitation to the shore. That is, the water met with in the tunnel should be able to flow by gravitation from the summit level in mid-channel to the shores of the two countries. This is necessary for safety during construction, and for drainage afterwards. (3) The tunnel will be made for two lines of way, and be so designed as to be capable of being worked by ordinary locomotives. (4) The gradient will be nowhere worse than about 1 in 80. Geology has told us the kind of strata which will be met beneath the Channel. The experience of engineers gained in past works can alone determine through which of these strata, and through what part of them, it will be best to pass. Before attempting to do so, due consideration should be given to the following questions:—(1) What are the military requirements with regard to the tunnel? (2) Where must the tunnel end inland in order to give the best accommodation to existing railways? (3) What are the most favourable strata for the tunnel works? (4) On what line will any error in our geological calculations be of least moment? (5) Which is the shortest practicable submarine line? The problem, in so far as it depends on surface features of the land and geological conditions, is very different in the two countries, being simpler in France. The points where the tunnel can pass under the shore-line in France are limited by geological conditions to the part of the coast which lies between the Ferme Mouron on the east—where the boring was made in 1867—and Sangatte on the west, a distance of about two miles. The country, for some way inland throughout this distance, is low and flat, and probably, looking to military requirements or to communications with existing railways alone, it is not very material within these limits where the tunnel first reaches the coast. The point may be determined wholly by engineering and geological requirements. The case is very different and much more complicated on the English coast. Geological conditions will admit of the tunnel passing under the shore-line anywhere between St. Margaret's Bay on the east and Shakespear Cliff on the west, a distance of 4½ miles. With the exception of the valley of the river Dour, which enters the sea at Dover, the land along this part of the coast is high, bounded by chalk cliffs from 200ft. to 500ft. high. Such being the nature of the coast, there are only three places where the exit from the tunnel can be made—in the valley of the Dour near Dover, inland in the chalk escarpment to the north of Folkestone, and in the landslip between Abbot's Cliff and Folkestone. In the first case the tunnel would pass under the shore line to the east of Dover, and in the latter two cases to the west of Dover. At the last-mentioned place, between Abbot's Cliff and Folkestone, the tunnel on the South-Eastern Railway has been partially destroyed by a landslip, and the line was blocked for some weeks near Abbot's Cliff by a fall of chalk in 1876. This part of the South-Eastern Railway is liable to be obstructed at any time by larger landslips. For this reason it would be out of the question to place the tunnel mouth on such treacherous ground, even if the place satisfied other requirements, such as facilities for the defence of the tunnel, and for communication with existing railways. Similarly, if the tunnel exit were in the chalk escarpment to the north of Folkestone, it would be near no fortified place, nor could junctions be conveniently made with existing railways. Moreover, this position would necessitate at least six miles of land in tunnel, in addition to a longer sea tunnel, than from any point of the shore further to the east. The valley of the Dour alone remains to be considered. The tunnel mouth can there be placed at a moderate height above high-water level, which means a shorter length of tunnel, and better gradients between the tunnel mouth and the lowest point of the line beneath the sea; it can be placed either within or without the fortifications, as the military authorities may require; and, as the existing railways terminate at Dover, they can with ease be connected by short railways with the tunnel line. It remains to be seen whether the engineering and geological requirements are as compatible with its terminating at Dover as at the only two other possible places. I have stated that if the tunnel terminates at Dover it must pass under the shore-line to the east of Dover. This must be so for the following reasons. If we take a gradient of 1 in 80, and assume that the level of the rails where the tunnel passes below the shore line at low-water mark cannot be less than 100ft. below the surface of the foreshore, we then require a distance of at least two miles between the point where the tunnel passes under the shore and its mouth inland, supposing it to terminate at a point not much above high-water level. The higher its terminal point is above that level to a greater degree will the required distance exceed two miles. From this it will be seen that if the tunnel passes under the shore-line to the west of Dover, that is between Dover and Shakespear Cliff, it will, if it is to terminate in Dover, have to make a useless circuit of two miles inland. But further than this, the sole advantage which it can be alleged is to be gained by crossing the shore-line west of Dover, is that of remaining in certain lower beds of chalk, which have their outcrop near Folkestone, some six or seven miles to the west of Dover. Now, this advantage, if it be one, can only be secured by placing the tunnel mouth on the outcrop of the beds in question, that is in the Folkestone Landslip, or on the chalk escarpment to the north of Folkestone. That is to say, the sole reason alleged for going west of Dover precludes the tunnel terminating near that town. From these considerations it will be seen that, if the tunnel terminates in the Valley of the Dour, it should cross the shore line to the east of Dover, and there are other and far more weighty reasons why the tunnel should leave our coast to the east of Dover. The plans deposited by the Channel Tunnel Company this session show the sea tunnel to begin at Fan Hole, which lies a short distance to the west of the South Foreland Lighthouse. The first line laid down by Sir John Hawkshaw, in 1867, left our coast at the same point. It was afterwards moved to St. Margaret's Bay, further to the east, and was so shown in the plans on which the French concession was obtained. In both cases the tunnel was shown to pass in a direct line to the Ferme Mouron in France. Now, a line drawn from a point about half a mile to the east of Fan Hole, to a point about half a mile to the south-west of the French works at Sangatte, is the shortest line between the two countries, measured from low water to low water, and is about 20¼ miles long. From Fan Hole to the Ferme Mouron, in a direct line—line B on plan—is 21½ miles, and from the same place to the boring made in 1876, near Sangatte, is 20¾ miles—line No. 1 on plan. Practically this last is as short a line as can well be obtained. For to move the point of departure eastwards in England would be to lengthen the land tunnel in order slightly to shorten the sea tunnel, and geological conditions prevent our moving the line further to the west in France. As we move the point of departure on the English coast to the west, we increase the length of the most direct line to the French coast, and as we move it to the west of Dover this length is rapidly increased, for the tunnel cannot be made in a straight line from any point in England west of Dover, but must be made in a curve, deviating considerably from the most direct line. Thus from Fan Hole, or thereabouts, the shortest line for the sea tunnel is obtainable; again, as Fan Hole is distant a little over two miles from Dover, it is at the minimum distance, required to pass with a gradient of 1 in 80 from the mouth of the tunnel to the required depth below the shore line, and thus we get the shortest possible land tunnel. I think that, so far, it has been shown that everything is in favour of the tunnel terminating in the valley of the Dour, and passing beneath the shore line near Fan Hole. It remains to be seen how far these advantages are outweighed by any geological conditions afforded by the Folkestone route. The only reason which has been given for taking the tunnel under the shore line to the west of Dover is, that by so doing it can be made wholly in the lowest beds of chalk. It is asserted that no water, or very little, will be found in these lower beds. Now what are the facts? We are told that little water is found in the heading from Shakespear Cliff; that may be so, as far as it has gone. In the headings driven at Sangatte, in the corresponding beds in France, water is met with flowing from fissures at the sides and bottom, and not confined to one place, but throughout the headings. The quantity which I saw was not large—the largest spring, perhaps, 30 gallons per minute—but it is enough to prove that those beds are not impermeable; and no one can assert that where small water-bearing fissures exist, larger ones may not be met with. In the region where a tunnel is possible, the only other evidence we have as to the water-bearing qualities of these beds below sea level, is that obtained from small borings, few in number, and not of much value as compared with the evidence derived from headings and shafts through the beds. Above the level of the sea we can study the beds at many points. I do not attach much value to deductions as to the probable condition of the beds below the sea level, made from their observed

* British Association, Section A.

† Trials were made with Mr. Brunton's machine in the grey chalk at Snodland on many occasions. On the 8th September, 1870, it excavated a heading 7ft. in diameter at the rate of 44in. per hour; on the 20th January, 1871, the rate was 45in. an hour, and on 25th February, 1871, it was 49in. an hour.

* Transactions, Geological Society of London. Vol. 5.

† Transactions, Geological Society of London. 2nd Series, Vol. 1.

conditions above the sea level, for the constant movement of the land waters, from the highest levels to the points where they are discharged into the sea, must produce well-defined drainage channels underground, which need not necessarily exist at greater depths where there is no such rapid circulation. Still, as much has been made, especially by the French engineers, of evidence derived from observations on the zones, from which water is discharged on land, I will give a few facts relating to them. In France water may be seen to flow in many places from the lower beds of chalk, where they appear in the cliffs, between Escalles and St. Pot. I saw water flowing at the very junction of the lowest beds and the green sand. There are some large springs at Cran d'Escalles, which, on the section accompanying the French report—1875-6—are shown at about 60ft. above the upper green sand. The section shows Lydden Spout on the same horizon, but that copious and well-known spring on the coast between Folkestone and Dover issues, according to Mr. F. G. Price, who carefully measured the cliff section near it, at the top of the so-called "cast bed," about 32ft. above the upper green sand, or 46ft. above the gault. Therefore, if this evidence is worth anything, it shows that, on the French side, water might be met with largely 60ft. above the green sand; or, allowing 36ft. for the depth occupied by the tunnel and its masonry, 24ft. only above the tunnel, supposing it to be driven continuously along the top of the green sand. On the English side, as the water is found only 32ft. above the green sand, the top of the tunnel would be in this water-bearing zone on the same assumption. It is needless to say that no railway tunnel could be driven along the top of one bed, following all its flexures. Thus, if the evidence from the permeability of the strata on land proves anything, it is that a tunnel driven in the lowest beds of chalk must come very near a bed from which large springs are discharged on land, and that it will probably have to pass into this bed. I may here remark that it is a fallacy to suppose that if a heading were driven across the Channel in one bed, without meeting with water, it would prove that a tunnel could be driven on the same line equally free from water. The vertical depth of a heading is only 7ft., that of the excavation for a tunnel would be at least four times that depth. In the Severn tunnel works, headings have been driven in perfectly dry strata, yet, when the same have been enlarged for the full-sized tunnel, large quantities of water have been met with in the adjoining strata.

(*To be continued.*)

THE NORTH-EAST COAST EXHIBITION.

THE Earl of Ravensworth, in opening the North-East Coast Exhibition in Tynemouth, delivered an address, the principal portion of which is, we think, worth reproducing in our columns. He said, after some preliminary observations :—

"I may be permitted, in the first place, to cordially congratulate the energetic promoters of the Exhibition upon the choice of the locality. No more suitable locality could have been found than this, which is practically the centre of the great—I might say almost the greatest interest of the North of England—I mean the shipbuilding interest, and all those various trades connected with it. We are within easy access of all the magnificent group of ports, which I may embrace in one phrase and call the north-eastern ports, comprising Blyth on the north, the port of the Tyne, the port of the Wear, the port of the Tees, and extending as far as Whitby on the south. Well, ladies and gentlemen, you all know very well that this mighty industry, this national industry I will call it, has enjoyed for the last four years an almost unprecedented period of prosperity; and I rejoice to think, from all I can learn, that these great ports, and the great sister industry upon the Clyde, are still enjoying that prosperity. I can discover no symptom of a decline in that prosperity. I must further congratulate the executive committee upon having found such an edifice as this for the purposes of this Exhibition. I think it is very satisfactory that they have done so; and when you have had an opportunity of inspecting this building and its contents, and also the contents of the various annexes, you will agree with me that the Exhibition is worthy of their efforts. The first department to which I wish to direct your attention for a few moments is that of naval architecture. By the favour of the Admiralty, we have been furnished with some interesting and almost historical models; and in this particular department you will be able to compare the graceful forms of the old sailing line-of-battle ships—those old wooden walls of England of which we used to be so proud—with those ponderous and iron-cased monsters the modern war vessels, which are certainly more remarkable for their prodigious offensive and defensive purposes than for any peculiar grace and elegance of form, and—standing here in the presence of some able critics—I will venture to add that they possibly lack a little of what I may call uniformity of type. There is a very old saying, and a very true one, that good models are an essential element of the condition of good work; and we also know very well that another essential condition of successful production is the judicious division and distribution of labour. Division of labour is one of those good things which has some drawbacks. It implies, and necessarily implies, a certain monotony of toil, because it involves a certain concentration of mind and energies upon a limited sphere of work, and therefore I think it is of the highest importance that, from time to time, those intelligent classes of our fellow-countrymen—I mean the skilled artisans—should have the opportunity of seeing the completed ship on a perfect and well designed model, and thereby be enabled to judge of and to appreciate the value of the individual labour that each man has added to the work. There is, probably, no work in connection with which the division of labour is more usefully applied than the construction of a ship. You have your rivetters and your fitters, your riggers, your ship carpenter, you have the decorator and the cabinet maker, and various other trades employed, and there are also the large class of workmen who are employed upon the more intrinsic portion of the ship—the machinery. I trust the working classes will avail themselves of this opportunity of seeing the models which are exhibited here, and which are the finest specimens of naval architecture. I think the executive committee have most wisely offered to the various workmen, at the vast establishments at the ports I have mentioned, the opportunity of exhibiting their own models, and have offered prizes and diplomas to the successful exhibitors on this occasion. You will see exhibited, of course, models of magnificent ocean steamers, which are the wonder and envy of the world. You will see models of yachts of every form, boats of all descriptions, and, in fact, of everything in which our maritime commerce is carried. The next department to which I shall refer is one equal in importance to the department of ships' models—the marine engineering department, which, there is no doubt, will have more attractions for the scientific and instructed people who visit this place. I will only state that, great as has been the improvements effected in recent years in our types of ships, that improvement is small in comparison with the progress and improvement that have been made in marine engineering. It was only at the close of the last century and the commencement of this century that that great pioneer of steam power, James Watt, was content to conduct his valuable experiments with a pressure of 15 lb. on the square inch. Now a pressure of 80 lb., and even 90 lb., and more than that, is to be found in connection with our mercantile steamers. Bear in mind what this means. This vast acquisition of power has been obtained at a great economy of fuel; and when you remember how universally steam has taken, and is still taking, the place of sail, even in the most distant ocean voyages; when you remember the cost of coaling at different ports, and the delay connected with coaling; when you remember further that the more you economise your coal space, the more space you will have for cargo, and the greater will be the profit earned by the ship—when you remember all these things, you will be able to appreciate in some degree the debt we owe to the marine engineer. I will illustrate the triumphs of the marine engineer by referring to one or two vessels. The Alaska, which is a steamer built not long ago, and forms one of the Guion line of Transatlantic steamers, performed the voyage across the Atlantic to New York, a few months ago, under seven days. The Alaska is not inappropriately called the greyhound of the Atlantic; and she has a sister ship, the Arizona, belonging to the same company, and built by the same builders, Messrs. Elder and Co., of Glasgow, and these vessels can be claimed to be the two fastest ocean steamers in the world. The Alaska performed the voyage out and home, under rather unfavourable circumstances of weather, in a very few hours over fourteen days. That, I believe, is a feat that had never yet been accomplished in ship travelling. I mention this only to show what I consider are the triumphs achieved by marine engineers. The same firm—Messrs. Elder—are at this moment under contract to build a vessel which will run half a knot faster than the Alaska, and I need not remind the engineers around me of the amount of uncertainty and difficulty which arise in getting one knot or a half knot more speed out of a vessel. I hope Messrs. Elder will be successful. The marine engineer has not only annihilated time, but he has defied distance, and brought the most distant parts of the world within the limits of a voyage of a few days or weeks. Presiding over this department is a gentleman who stands at the head of his profession. There is another section which must be of the deepest interest to all of us—I mean that connected with lifeboat work. You are well aware, perhaps better than I am, of the nightly conflicts that are waged with the elements by the noble crews of the lifeboats, and the efficient aid afforded them by the Coast Guard, the very pick of our Royal Navy—aided by all the appliances which do so much in the saving of life, and, I may add, last and not least, by the noble Volunteer Life Brigade, in whose birthplace we are standing at this moment. South Shields, I believe, was the birthplace of the lifeboat, and some twelve years ago Tynemouth initiated the Volunteer Life Brigade. Could a more suitable locality be chosen for an exhibition of lifeboats, and all the gear connected with them, than Tynemouth? I may also remind you that a great ancestor of the present Duke of Northumberland, whom I am glad to see here to-day, the great Duke Algernon, was one of the first supporters of the lifeboat movement, and supported the first designer of the lifeboat which is now in general use. I think that the Lifeboat Institution owes much to the house of Percy. The next department I come to stands side by side with the Lifeboat Institution—I mean the lighthouse department, and all the various appliances which art and ingenuity have invented to minimise the danger of our coasts. Well now, ladies and gentlemen, there is no element, not excepting even water itself, that has afforded to the scientist and to the philosopher, and to the practical engineer, a wider scope and field for experiment in recent years than the element of light. The poets of old, in all the classic imagery of their poetic mythology, were wont to represent the king of the heavens, the father of the gods, seated upon clouds, with a thunderbolt in his right hand ready to hurl the mighty missile at the head of offending mortals or gods, as the case might be; but the modern scientist appears to me to handle the lightning with equally as much readiness and still greater dexterity than Jove himself. It is impossible to say to what use and point this extraordinary and marvellous invention may not reach. It is only a few days ago that Professor Siemens, an able exponent of everything connected with electricitity, astonished the world by telling us that before many years have elapsed the forces of wind and wave may be employed to create the very light which is to warn the storm-bound mariner, and guide and lead him into the haven. Science is thus going to help nature herself to protect mankind against her own fury. Surely we live in wonderous times. The marine engineer has annihilated time and space, and now the electrician is going to make the fire from heaven our friend. The electric light has been employed usefully in lighting our coast; and we look to it to light our harbours, our quays, and our streets, and even our line-of-battle ships are lighted by it at this present time. There is no saying to what uses this magnificent light may not be applied. You will see here specimens of the various systems of concentrating and distributing this wonderful light. We find in this county a branch of the invention, and a company formed to carry it out; Messrs. Swan and Co. are prepared at this moment to light our kitchens or our corridors upon the shortest possible notice. All these triumphs of science will be exhibited to your wondering eyes within these walls. I will now allude last, but certainly it is not the least department, to the department which represents the fishermen and all the gear and appliances connected with this trade. The fishermen's avocation has always been, and I fear always will be, a dangerous avocation from the very nature of the circumstances under which it is carried on. I hope that our hardy toilers of the sea will spare a few hours from their toil to visit the Exhibition, if only to see what science and philanthropy combined have done to minimise the risks of their calling. They will see here the best types of boats; they will see the life-jacket, the life-buoy, all the appliances connected with the lifeboat, and the lighthouse; and all those appliances which are exceedingly simple, and many of them extremely effective if employed with calmness and coolness at the right moment; and we know that calmness and intrepidity are leading characteristics of our seafaring population. They will see all these things here, and will, at any rate, give us credit for having done, and for doing, our best, as I said before, to minimise the risks attending their avocation. They will see that which is still more important in regard to the saving of life upon our coasts—the improvement of our existing harbours; they will see what the submarine engineer has done, and they will point with pride, under a summer sun and with a calm sea, to the magnificent piers which have turned a dangerous and a fatal bar into a safe, commodious, and accessible harbour, and have robbed the Herd Sand and the Black Middens of their terrors; and you are going now to reduce all danger to a minimum by erecting a new lighthouse on the inner sand, which has been fatal to more than one noble vessel. They will find our friend, Mr. Messent, an able and consummate engineer, working under all the stimulus given by the Tyne Improvement Commissioners, carrying on the great work of making this a harbour of refuge worthy of the Tyne and worthy of the country. This is a great anniversary. I have been speaking to you about the lifeboat. I am now going to speak to you of the first effort made in the volunteer lifeboat by Grace Darling forty-four years ago. To-morrow is the proper day of the anniversary of the occasion when Grace Darling and her gallant father rescued a great portion of the crew of the Forfarshire forty-four years ago, and was the means of suggesting to many people the importance of always having at hand volunteers to save life. I bid you all a hearty welcome within these walls this day. I trust you will find this great Exhibition worthy of your attention and interest, and that will be an ample reward to its spirited promoters."

ON THE PRESSURE OF WHEAT STORED IN ELONGATED CELLS OR BINS.*

By Mr. ISAAC ROBERTS, F.G.S., F.R.A.S.

IN America wheat is now largely stored in cells or bins measuring from 10ft. to 12ft. square and from 50ft. to 80ft. in height. They are generally built with wood partitions and fill the interior of great rectangular structures. In this country such a structure is being erected at Fleetwood, and on a small scale bins have also been erected in Liverpool. Mr. G. E. Grayson, architect of Liverpool, has designed a large structure intended for a granary. It consists of a network of hexagonal cells or bins built in brickwork, and should the scheme prove to be the economical mode of storing grain that is reasonably anticipated, such structures will in future become numerous. One great difficulty in designing buildings of the class here indicated is the absence of data by which the strength of the partitions and external walls, which form the cells, can be computed. Any data founded on the rules applicable to hydraulics will not apply, nor will rules applicable to sand or gravel apply, as the friction amongst the particles and difference in the specific gravity would give inaccurate results. Hence the experiments which I will now describe have been undertaken to afford data which may indicate with more or less accuracy the pressure upon a unit of surface exerted by wheat when stored in elongated cells. I caused four cells to be made of wood, and numbered respectively 1, 2, 3, and 4.

Cell No. 1 was a hexagon, each side of which measured 4in., the inscribed circle being 7in. in diameter. The height was 60in. It was supported on three legs, and the bottom consisted of a thin board about 9in. square, resting upon a weighing machine and counterpoised so as just to touch the bottom of the cell—when placed in position. Half an ounce weight on the board would be indicated by the machine. The wheat was measured into the cell in imperial gallons and quarts, one gallon weighing 7·8 lb. The weighing machine was weighted with 56 lb., and after the given quantity of wheat had been measured into the cell, the weights were removed half a pound at a time till the machine indicated the pressure upon the movable bottom of the cell within the limit of half a pound weight. One gallon of wheat poured into the cell measured 6¼in. height and indicated a pressure of 5½ lb. on the bottom; two gallons 12½in. in height, pressure 7½lb.

From two gallons up to and including nine gallons, or from 12½in. high in the cell, to 56in. in height, no increase in pressure beyond 7½ lb. was indicated, though nine gallons of wheat, weighing 70·2 lb., were put into it. Twenty-six separate weighings were made with various quantities of wheat from two gallons up to ten gallons, and in no instance was the minimum pressure below 6 lb. nor the maximum above 7½ lb. After obtaining the results above stated I caused the cells Nos. 2, 3, and 4 to be made in order to determine if these results would be confirmed by square cells and by larger hexagonal cells.

Cell No. 2 was square, measuring 7in. by 7in. and 36in. in height. The area was, therefore, equal to 49 square inches, whilst the area of cell No. 1 was 41·59 square inches. Cell No. 2 was placed over the weighing machine, with a movable wood bottom counterpoised in the manner already described. Two gallons of wheat measuring 11in. in height gave 8½ lb. pressure on the bottom of the cell, and when it was filled with six gallons of wheat weighing 46·8 lb., and measuring 33in. in height, the pressure was still the same. With seventeen separate weighings of various quantities of wheat from two gallons up to seven gallons, the minimum pressure in any case did not fall below 7½ lb., nor the maximum rise above 9½ lb.; three gallons would sometimes give the maximum pressure and six gallons would sometimes only weigh the minimum. The square cell, No. 2, therefore, within narrow limits confirms the results obtained by the hexagon at cell No. 1. Cell No. 3 was a hexagon measuring 6⅝in. on each side, the inscribed circle being 12in. in diameter and the cell 60in. in height. This cell was arranged also over the weighing machine table as described for Nos. 1 and 2. When eleven gallons of wheat, weighing 87·97 lb. and measuring 24in. in. height, were placed in the cell, the maximum pressure on the bottom was reached; any additional quantity of wheat up to twenty-six gallons weighing 202·8 lb. and filling the cell, did not increase the pressure on the bottom. Eighteen separate weighing, were made with this cell with varying quantities of wheat between eleven gallons, and in any case the minimum pressure on the bottom was 46 lb. and the maximum 49½ lb., the height of the wheat in the cell at 24in. indicated these pressures. These results again confirm the accuracy of the data obtained by the cells Nos. 1 and 2. Cell No. 4 was a hexagon, the sides of which measured 12in. each, the inscribed circle being 20·75in. diameter and the height 96in. The cell was placed over the weighing machine in the manner described with cells No. 1, 2, and 3. Fifty-one gallons of wheat weighing 397·8 lb., and measuring 36in. in height in the cell, gave the maximum pressure of 238 lb. on the bottom, and from 51 gallons up to 131 gallons from 36in. to 93½in. height, or from 397·8 lb. up to 1014 lb. of wheat in the cell; and the minimum pressure of 211 lb. and the maximum pressure of 238 lb. were obtained by the respective weighing. Nineteen trials with varying quantities of wheat were made. Again the results obtained by the smaller cells Nos. 1, 2, and 3 are confirmed by this large one.

I now proceed to discuss and formulate the data thus obtained, so as to make them available for practical use, first epitomising the results obtained :

Table of the Results of the Weighings.

Cell No.	Diameter of inscribed circle.	Area of cell in inches.	Height of maximum pressure.	Height of cell.	Mean pressure on bottom.	Weight of wheat in cell.
	Inches.		Inches.	Inches.	lb.	lb.
	20¾	374·11	36	96	224	1014
3	12	122·8	24	60	48	202·8
2	7	49·0	11	36	8½	46·8
1	7	41·57	12½	60	7	70·0

It will be observed that all pressure upon the bottom ceases before the cells, respectively, are half filled with wheat.

That the highest point within the cell where the pressure ceases does not form the apex of a cone, having the diameter of the inscribed circle as its base, is evident; but the wheat must form either a parabola or hyperbola with that base, and the whole of the weight of the wheat that may be filled into the cell, excepting only the parabola or hyperbola, is supported by friction against the sides, and the friction of the individual grains against each other. They form a self-supporting dome out of a plug of wheat held in position by friction. This generalisation is borne out by each of the cells, whether it be large or small. The next step will be to determine some ratio existing between the diameter of area of the cell and a portion of axis of the parabola, the product of the length of which, by the diameter or area, will equal the cubical quantity of wheat that will represent the pressure upon the bottom. I found that 1·03 the diameter of the inscribed circle multiplied by the area of the cell will furnish a constant that will give very satisfactory results in each of the cases we are now considering, and be applicable in general practice. The formulæ are as follows :—

Let A = area of cell in square feet;
D = diameter of inscribed circle in feet;
C = 1·03 the constant;
W = weight of wheat in pounds of cubic feet;
P = pressure upon bottom of cell;
$\frac{P}{A}$ = pressure per square foot of area.

FORMULÆ.

$A \times D \times C \times W$ = the pressure on the bottom of the cell, and

$\frac{P}{A} = D \times C \times W$ = the pressure upon each square foot of area.

In order to test the accuracy of the formulæ with the actual pressure so determined in the four cells already described, we have the following :—P in cell No. 4 = 225·8 lb.

The actual pressure obtained by nineteen pressures were 211 lb. minimum, 238 lb. maximum, 224·5 lb. mean. P in cell No. 3 = 42·83 lb.; the actual pressures obtained by eighteen weighings were 41·5 lb. minimum, 49·5 lb. maximum, 45·5 lb. mean. P in cell No. 2 = 9·7. The actual pressures obtained by seventeen weighings were 7·5 lb. minimum, 9·5 lb. maximum. P in cell No. 1 = 8·44 lb., and the actual pressures given by twenty weighings were 6 lb. minimum, 7·5 lb. maximum.

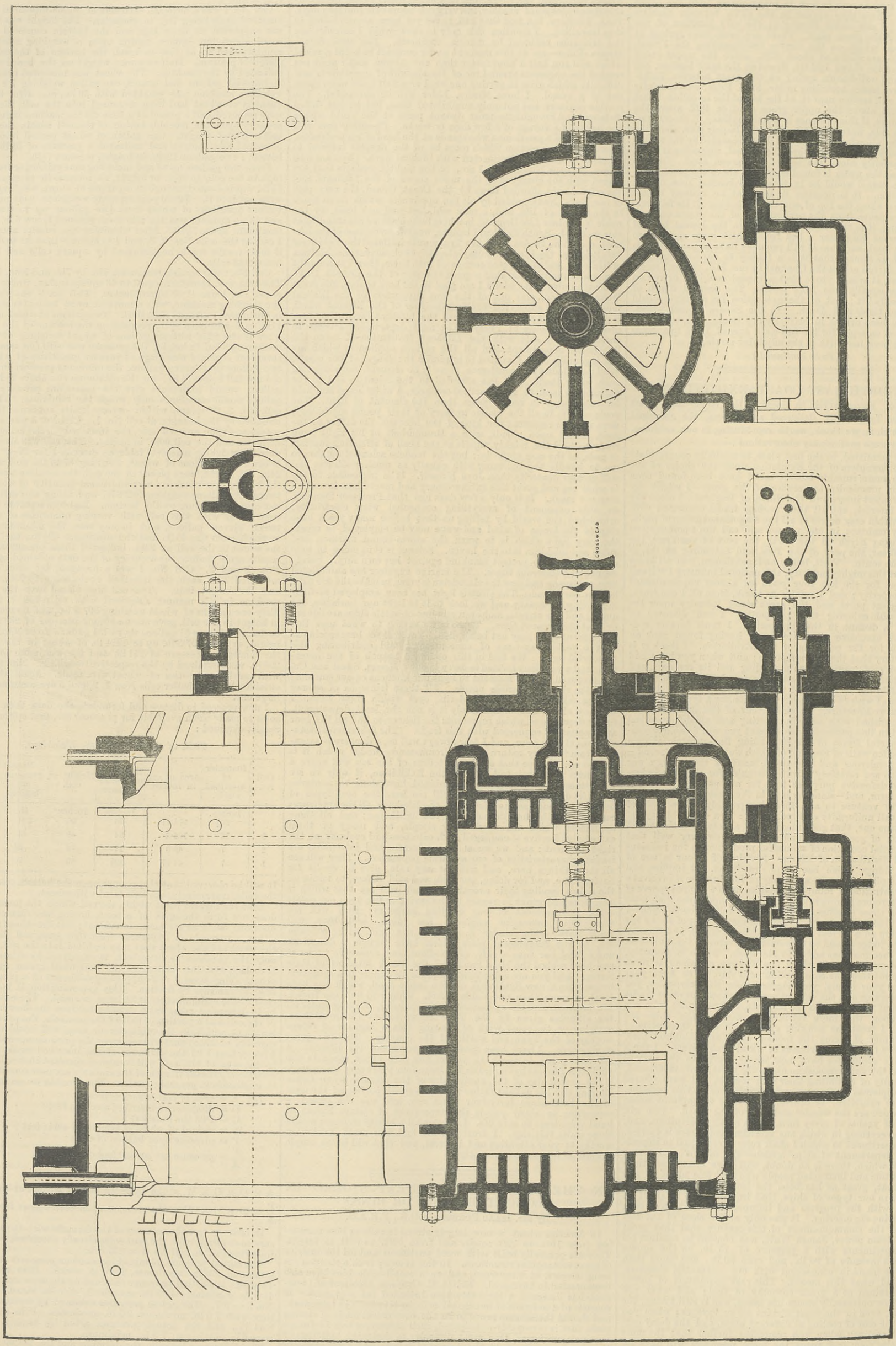
The differences between the formulæ and the actual weighings are within the limits of divergence that must always remain with wheat, for it is itself favourable in specific gravity, in size of grain, in adhesiveness among the grains, and in its moisture.

* Paper read before the British Association at Southampton, 30th August, 1882.

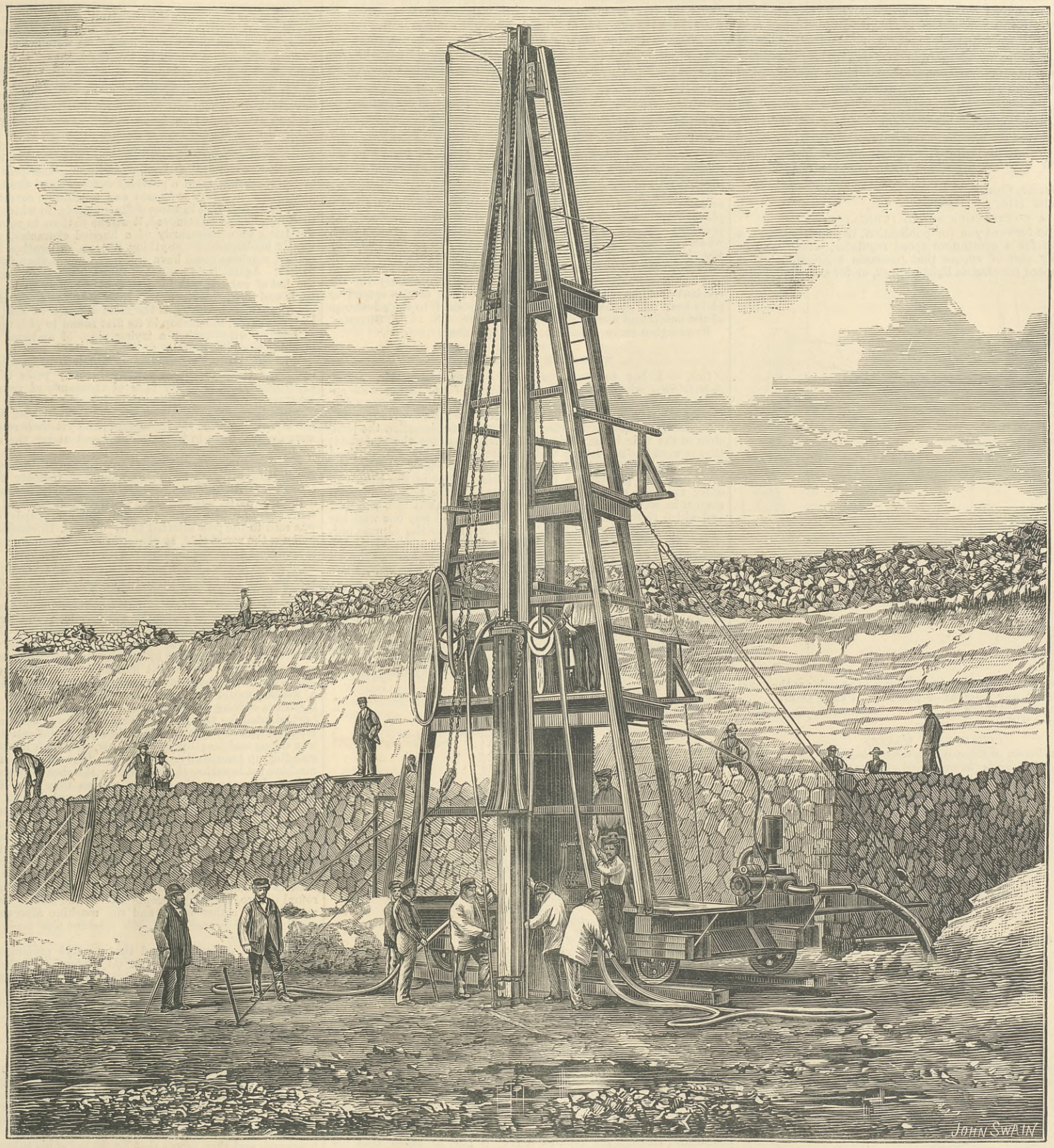
COMPOUND CONDENSING ENGINE, HALPIN'S PATENT.

MESSRS. MANLOVE, ALLIOTT, FRYER, AND CO., NOTTINGHAM, ENGINEERS.

(*For description see page 202.*)



LACOUR'S HYDRAULIC PILE DRIVER, CALAIS HARBOUR WORKS.



IN our impression for August 11th, page 109, we described Lacour's hydraulic pile driver, used with much success on the new Calais Harbour works. The accompanying engraving, copied from a photograph, illustrates the pile driver in position. It will be remembered that the monkey contains a cylinder, within which is a piston and rod. The rod projects from the bottom of the cylinder, and its end rests on the top of the pile; by forcing in water between the piston and the bottom of the cylinder the latter, with the monkey, is raised, and by letting the water out the cylinder falls and delivers the blow. Thus the weight of the cylinder and monkey is always borne on the pile. In the particular machine which we illustrate, pressure is obtained by means of a steam pump on the frame and hose pipes as shown. The Lacour system is said to give very great satisfaction on the Calais Harbour works.

LETTERS TO THE EDITOR.

[*We do not hold ourselves responsible for the opinions of our correspondents.*]

COMPOUND ENGINES—A SUGGESTION.

SIR,—From a consideration of the following figures, I would suggest a form of compound engine which ought to get more power out of a given quantity of steam than any form hitherto used. In the ordinary compound engine there is a considerable pressure of steam on the low-pressure piston, say 10 lb. mean pressure on square inch. Call the area of this low-pressure piston 1, then taking vacuum at 13 lb., the power may be expressed by 1×10 (for steam) $+ 1 \times 13$ (for vacuum) $= 23$. Now, let the low-pressure piston be ten times larger than in the preceding case. Steam pressure is now 1 lb. per square inch, and our figures are 10×1 (for steam) $+ 10 \times 13$ (for vacuum) $= 140$. The high-pressure cylinder, steam, stroke, &c., are taken the same in both the foregoing cases. If in the latter case we suppose the mean steam in the low-pressure cylinder to have fallen to atmospheric pressure, we shall have 0 (for steam) $+ 10 \times 13$ (for vacuum) $= 130$. By thus making a large low-pressure cylinder the power is increased about five times, also 9 lb. back pressure is taken off the small piston.

The greatest advantage appears to be gained by letting the high-pressure steam exhaust into low-pressure cylinder or cylinders so a ge that the mean steam pressure is then atmospheric; thus, a arge piston area is obtained for the vacuum to act on, and full steam pressure—above the atmosphere—is applied on the high-pressure piston. As so much more power is thus obtained from the low-pressure than from the high-pressure, it will balance better to use two high-pressure and two low-pressure cylinders—two tandem engines—than one high-pressure and one low-pressure cylinder if there be two cranks. By letting both high-pressure cylinders exhaust into a valve chest common to both low-pressure cylinders, a more even pressure will be maintained on the low-pressure pistons than by each high-pressure cylinder exhausting only into its own low-pressure cylinder. A flue might wind round the cylinders and valves, and a casing of felt and lagging, &c., outside the flue, keeping up the temperature, while not diminishing quantity and heat of steam by a steam jacket or receiver.

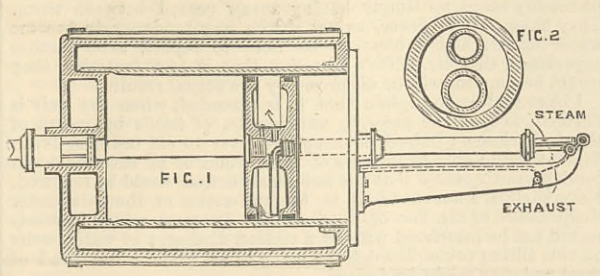
An engine on this plan, with two high-pressure cylinders, each 19in. diameter, and two low-pressure cylinders, each 120in. diameter, stroke of all 6ft., with steam at 80 lb., cut off at half stroke, making 50 revolutions per minute, will give about 6000 indicated horse-power. J. L.

Queenstown, September 13th.

[Our correspondent's reasoning contains an error. Our younger readers will find a search for this error an instructive exercise.—ED. E.]

JACKETTED PISTONS.

SIR,—In January last I designed for use in the steam cylinders of a compound air compressor the divided steam-heated piston, a tracing of which accompanies this letter. I am not able to say



whether this invention is antedated by that of Messrs. Geoghegan and Sturgeon, described in your issue of September 8th, but it is undeniably original, and is supplied with steam and exhausted through the hollow piston rod produced through the back cover, the exhaust pipe being led to the lowest part of the piston. The steam supply can be regulated at will by a valve on the pipe. An enlarged section of the hollow rod and pipes is shown in Fig. 2. A modification of the same arrangement provides cold water to the interior of the air pistons for cooling purposes. I apprehend that with the additional surface provided in this way, and with heated covers, the maximum benefits of steam jacketting will be attained, and when the conclusive trial of jacketted *versus* unjacketted cylinders is made, it is to be hoped that the former system will have the benefit of these arrangements.

Hoddesdon, Herts, REGINALD BOLTON.
September 9th.

THE FORESHORE AT HASTINGS.

SIR,—Your article on "the Sea at Hastings," in the last issue of THE ENGINEER, lays great stress upon the theory of some exceptionally destructive natural agency being at work on the coast about Hastings, and hints, when commenting upon my letter to you, that I have overlooked this part of the problem.

I admit that the supposition as to such an influence is not improbable, having regard to the fact that two or three Martello Towers, which at one time stood at the westward of the town, were about twelve years since undermined by the sea, after having stood for nearly seventy years.

I doubt, however, if the scarcity of beach, which manifested itself six years ago at the west end of the borough, was the result of any persistent destructive action, such as is suggested in your article; for the evil has since been remedied after the construction of sundry groynes by the collection of a fine bank of shingle, which has now lain undisturbed for three or four years. In short, it appears to me that more ordinary conditions are sufficient to account for the phenomena discussed. The difference of opinion, such as it is, is probably one of degree rather than of kind, as we both admit the same agencies to exist, though apportioning to each different values. W. H. THORPE.

Hastings, September 10th.

RAILWAY RATES FOR COAL.

SIR,—I have read your leader in your last ENGINEER on the haulage of coals with much interest. It is twenty years since this question to have coals at $\frac{1}{4}$d. per ton per mile was before the House of Commons Committee. The promoters of this were the late Mr. G. P. Bidder, the late Mr. I. F. Tone, and I think Mr. G. R. Stephenson. The line was to be a mineral one, to start

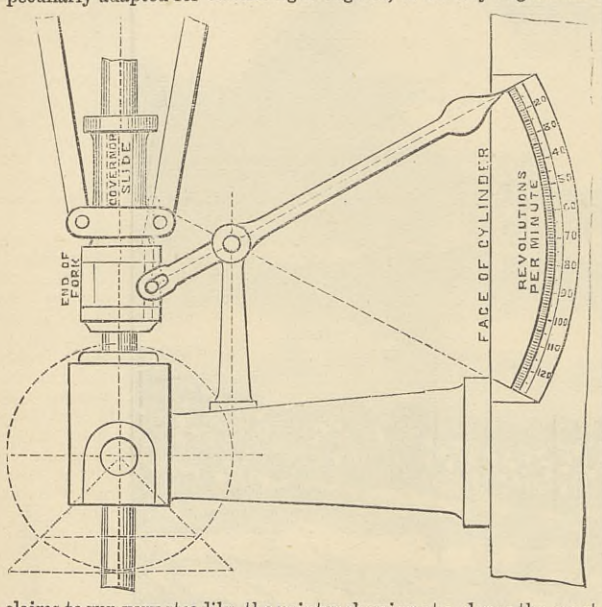
from Askern, near Doncaster, to London, by way, I think, of Cambridge route.

The evidence was taken from my books, being at that time locomotive superintendent on the Blyth and Tyne Railway. My system in getting up the evidence—I consider a little simpler than the way you have put it—was guided by the money made per mile and cost per mile. Having made use of past opportunities afforded me to put into practical shape the ideas which I had long entertained respecting the proper method of working mineral traffic at this time, and having got the engines in good order, I put twenty more tons on to the coal sets and intended putting more on, but my patent three-cylinder engine failed to meet what I expected, and the chairman was not willing for me to make the second trial. My evidence is from familiar facts taken from daily experience. Should your leader raise a discussion on this most important question, then the nation ought to thank you for it; I have long thought of it. On the 36,000,000 tons, in round numbers, over the North-Eastern Railway, would reduce ¼d. per ton per mile; this over twenty miles would relieve the coal trade in this district. WM. WENDALL.

16, Davies-street, Cardiff,
September 11th.

A CONTINUOUS SPEED INDICATOR.

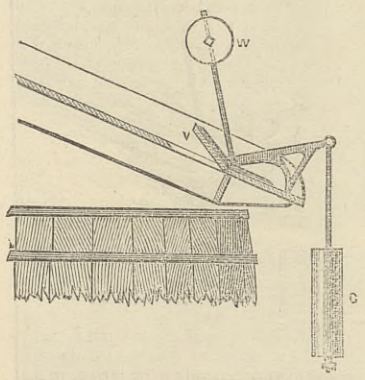
SIR,—I beg to forward you for publication, if you think well, a design of mine for a continuous speed regulator, which may be applied to any sort of engine that possesses a governor. It is peculiarly adapted for electric light engines, or for any engine that



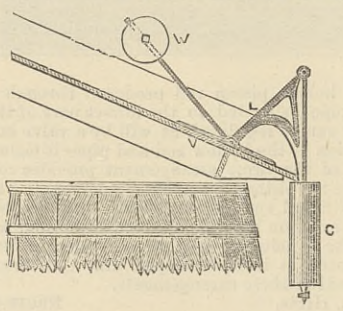
claims to run very steadily, the pointer showing at a glance the exact speed of engine at any moment of time. PERCY DEED,
33, Carholme-road, Lincoln, Mechanical Engineer.
August 24th.

CLEAN RAIN WATER.

SIR,—A gentleman of this town, a retired banker, and a member of the Society of Friends, having tried various filters to purify the rain water collected on the roof of his house, came at last to the



conclusion that if the first part of a shower were allowed to wash the roof, he would attain his end. I can vouch for the success of the apparatus, which, as far as I can recollect, is as sketched below.



It has an artistic simplicity about it which will recommend it to your readers. The weight W and the angle of the lever L are such that when the valve V is once opened it goes full open. A small tap at the bottom of the can C acts the part of a cataract, and brings the apparatus back to a normal state very soon after the rain ceases. MILLWRIGHT.

Newcastle-on-Tyne, September 2nd.

TRAILING ROLLING-PLANT ON TRAMWAYS.

SIR,—It may be stated generally that practice obtains, at least with the public, a greater favour than theory, although the practice may be doubtful and even faulty, which is not the case with theory. Good practice may be said to be that built on theory, prqperly so-called. A greater obstruction to the application of science to art than this undue public favour is manifested in the popular prejudice expressed by clamour, perhaps interestedly directed not only against the theory but also against the project. These forms of obstruction to advancement may be of greater or lesser extent, but during their continuance not the less mischievous. A well-known case of such evil obstruction is furnished in connection with tramways. It is in the recollection of most persons interested in such ways, the popular outcry raised against the line laid down in London by Mr. Train. Even men of education fell in with the clamour. A case of public nuisance and danger was carried before the Lord Chancellor on affidavits made by gentlemen of respectability. The line was taken up by order of the Court. It is now seen that the public clamour and popular disfavour, then so loud and strong against tramways, were as false as they were vigorous, for now these ways find great public favour. There are other equally mischievous prejudices to be removed in favour of the public convenience.

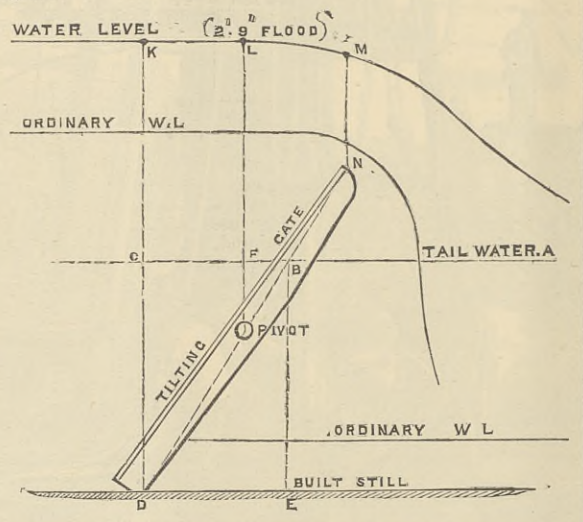
The trailing of rolling-plant on railways has been already more or less discussed, and for special purposes the adoption of a central rail proposed. There is no startling novelty to be considered. The practice on the more general order of railways—those with plain rail heads—has been to effect the "trail" of the rolling-plant by means of inside wheel flanges to pass between the rails of the way. By this arrangement—practice—the surfaces to come in contact for the purposes of "trailing" are the outer or tire side of the flanges and the inner side of the rails; and in trailing the controlling contact is that of either of the wheel flanges and its rail as the case may be. Viewing the pair of wheels as at the ends of a cylinder, in length equal to the gauge, the middle part being partially removed for mechanical or economic consideration, no violence is done to the present practice. If the wheel cylinder be shortened in the middle part, and the shortening be continued to the vanishing point, we arrive at the consideration of a single wheel with a middle projecting flange, having the same surfaces for "trailing" contact as when apart. Again, in regard to the control exercised by the rails on railways, if the proximity of the contact surfaces be preserved, we arrive at the consideration of a single flange wheel, and a corresponding single grooved rail, as the essential requirements of present practice in "trailing" rolling-plant on railways. The tramway rail and car wheel illustrates the practice. From this it may be seen by a little consideration that, whatever danger or inconvenience there may be to the public by the construction of tramways in public thoroughfares, such are intensified by the existing practice of grooving both rails, when, as may be seen, only one grooved rail is really necessary for the efficient trailing of the car. The road surface of the second or plain head rail might be considerably diminished, to the advantage of the public and economy in traction power. J. SMITH.

Kennington-grove, Lambeth, 11th September.

WISWALL'S TILTING WEIR.

SIR, — I beg to reply to your correspondent, Mr. Olive, A.M.I.C.E., whose letter on the subject of my tilting weir appeared in your issue of the 8th instant. I am obliged to Mr. Olive for the interest he takes in the work, and am glad to give him the information he asks. I notice that he does not question the principle of the weir in any way, but merely disputes the statement that it would be self-acting under a pressure of 2ft. 9in. of flood water. The question really resolves itself into one of whether the pivot has been placed at a point sufficiently low in the gate. In order to judge of this, it is necessary that the peculiar circumstances in which the weir is placed should be taken into account, and which circumstances could not be known to any one who has not taken observations and made experiments for the express purpose. Mr. Olive assumes that the ordinary water level in the higher pond is that of the crest of the weir; in my calculations I take it that the ordinary level is 1ft. higher than the weir, there being usually 12in. of water running over the latter.

The next point, and which is of still greater importance in this particular case, is that for every 1ft. of water which the upper pond rises in time of flood, there is rise of 2ft. of tail water below the weir, the natural gradient of the surface of the river being so much greater in flood time than when there is only the ordinary flow of water. The simple means whereby I calculated the head at which the weir would automatically tilt is shown by the following diagram:—



As will be seen, the ordinary level of the river I assume to be 1ft. above the crest of the sluice gates. Under these circumstances there is about 1ft. 6in. of tail water, with 2ft. 9in. of flood water, there would be 5ft. 6in. extra of tail water; this is shown in the diagram. I leave out the weight of the gate, as when it is almost submerged it becomes of very nearly the same specific gravity as the water. If the plane of the upper surface of the lower pond be continued through the gate, as A B C, it may be taken that the body of water of which B E D is a section will counterbalance that of which C B D is a section—there thus remains C F K L as the area representing the force below the axis, and L F B N M as the force upon the gate above the axis. The width of the gate above the axis being 10ft. and below the axis only 9ft., it follows that the gate will be in equilibrium when 10 L M N B F equals 9 K L C F, which is the case in the above diagram. The momentum, then, required to move the gate would be supplied by the velocity of the stream which impinges upon the upper part of the gate. This being in times of 2ft. 9in. flood equal to about 15ft. per second, would be considerable.

With reference to the remarks as to the silting that would take place, and also that the timber would become water-logged, I have to say that neither objection is tenable. The gates can with the greatest of ease be made self-cleansing within a few moments by simply raising them one or two inches from their bed, when any silt which may have accumulated is instantly shot away. A gate fixed in the river Medlock, at Manchester, under circumstances far more likely to allow the silting up, does not suffer at all from this cause, but is in perfect working order, and has several times during the last twelve months acted automatically under a head of only 2ft. of water, at which point it was designed to tilt.

With regard to the water-logging, perhaps the drawings published were scarcely sufficiently large to show that the outer edges of the gates below the axis had 4in. free play, which will allow of the swelling of the timber far beyond any which could possibly take place. The upper edges which slide into contact are very easily examined at intervals, and if found to be getting tight can be readily eased by simply having a saw passed between them. They have not, however, as yet shown any tendency to become water-logged, and I hope to be able to report, after further experience, that Mr. Olive's assertion that it is a fact that they would become so, will be disproved by the actual results.

I have further to explain that it is intended, when the weir is finished, to open the gates in anticipation of floods by means of the draw chains; indeed, to keep the river to its ordinary level. Thus it would only be in cases of inattention or of extreme floods coming unexpectedly that the automatic action would be required. Nevertheless, I am confident in the self-action of the weir under the pressure of 2ft. 9in. of flood water. In cases where interests would not be interfered with by a sudden discharge of water, weirs on this tilting principle might be made to act under a less head of flood water as might be desired.

In conclusion, I have to say that I shall be pleased to give any further information on the subject, and to show to any of your readers the weir in operation if they care to make an appointment with me for the purpose. FRANCIS WISWALL.

Bridgewater Navigation Offices, Manchester, September 13th.

SHEAF-BINDING REAPERS.

SIR,—In your issue of the 8th instant, a notice appears of the trial of sheaf-binders by the Highland and Agricultural Society of Scotland, upon which perhaps you will give us space for a few remarks. In the notice referrred to, we were not a little surprised to read, being so contrary to the facts, that "the trial seems to have been a severe one, lasting as it did over two days." In venturing upon any criticisms of the trial we, of course, expose ourselves to the usual remarks applied to "disappointed exhibitors;" nevertheless, no one will contend that we are not justified in preventing the public from being misled as to the completeness of a trial, which could not well have been briefer. What are the facts? After an excessively wet day on Monday, the machines were put to work on Tuesday morning shortly after eleven o'clock, and the trials were concluded the same evening by half-past six, the land and crops being, from a previous wet week and the heavy rain the day before, in a very soddened and unsuitable condition. As the crops to be cut were in three different fields, to which of course the machines had to be removed, it will be obvious to your readers that the trials were necessarily of a hurried character, and the time totally inadequate for anything like an exhaustive trial; indeed, neither machine could have cut much more than four acres altogether. Again, it so happened that our machine, standing first on the list of entries, was in each field the first to be submitted to trial, and had, therefore, the outside of the crop, which, as every practical farmer knows, is the most difficult to deal with; and it had, moreover, the mishap in its first round to pick up a stout piece of fencing wire—rather a trying piece of material for any such machine to contend with.

Without, however, dwelling upon details, we would remark that upon the three machines exhibited, many years of thought and experiment, and probably tens of thousands of pounds had been expended by the manufacturers in bringing them to their present state of perfection, all three machines performing their work to the astonishment of the lookers on; and yet their respective merits were decided upon in the brief time and under the circumstances we have described.

The following extracts from the report published in the *Glasgow News*, before the awards were announced, indicate the opinion of those who witnessed the trials:—"The field of wheat was divided into three parts, but we noted the machines were all tested at the same place for two or three rounds, and afterwards each of them was sent to the post allotted to it. Messrs. Howard's machine had perhaps the worst side, as the crop was rather short and thin, but it appeared to be the favourite with the onlookers. The sheaves were much neater, there were no loose straws hanging from them, and the stubble ends were quite square: and there was a firmness about them, when lifted below the arm to stook, which was wanting in the others. None of the machines made very good work across the field; the stubble was too long and irregular, and a good many straws were left behind the cut; but down hill the work of all the three was everything that could be wished. The general opinion expressed by farmers was that they had never seen such good work. As a slight indication of the cleanness and neatness with which the sheaves were laid down, it may be stated that a woman would not have got a lapful of straws after all the machines cutting down the hill. The oat field was probably the best adapted for testing the working powers of the machines. The crop was scarcely ripe, and therefore more difficult to cut; and it was strong and lengthy in the straw, although a little thin, and standing up beautifully. During the first round or two Howard's machine made rather the best work; the sheaves were left as neat, firm, and square at the stubble end as they were in the wheat-field. Its only defect was that, owing probably to the length of the straw, the sheaves did not come as neatly from it as in the other two fields; but after a round or two this was remedied. The other two machines, while making capital work, did not apparently leave the sheaves so neat, the string seeming, if anything, too near the middle of the sheaf. This, however, was thought by some onlookers to be rather an advantage, as the sheaves would, in consequence, dry sooner in the stook. After a round or two, Hornsby's people altered the size of the sheaf, as it was thought rather large, and the machine afterwards made, if anything, neater work. Wood's machine also made capital work in the oat-field."

Whilst we do not contend that a more prolonged trial would have led to different results, we do contend that the producers of such machines had a right to expect a more prolonged trial from such a Society; and had such been made, the awards would unquestionably have inspired greater confidence, and been more satisfactory to the public. JAMES AND FRED. HOWARD.

Britannia Ironworks, Bedford, Sept. 12th.

SEWAGE AND AIR.

SIR,—I am afraid "A. F.'s" recent walk in a country lane has had a decidedly prejudicial effect on his digestive organs, and has caused him to view matters with not quite such a strict attention to facts as usual. If he will send a number of pails or tubs to the narrow lane in question for the use of the labourers, and after they have been in use a few weeks will take another stroll in the neighbourhood, and then report that by the use of his tubs—so collecting and drying both the solid and fluid excretions together—the nuisance has been abated, I for one will willingly acknowledge that his theory as to the reactionary principle is correct. In my letter to you of the 28th ult., referring to what has been done at Batley, I distinctly said that I was not advocating that plan, but simply showing what might be done even on a large scale with a proper system of ventilation, by merely separating the solids from the fluids. Properly arranged ventilation is indispensable in any system, but in "A. F.'s" narrow country lane I fancy he got a little too much of it.

"A. F." only begs the question when he speaks of the "case" and "such an instance" referred to by me being successful, as if I had referred to some isolated closet in a desert, when I quoted from the Mayor of Batley's letter that they had over one hundred arranged on the separation principle in various parts of the town, besides mills and manufactories. Yet your correspondent says, "we know it cannot be effected—*i.e.*, the separation of the urine—when closets are indiscriminately used as in the generality of households!" After the facts set forth in my letter, I think it hardly fair of "A. F." to dismiss the matter in so cavalier a manner, as "For municipal purposes, therefore, the principle could not be carried out and need scarcely be discussed." Cool certainly! I am afraid that dirty country lane has much to answer for.

As although "A. F." dismisses the separation system as impracticable, yet wants "further information as to the condition of the matters removed from the latrines so as to enable those who are interested in the matter to form more conclusive opinions," I conclude he has not really made up his mind on the subject in spite of his dictatorial utterances, and wishing to oblige him all I can, and more still to win him over if possible to my views, I am making inquiries on the subject and hope shortly to forward you the information he desires. G. SEPTIMUS HUGHES.

Manchester, September 12th.

ENGINEERING SCHOLARSHIP, UNIVERSITY COLLEGE, LONDON.—At the commencement of the coming session the Council of University College award—on examination—an entrance scholarship of £35 per annum, tenable for two years, to engineering students. The scholarship is the gift of the Gilchrist trustees, and the engineering laboratory and students are under the direction of Professor Alexander B. Kennedy. Intending candidates should communicate with the secretary of University College at once on the subject. There are also other entrance scholarships open to, but not restricted to, engineering students.

RAILWAY MATTERS.

ON the Berlin elevated railway Hartmann's wrought iron longitudinal sleeper permanent way is used. It weighs, without the tie rods, 264 lb. per yard.

THE pressures used in locomotives have gradually increased from about 60 lb. a generation ago, to 130 lb. and 140 lb., the present usual pressures; and now the Boston and Albany Railway Company is using 165 to 175 in the new engines on its line.

WHEN M. Olin succeeded M. Sainctelette as Minister of Public Works in Belgium, the direction of Ponts et Chaussées, and also of Mines, was transferred from this department to that of the Interior, thus leaving only railways, the post-office, and telegraphs under the control of the former.

THE near completion of the direct railway to Lichfield from Birmingham *vid* Sutton has necessitated the provision of a new city station at Lichfield. The selected site is not the most advantageous that might have been secured, yet the new station will be far more commodious than the present one, which it will adjoin.

LAST session of Parliament a Bill was presented to form a railway through Cannock Chase, but it was rejected. During the last week the inhabitants of the district have been holding meetings to urge the promoters to re-introduce the Bill, and promising it support. Certain of the promoters have expressed their belief that the request will be conceded.

THE Berlin overhead railway is worked with tank locomotives weighing, when full, 40 tons, of which 27·5 tons is on the driving wheels. They are designed to work with a pressure of 154 lb. The cylinders are 14·4in. by 23·2in., driving wheels 5ft. 3in., and two trailing wheels 41½in. in diameter. The total wheel base is 13ft. 1½in., the driving wheel base being 7ft. 4in. The heating surface is about 712 square feet.

A CORRESPONDENT writing to the *Times* on the St. Gothard route says that in the five tunnels, which make a complete turn of a spiral, and are difficult to ventilate, "the smoke of the abominable fuel used in the locomotives is unimaginable. The great tunnel, on the contrary, is well ventilated, and the windows of the carriages may and should be kept open during the whole passage, especially as no orders exist forbidding smoking in the carriages. I insisted on opening my window, in spite of the conductor, and enjoyed fresh air all the way through."

A NATIONAL exhibition of models of improved railway wagon couplings, appliances, &c., is to be held at the Drill Hall, Darlington, on Tuesday, October 3rd, 1882, and four following days. Inventors of improved railway couplings, or of coupling appliances designed with a view to promote greater safety, are respectfully invited to co-operate with the society by sending working models of their inventions to the exhibition. The exhibition offers a specially favourable and inexpensive opportunity to inventors of bringing their designs to the notice of the railway companies, the inspecting officers of the Board of Trade, the officers and men in the employ of railway companies, and the public. Mr. F. W. Evans, 306, City-road, London, is the general secretary, and the office of the local committee is at the Mechanics' Institution, Darlington.

ACCORDING to Herr von Schultz, who has recently made a report on a survey made by order of General Struve, along the proposed south-eastward, or Central Asian Railway extension of the Orenburg Railway, the best line is by way of the valley of the Ilek, across the southern part of the Mugodjar Hills to Tetse-bash Bay, on the north-western shores of Lake Aral. Another party, at the same time, starting from Kara-Turgai and Kazalensk, and working across the Kara-Kum desert to the north-west, examined the country east of the Great Barsuk sands; but this was found far less favourable than the Tetse-bash line, which is better populated, has more water, and a better supply of materials requisite for the construction of a railway; it is only 480 miles in length, terminating at Tetse-bash Bay, which makes a good harbour, while from the Sea of Aral the rivers Oxus and Jaxartes are navigable for the distance of 1600 and 1300 miles respectively.

IT appears that the St. Gothard Railway Company have obtained the sanction of the Swiss Government to laying a second line of rails in the tunnel. This shows that anticipations as to the success of the new route were fully warranted. The opening of the tunnel has certainly exerted a marked influence on the Great Eastern Company's continental traffic, for, in addition to the daily service to Antwerp as well as Rotterdam, they have been obliged to put an extra cargo boat on each of these stations. Moreover, finding a block of goods imminent, they have decided to open the new quay at Parkeston before the time originally contemplated; and steamers have already discharged and loaded there. Three vessels can even now be accommodated; and five miles of siding are already open. The booking office, waiting, and first and second-class refreshment rooms are also in such a forward state that it is expected the passenger traffic will soon be transferred to these more commodious quarters. If the company could only infuse a little of its own enterprise into the Dutch Government, so as to get the navigation of the Scheldt and Maas improved, an appreciable amount of time might be saved in their through route from London or Doncaster to the Continent.

"A CAPITAL of about eight millions would suffice to construct the Euphrates Valley Railway, including, the *Nautical Gazette* thinks, stations and plant, and upon this sum dividend earning should not be impossible. In the worst case a guarantee of 4 per cent. interest would only cost Government the inconsiderable sum of £320,000 per annum, compared with which the political advantages to be obtained are immeasurably more consequential; indeed cannot be weighed in the same balance. Besides which, the saving of seven days in the passage to India would enable Government to effect several economies in administration, and in all probability to more than save the actual outlay. About the strategic advantage of a quick alternative route which would make us to some extent independent of the Canal there can be no two questions. It would enable us to govern Indian twice as efficiently and ten times more safely than at present, while it would do more than anything else to secure the peace of Europe. Egypt and the Suez Canal would then lose much of their political significance, and it might be possible for continental nations—then no longer jealous of England—to come to look upon the Canal in the light of a commercial water way only." All do not think with the *Nautical Gazette*.

A CORRESPONDENT writing to the *Times* on the losses of life and property resulting from recent cases of broken draw-bars, says:—"The cause is not far to seek; it certainly is that the wagon companies do not now put side chains to the wagons, as they formerly used to do. A draw-bar breaks, and, of course, pulls out; the end sticks in the ground, lifts the next carriage up and off the rails, and a number follow; and should a train be passing in the opposite direction, the consequence is a fearful loss of, perhaps, both life and property. Let any person watch the starting of a train of, say, thirty wagons, of about ten tons each, which will happen, possibly, twenty times between London and Birmingham, and see the fearful strain put upon each draw-bar as the train is put in motion—jerk, jerk, jerk—and the wonder is that broken draw-bars are not many times more numerous than they are. When side chains are fitted to each wagon, and they are properly linked, if a draw-bar breaks the side chains catch the strain, and prevent the draw-bar from falling out, and by its falling upsetting the train or any part of it. The four chains to each truck would not weigh more than about 56 lb. Side chains would have prevented the two recent accidents, and the far more terrible one at Holloway a short time ago." It will be seen that this correspondent is not aware that side chains have rarely been known to be of any service when a draw-bar breaks, as, when that takes place, the side chains break too. Stronger side chains with a volute spring at their backs might, however, be of value.

NOTES AND MEMORANDA.

THE total population of France numbers 37,672,000, against 36,905,000 in 1876. There has thus been an increase of 767,000 in the course of the five years intervening between the two censuses. Between 1872 and 1876 the increase amounted to 802,000; from 1861 to 1866, to 684,000; from 1856 to 1861, to 1,342,000; and from 1851 to 1856, to 256,000.

THE American Senate passed, July 28th, the joint resolution, introduced by Mr. Fowler, authorising the President to invite delegates from all nations to meet with American delegates in Washington for the purpose of fixing upon a meridian proper to be employed as a common zero of longitude and standard of time-reckoning throughout the world.

SEVERAL Belgian firms prepare an ornamental paper, which, at the first sight, cannot be distinguished from satin. The method of production consists in covering common paper with an adhesive size, and asbestos, dyed to the shade required, is sprinkled upon the moist surface. Asbestos takes up all colours, especially the anilines, very readily. The superfluous matter, when dry, is easily taken off.

THE following method has been suggested for coating metal surfaces with glass, which may be found to answer various purposes:—Take about 125 parts—by weight—of ordinary flint glass fragments, twenty parts of carbonate of soda, and twelve parts of boracic acid, and melt. Pour the fused mass out on some cold surface, as of stone or metal, and pulverise when cooled off. Make a mixture of this powder with silicate of soda—water glass—of 50 deg. B. With this coat the metal to be glazed, and heat in a muffle or other furnace until it has fused. This coating is said to adhere very firmly to steel or iron.

AT a recent scientific meeting in San Francisco announcement was made of the discovery in Southern Oregon of a large deposit of nickel ore, resembling that discovered in New Caledonia in 1864, the development of which by the French has so greatly extended the economical use of this metal. The New Caledonia minerals are known as garnierite and noumeite, both hydrated silicates of nickel and magnesia, occurring with chrome iron, steatite, and other minerals found only in serpentine. There are, likewise, two of the Oregon minerals, one dark, the other pale apple green, like those of New Caledonia, and closely corresponding with them in hardness and specific gravity.

THOSE who devised thermometer scales have certainly not been prophets in their own country. While the English and Americans adopt the system of Fahrenheit, a German, the Germans, Austrians, and Russians favour that of Réaumur, a Frenchman. The French know no other scale than the centigrade devised by Celsius, a Swede; and, to complete the chain, the Swedes use that of Leslie, an Englishman, or rather a Scotchman. The adoption of these various scales is the cause of much trouble, which is, perhaps, most relieved by remembering that 1 deg. Fahrenheit is equivalent to 0·55 deg. Centigrade or 0·44 deg. Réaumur; 1 deg. Centigrade to 1·8 deg. Fahrenheit or 0·8 deg. Réaumur; and 1 deg. Réaumur to 2·25 deg. Fahrenheit or 1·25 deg. Centigrade; although the usual method adopted to bring Fahrenheit degrees to Centigrade, is to subtract 32 and multiply by $\frac{5}{9}$; and to bring Fahrenheit to Réaumur, subtract 32 and multiply by $\frac{4}{9}$. To convert Centigrade degrees to Fahrenheit's, multiply by $\frac{9}{5}$, and to Réaumur's by $\frac{4}{5}$, adding 32 in both cases.

THE unsanitary condition of certain towns in the United States has drawn attention to the fact that wooden houses, and especially wooden foundations, are liable after a certain time to cause malarious symptoms. So many malarious attacks have been experienced of late years in San Francisco that the medical men began to suspect the buildings, especially as the structures themselves, which are nearly all built on wooden foundations, began to show disturbances, cracks appearing in the walls and the floors settling. Scientific investigation into the causes of these troubles points to the fact that the wood used in the foundations becomes decayed by contact with the sand, which destroys its fibre and leaves it porous and brittle. The next stage in the process is the formation of a fungus growth from the edge of the wood, composed of infinitesimal insect life, which burrows the remaining wood until its vitality is gone, and the insect itself dies. Physicians attribute many of the unpleasant smells and the bad health that hang about the inhabitants of these dwellings to this malarial condition, which to a great extent disappears as soon as proper foundations are substituted for those of wood. There are doubtless many old houses in this country which, without being actually dangerous to health, have constantly hanging about them a damp odour of decay giving rise to *malaise*, and it is most probable that the woodwork will in many cases be found to be permeated by insect life.

THE International Postal Bureau at Berne has lately issued a statistical report concerning the operations of the International Postal Union in the year 1879. It deals only with the postal intercommunication of the twenty-five chief countries belonging to the Union. The figures are colossal, and we know that they have much increased during the two years and a-half which have passed since. The total number of letters, &c., carried amounted in round numbers to 8280 millions, of which 4900 millions were letters and post-cards, being about an average of 13½ millions daily. The other objects carried included newspapers and other printed matter, patterns, &c. Europe, the smallest quarter of the globe, was credited with 5624 millions of postal objects; America comes next with 2366 millions; Asia had 205 millions; Australia 73 millions; and Africa is last with 12 millions. Reckoning the total population of the earth at 1400 millions, these figures would give an average of 5·9 postages per head, of which 3·5 would be letters and post-cards, and 2·4 printed matter, &c. England is set down for 1587 million postages; Germany is next with 1200 millions. But in the matter of post-cards, Germany comes first with 123 millions, while England had only 114 millions. The average postages of letters and post-cards per head of population give 36·3 for England, 23·2 for Switzerland, 16·8 for the Low Countries, and 15·9 for Germany. It is not surprising to find that the lowest grades in the scale of postal communication are occupied by Servia, Turkey, and Bulgaria.

SOME interesting experiments have recently been made in connection with radiant heat by Professor S. P. Langley, of the Alleghany Observatory. He finds as one of the results of these experiments carried on at Mount Whitney that the true solar constant, or amount of heat sent to the earth, is one-half greater than that determinated by Pouillet and by Herschel near the sea-level, and even greater than the latest values assigned by M. Violle. But the temperature of space, on the other hand, is lower than that assigned by Pouillet. If the atmosphere of the earth were withdrawn the temperature of the latter would greatly fall even though the sun's radiant heat were materially greater than it is. Mr. Langley believes that this temperature under such circumstances would be 50 deg. Fah.—that is, that mercury would remain a solid under the vertical rays of a tropical sun if radiation into space were wholly unchecked, or even if, the atmosphere existing, it let radiations of all wave-lengths pass out as easily as they come in. It is not merely by the absorption of the air but by the selective quality of this absorption that the actual surface temperature of the earth is maintained. Without this comparatively little known function, it appears doubtful whether, even though the air supported respiration and combustion as now, life could be maintained on this planet. The temperature of a planet, consequently, probably depends far less on its neighbourhood to or remoteness from the sun than upon the constitution of its gaseous envelope, and it is perhaps not too much to say that we could approximately indicate already the constitution of an atmosphere which could make Mercury a colder planet than the earth, or Neptune as warm and habitable a one.

MISCELLANEA.

THE value of the steam engines exported last month was £310,286, and in the eight months of the year £2,372,549 against £2,187,565 in the corresponding period of last year.

THE September number of "Art and Letters" completes the first volume. It contains, as usual, some excellent wood engravings, accompanied by interesting, descriptive, and historic letterpress.

THE Post-office authorities intend to make Euston-square a principal centre not only for the arrival and despatch of parcels under the new regulations, but for the ordinary letter service. For this purpose a spacious new building will be erected close to the London and North-Western Railway Station, from which all parcels and letters arriving by that route will be sent after assortment to the various postal districts of the metropolis.

THERE is now working in Pittsburg what the *American Manufacturer* says is the greatest rock and ore crusher on earth. The stone it is working on is almost as hard as flint, it being the Ligonier stone. It is said it will break a ton of this stone in a minute. There are five sizes of this machine, the largest of which will reduce to road metal size from 30 to 50 tons per hour. The machine at work in this city is well worth going to see.

THE laying of cast iron pipes underground for the telegraph cable between Paris and Marseilles is rapidly progressing from both ends along the right bank of the Rhone, and following the main roads, the pipes being placed at a depth of about 5ft., with large cast iron chambers for facilitating repairs at about every 1600ft. At every 328ft. the pipes are united by cast iron couplings, which will also permit of inspecting and repairing the cable.

IT is stated that some further experiments by the Naval Explosives Committee have been carried out at Chatham, to see if any conclusion can be arrived at as to the explosion which caused the loss of the Doterel. Some xerotine siccative and a can of gunpowder were put on board the gunboat Bullfinch, and the former was exploded. It set fire to the ship, but did not explode the powder. The committee are of opinion that the Doterel disaster was not caused by siccative exploding.

A NEW steam engine has been recently patented in Austria by Professor Wellner of Brünn. The so-called "steam wheel"—according to the account in the *Polytechnischer Journal*—consists of a simple water wheel, mostly immersed in hot water in a closed vessel. Steam is admitted at the lower part, and forces the cells of the wheel upward, producing rotation. The steam fills more and more of the cells on the rising side, and at length begins to escape into the steam space above the water.

A SUGGESTION which will probably meet with general support was recently made by a correspondent in the *Pall Mall Gazette*. He says:—"The objectionable term *scientist* may easily be replaced by a better, after the example of the Italians. Men addicted to the pursuits of science are called in Italian *scienziati*—scientiates—just as one who has obtained a licence is termed a licentiate, or one endowed with potency a potentate. In like manner the studies of science are denominated *studj scienziali*—sciential studies—which is in reality more accurate than to call them scientific, and in conformity with our adjectives essential, potential, &c. Our language might thus be enriched in its element of Latin origin from the eldest daughter of the Latin, instead of being degraded by a baseborn bantling such as that so justly repudiated."

PRIZES of £100, £50, and £25 are offered by the Committee of the Great International Fisheries Exhibition, London, 1883, for essays, amongst other things: "On improved facilities for the capture, ecomonic transmission and distribution of sea fishes," including information on "Improved nets and modes of catching salt-water fish, the application of steam to deep-sea fisheries, the advantages of steam carriers, greater facilities to be given by railway companies in regard to rates, refrigerating vans, new and improved fish markets, cold storing rooms for ditto;" also "On improved fishery harbour accommodation for Great Britain and Ireland, indicating the localities most in need of such harbours, the general principles on which they should be constructed, and the policy the State should adopt in aiding and encouraging harbour accommodation for fishing purposes;" and on "The best appliances and method of breaking the force of the sea at the entrance to harbours and elsewhere."

THE first experiment of lighting sections of New York with Edison's incandescent electric lamps was made successfully on Monday evening, the 14th inst. Eighteen miles of wire in pipes have been laid by the company and 16,000 lamps placed in stores and offices. The work has been completed in about a third of this section, and 5000 lamps along six miles of wire were burning on Monday night, the circuit including the *Times* and *Herald* buildings and some large offices. In all of these the light was soft, perfectly steady, and seemed more evenly distributed than from gas burners, while it gave out only a fifteenth of the heat of gas. The cost, the correspondent of a daily contemporary telegraphs, will be a trifle less. The lamp circuits have a porcelain shade over an air-tight pear-shaped ground-glass globe 4in. in diameter, in which is a carbon horseshoe. All the subscribers express satisfaction with the experiment. Lights half-a-mile from the supply station burned as brightly as those in the station. When the work in the section is completed 22,000 lamps will be supplied from one station.

THE new steel plant of the South Chicago Steel Works, now in operation, consists of four blast furnaces, producing 6000 tons of iron per week, which is not run into pigs, but taken in ten and twelve ton ladles directly to the three 10-ton converters. The steel from the converters is cast in 1-ton ingots, which are carried directly to the four Siemens gas furnaces, and from them, after heating, to the three-high blooming train, where they run through and back, making eleven passes in less than one and a-half minutes. From the last roughing pass the bloom is carried on rollers directly to the rail mill, where in seven passes it is reduced to a rail 90ft. long, and delivered in front of the saws which cut it into three 30ft. rails. From the furnace till the rails are put on the platform of the drilling machine requires less than three minutes. Working to full capacity, it is said 40 tons of ingots and 120 tons of rails an hour can be turned out. The advantages of this plant are summarised as follows:—(1) The entire saving of the expense of the casting and melting of the pig iron. (2) The saving of the cutting of the bloom and reheating and handling of the billets. (3) The saving of the roughing train and of the time and labour of the difference between rolling one and a three length rail. (4) The saving of four crop ends to each three rails.

A REPORT on the coal-fields of Klip River, Weenan, Umvoti, and Victoria counties, by Mr. Frederic W. North, Natal, has lately been published. In concluding his report Mr. North draws special attention to the fact that coal exists in Klip River county, that there are several qualities, and that the workable seams vary from 4ft. to 10ft. in thickness. That both analysis and experiment have now proved that the coal may be used with economy in the locomotive. Some of the most free-burning will make gas; most of it, if properly mined, will make good house coal, and some of it is specially adapted for general steam purposes. That the area of the coal-field available for working is 1350 square miles. That this area assuming an average thickness of 4ft., and allowing the ample deduction of 50 per cent. for faults, worthless coal, and barren grounds contains 2,073,000,000 tons. That a large proportion of these coal deposits are either in Crown lands or upon farms, the land of which has been disposed of, but the right to work reserved to the Government. Railway communication is required for its development; and finally, in the hope of finding workable coals in either of the counties, he advises that a series of deep borings should be systematically made by the Government, first at a point near the mouth of the Umblanga river, and that the next should be immediately beneath the cliff, at Morewood's Cove.

KAMPANG KERBAU BRIDGE, SINGAPORE

MR. THOMAS CARGILL, MEM. INST. C.E., SINGAPORE, ENGINEER.

(*For description see page 201.*)

FIG 13

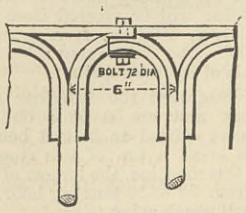
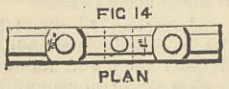


FIG 14

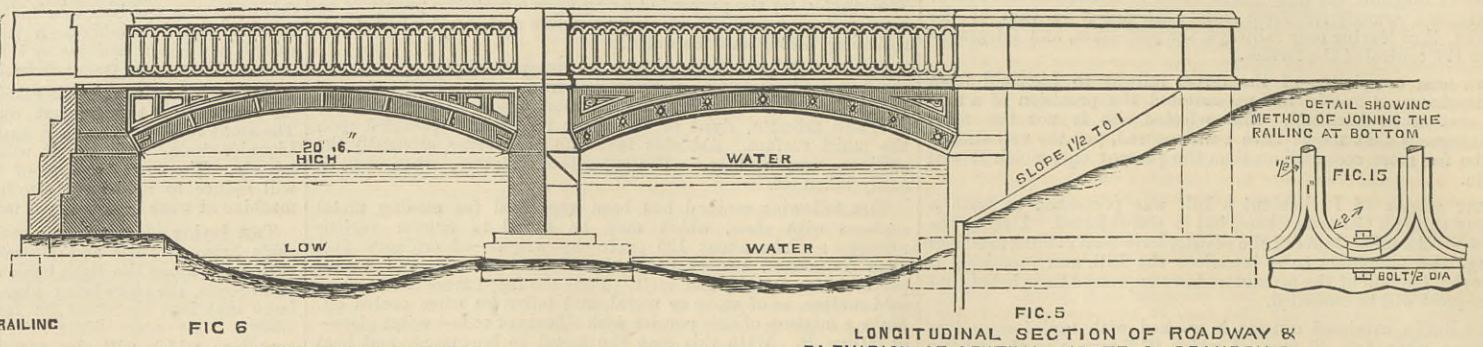


PLAN

DETAIL SHOWING METHOD OF JOINING THE RAILING AT TOP

FIG.3 LONGITUDINAL SECTION OF BRIDGE

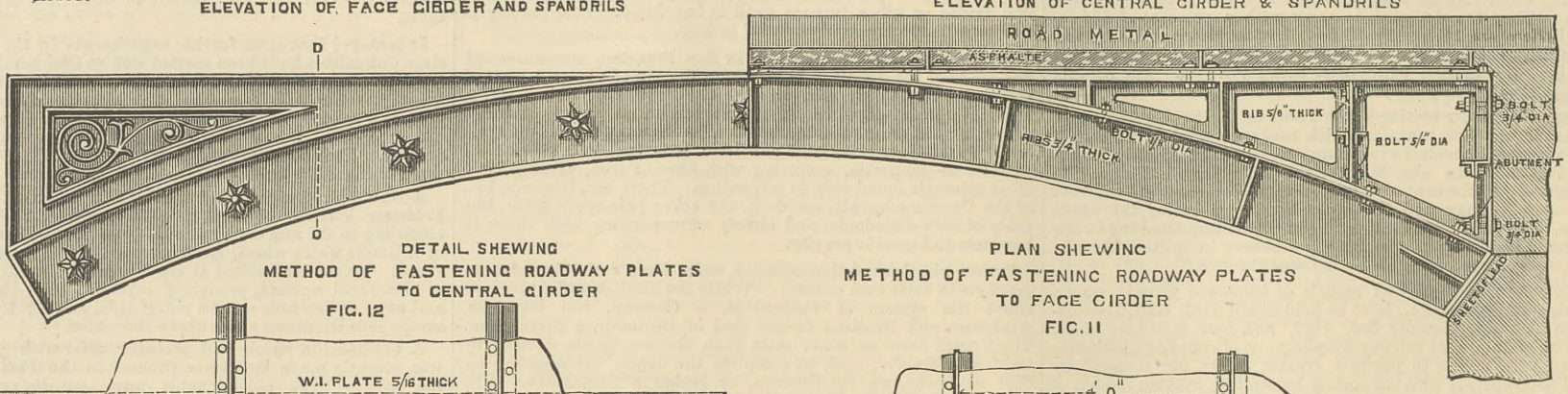
FIG 4 ELEVATION



DETAIL SHOWING METHOD OF JOINING THE RAILING AT BOTTOM

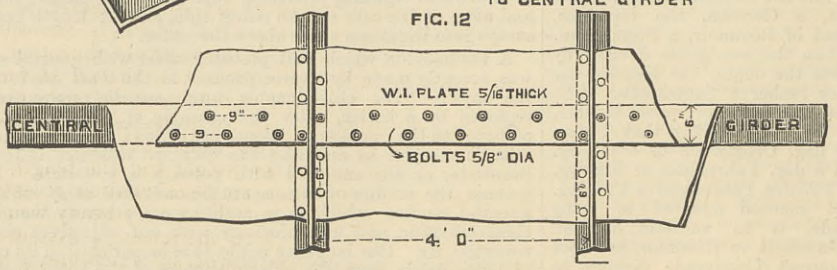
FIG 6 ELEVATION OF FACE GIRDER AND SPANDRILS

FIG.5 LONGITUDINAL SECTION OF ROADWAY & ELEVATION OF CENTRAL GIRDER & SPANDRILS



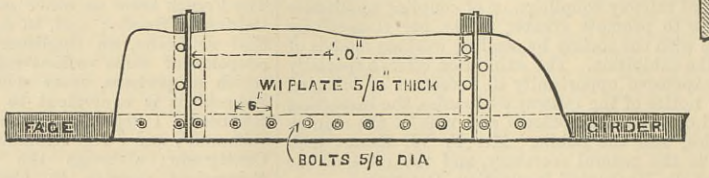
DETAIL SHEWING METHOD OF FASTENING ROADWAY PLATES TO CENTRAL GIRDER

FIG. 12



PLAN SHEWING METHOD OF FASTENING ROADWAY PLATES TO FACE GIRDER

FIG. 11



DETAIL OF ANGLE IRON BRACING CENTRAL SPANDRILS

DETAIL OF ANGLE IRON BRACING FACE SPANDRILS

CROSS SECTION OF PLINTH AND RAILING

ELEVATION OF PLINTH & RAILING OUTSIDE

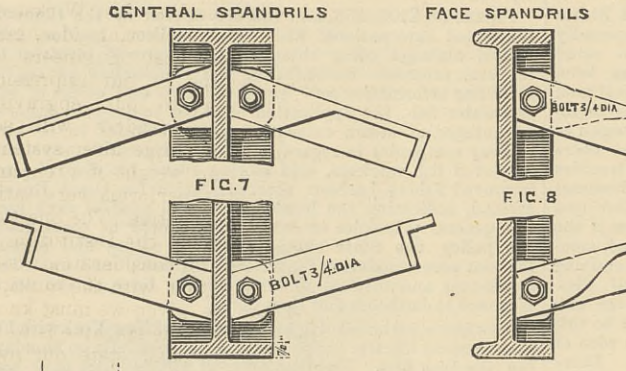


FIG.7 FIG.8

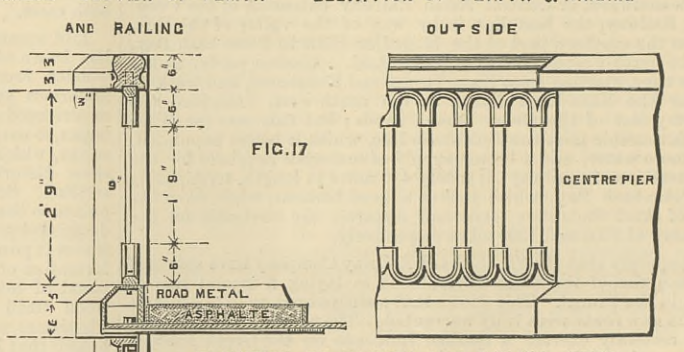
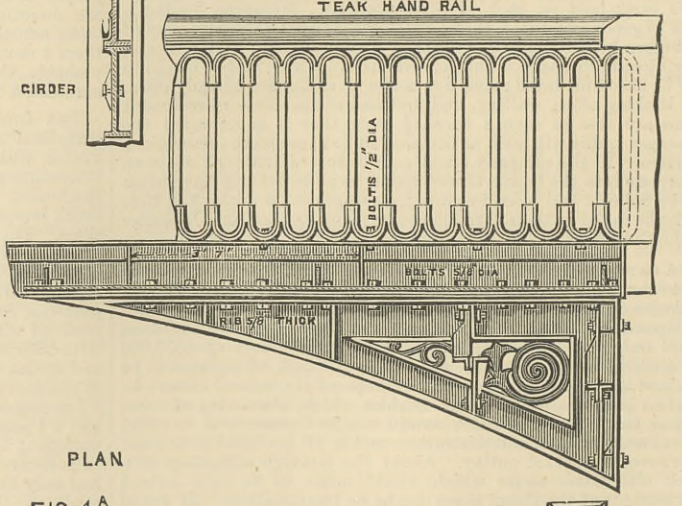


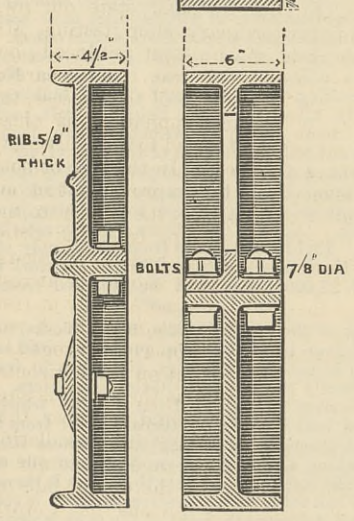
FIG.17

ELEVATION OF PLINTH AND RAILING INSIDE

FIG.16

TEAK HAND RAIL





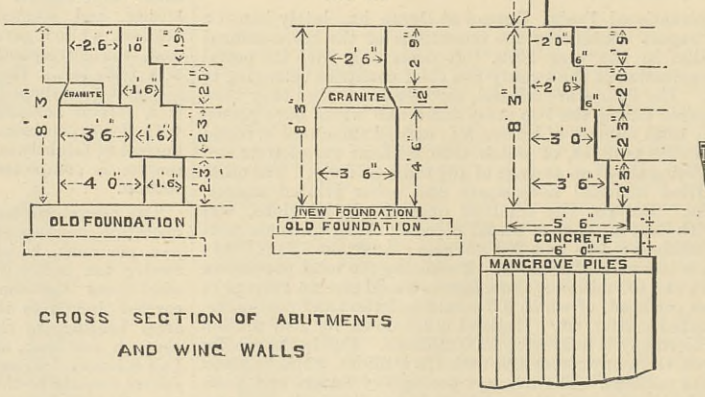
SECTION THRO. C.D FIG. 9

SECTION THRO AB FIG. 10

FIG. 18

FIG 19

FIG 20



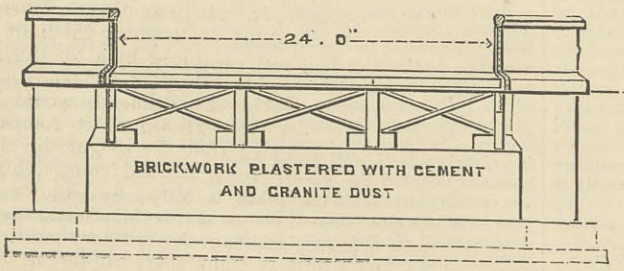
CROSS SECTION OF ABUTMENTS AND WING WALLS

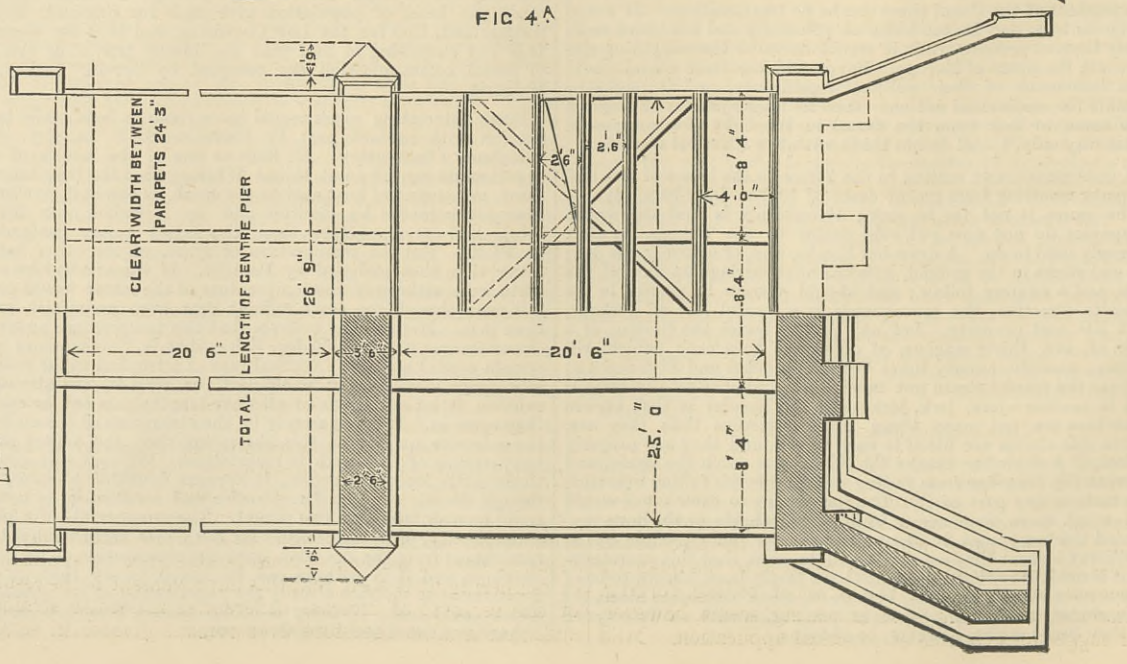
PLAN

FIG 4A

FIG. 4.B

CROSS SECTION





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TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a* 1d. *postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

*** *We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.*

*** *All letters intended for insertion in* THE ENGINEER, *or containing questions, must be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever will be taken of anonymous communications.*

R. R. (Newton, N.B.)—*The furnaces as employed at the works you mention have not been described in our columns.*

COMPRESSED PAPER (R. V.).—*A letter has been sent to the address given by you and returned. Send addressed and stamped envelope.*

PERPETUAL MOTION.—*A work on this subject by the late Mr. Dirks was published about twenty-five years ago. You can probably obtain it through any bookseller.*

ERRATA.—*In the paper by Sir W. G. Armstrong which we published last week at page* 181, "*On the Treatment of Steel*," *the following errata occur:—In column* 1, *line* 2 *from bottom, for* 34 *per cent. read* ·34 *per cent. In col.* 2, *line* 35 *from top, the word "when" should take the place of the semicolon. In the second paragraph of col.* 2, *line* 26, *for* $\frac{2}{100}$ *read* $\frac{1}{100}$.

GOLD REEF CRUSHING MACHINERY.

(*To the Editor of The Engineer.*)

SIR,—Can any of your correspondents give me the name and address of a good maker of gold reef crushing machinery? GOLD.
London, September 13th.

ABEL'S CEMENT.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers give me the name and address of the maker of Abel's composition for coating canvas for making it waterproof?
Newport, September 8th. G. T. E.

MACHINE FOR CORRUGATING HARD STEEL SHEETS.

(*To the Editor of The Engineer.*)

SIR,—Can any of your correspondents inform me where I can get a machine to corrugate hard steel sheets of about $\frac{1}{16}$in. thick in ridges of $\frac{1}{2}$in. pitch? G. S.
Manchester, September 11th.

ENGINEERS IN AMERICA.

(*To the Editor of The Engineer.*)

SIR,—I shall be much obliged if any of your readers can inform me what prospects there are for surveyors in America, the best time of year to go over, and the most likely locality in which to obtain employment?
Cockermouth, August 31st. S. R. S.

FINISHING CASTINGS.

(*To the Editor of The Engineer.*)

SIR,—I have been trying for some considerable time to obtain the smooth blue finish on light castings, such as is produced by the large Scotch foundries, but have been unsuccessful hitherto. If any reader can give me any suggestion, or refer me to any good book on the subject, I should feel greatly obliged. C. S.
September 12th.

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Advertisements cannot be Inserted unless Delivered before Six o'clock on Thursday Evening in each Week.

*** *Letters relating to Advertisements and the Publishing Department of the paper are to be addressed to the Publisher, Mr. George Leopold Riche; all other letters to be addressed to the Editor of* THE ENGINEER, 163, *Strand.*

THE ENGINEER.

SEPTEMBER 15, 1882.

THE STRENGTH OF STEEL.

THE paper read before the British Association at Southampton by Sir W. G. Armstrong, on the treatment of steel for the construction of ordnance and other purposes, which we gave at length in our last impression, contains a number of experimental observations of high importance and instructive value. The first part of the paper, which deals with the behaviour of steel at a welding temperature, opens up a field of useful experimental inquiry for those engaged in the metallurgy of mild steel and its structural employment, though the information yet obtained is not sufficient to permit of immediate practical deductions. That part of the paper which deals with the mechanical properties of steel considered with relation to the quantity of carbon in the steel, and the effect of rolling, forging, wire drawing, tempering, and annealing, seems, however, to offer suggestions capable of practical application. Mild steel appears to be more susceptible to improvement in its mechanical properties by mechanical manipulation than any other metal. The improvement is not confined to its elastic and ultimate strength, but its range of extension and ductility are improved when the steel is also tempered, and to some extent when only annealed. This is not only noticeable in wire, but in larger sections, such as may be employed under certain methods of construction for ordnance. As far as the experiments have gone, it appears that the improvement of the elastic and ultimate strengths, by tempering in oil, is greater with steel containing the larger proportions of carbon, though its extensile range is lessened, as in one case from 23 to 16 per cent., a result which might have been qualitatively predicated from previously existing information, though this range is much greater than might have been expected in a material so markedly improved in elastic and total strength. Not the least important of the experiments described by Sir W. G. Armstrong was that which showed how enormously steel castings may be improved by tempering in oil. Some test pieces taken from a trunnion of cast steel containing 0·36 per cent. of carbon, showed an elastic strength or limit of 16 tons, total strength of 27·8 tons, and extension of 7·5 per cent., while similar pieces after tempering gave elastic strength, 25 tons; total strength, 37·7 tons; and extension, 12·5 per cent. The improvement was thus very remarkable under all heads. It is not stated whether the tempering consisted in simply cooling the steel in oil, or whether the pieces were "let down" after this cooling; neither are we informed as to the length of the test pieces, which has an important effect on the range of extension, but in any case the improvement is so great as to make the difference in extension in pieces from, say, 4in. to 8in. in length, trivial in comparison, and the cost of tempering, even if carried out in the usual way, much less than the increased value. The increase of ductility, or rather the toughness, is much greater when obtained by tempering than when obtained by increase in the proportion of carbon, so that mild steel castings may even now be employed in some cases with advantage, as compared with forgings having a higher percentage of carbon, while the advantage would be wholly on the side of castings if greater freedom from air bubbles could be obtained.

The improvement in steel by stretching has for some time occupied attention, and although the knowledge of the fact has hitherto led to no practical application, it led Sir W. Armstrong to make some experiments on the improvement in the strength of wire by what he describes as tempering, during the process of manufacture, the highest strength being obtained when the tempering is thus resorted to, and the wire passed through a die as the final operation. By making the passage through the die the last operation, however, the range of ductile extension is diminished, and the wire is more liable to fracture if the surface is slightly injured. For most purposes, therefore, it becomes necessary to make the tempering the last process, though this slightly reduces its ultimate strength; but Sir W. Armstrong finds that by judicious annealing the elastic strength of the wire may be greatly increased, and he mentions a case in which wire 0·2in. diameter was thus increased in elastic strength from 25 to 35 tons per square inch. This is certainly an unexpected result, and needs confirmation, not because there need be any doubt as to the accuracy of this experiment, but because if the fact pertains to mild steel generally, it is of the highest importance. He also refers to the value of the tempering in oil, for ordnance purposes, of long cylinders of steel, and to the fact that in bending wire over a cylinder, in order to give the cylinder strength, it is impossible to give the same degree of stretch to both its sides—that is the outer circumference of each wire ring would be stretched more than the interior circumference, and, in fact, the difference may be such that the interior circumference may be either in a neutral condition as to strain, or may even be under compression. The thinner the wire the less this difference, and hence the suggestion that flat wire of a given sectional area could be used under better conditions than round or square wire of the same sectional area. From these remarks it would seem that the idea of constructing a wire gun is not given up, but that to carry it out in the best way, two things are required, namely, an interior cylinder or cylinders of great length relatively to diameter, rolled as are tires in a tire mill, so as to get longitudinal strength in the gun, and wire combining a high elastic limit and high ductile range, or, in other words, wire of great toughness. But even having this wire, it can only be employed under the best tensional conditions by expanding the cylinder on which it is wound after the winding is completed. The wire of the necessary toughness could, it would seem, be obtained, and in order that it could be wound on the cylinder under the best tensional conditions, or approximately the best, it may be suggested that the wire as it comes from the ordinary die should pass between the surface of a roller and a half die, thus placing that part of the wire which rubs under the die in a state of compression, and the inner side, or that which runs over the roller, in a corresponding state of tension. This would cause the wire to coil up with the compressed surface outwards, but this would not be a manipulative objection, while the great advantage would be that when the wire was tightly wound on the gun cylinder the final tension might be made sensibly the same on both sides of the wire. The difficulties which present themselves in rolling a long cylinder of small diameter are, however, much greater, and although a possible method might be suggested, this may, perhaps, be best left to steel makers and rolling mill engineers.

Sir W. Armstrong's experiments, like others which have preceded them, indicate that whenever comparatively large masses of steel are cut up into smaller pieces, the latter exhibit greater strength and generally improved mechanical properties, and although some improvement may be made in steel in sections of considerable area by annealing or tempering, it is clear that this improvement is the result of the removal of internal differential molecular strains, and that it must therefore ever remain greater in small than in large sections. The similarity of the improvement in mild steel by careful annealing and by tempering, further indicates that much of that resulting from tempering in oil is due to annealing and consequent removal of internal strains, while the increased strength is probably due to the somewhat hardened exterior, or to the high state of compression under which the outer part of the thickness of the mass is placed, which probably enables the inner portions to come better into play when the mass or piece is submitted to a tensile strain.

TESTING MACHINES.

MR. DAVID KIRCALDY was the first to reduce the practice of testing iron and steel to a science. Before the publication of his book, which may almost deserve to be termed immortal, a good deal of iron and a little steel had been tested; but the lessons taught by the simple appliances used were not well understood; nor was much importance paid to the co-efficients of extension, elastic limits, and contraction areas—things hardly ever heard of twenty years ago. We have no intention of recording here at length what Mr. Kircaldy has done in the way of acquiring and imparting information. Any mention of testing machines which left his name out would be so far unfair, and for this reason we express our opinion here concerning Mr. Kircaldy's work. He also, it may be said, was the first to produce a really trustworthy and competent testing machine, and this we say without forgetting the machines in use at Woolwich Arsenal and elsewhere; but none of these was able to deal with large masses of metal. The introduction of steel and the uncertainty which existed concerning its quality, quickly led to the multiplication of testing machines, for sufficiently obvious reasons; and there are now few steel works of any importance which do not possess apparatus for ascertaining, at all events the tensile strength of bars and plates. Almost without exception all these machines have been modelled on much the same principle as Mr. Kircaldy's machine; that is to say, the specimen to be tested is secured in two jaws, one of which is connected with the head of a hydraulic press, while the other is secured to the short end of a lever. By the aid of force pumps the plunger of the hydraulic press is pushed out and puts a tensile strain on the bar to be tested, which is resisted by a weight on the long arm of the lever above mentioned. The amount of the weight and the length of the lever arms being known, a simple calculation gives the strain on the specimen. Inasmuch as very heavy weight would be required to test large specimens, a system of compound levers is usually employed, by which means the dead weight is reduced in amount and the machine made in one sense handier.

Our readers will not have forgotten that Mr. Wicksteed read a paper "On a New Form of Testing Machine" before the Institution of Mechanical Engineers at Leeds. We illustrated this machine in our impression for August 18th. By referring to our engraving and Mr. Wicksteed's paper, our readers will see the inventor has abandoned the multiple lever system; and that he uses instead one moving weight of a ton, and a single lever. That this machine performs very satisfactorily we know from personal observation. The question was raised during the Leeds meeting of the Institution of Mechanical Engineers, and remains for consideration, is or is not such a machine better than that with the multiple levers? Before any answer can be given we must know what are the conditions under which the machine is to be worked. Before going further we shall state our own views, which are that for ordinary shop testing, Mr. Wicksteed's is about the best machine yet produced; but that for tests requiring minute accuracy and a careful observation and recording of every step of the process, the multiple machine fitted with such appliances as those devised by Professor Kennedy, and added to the University College testing machine, is the best. In the case of both machines there is, however, room for improvement in one point, namely, the mode of applying the strain to the specimen tested. It will, we believe, be freely admitted that if a testing machine is intended to register the strain applied by a static load, that the load should be at rest. But in practical testing the load is not necessarily at rest. If, for example, we take Mr. Wicksteed's machine, it will be found that when matters are properly arranged, a skilful man can run out the low weight on the horizontal bar of the lever at just the same rate as the strain is augmented by the pumps. It will be found, however, that nothing he can do will prevent the weight from oscillating upwards and downwards through a range of a couple of inches, or even more. Now every time the weight falls an inch during such an oscillation it is obvious that a work equal to an inch ton must be done on the specimen. It may be said that this is quite unimportant. Is it? Let us suppose that the whole strain on the specimen, which is 2in. broad and $\frac{1}{2}$in. thick, is 20 tons. Then it is obvious that the distance through which the jaws gripping the sample move will be $\frac{1}{20}$in., and we shall have a strain equal to 20 tons moving through $\frac{1}{20}$in. on the bar. The work done on it will be equivalent to over 187 foot pounds of work done on the bar. It may be said that this is insignificant. So it is in one sense, but not in another. When a bar for example, is on the point of touching the limit of elasticity, the stored-up energy acquired by a ton during a fall of but 1in. may exert an important influence, and it is not too much to say that this influence would be great enough to make a sample exposed to it compare unfavourably with one so tested that the weight did not move till the moment of rupture, or the sudden stretching of the metal, which takes place in a way well-known to all practical testers. Now, let us ask, is Mr. Wicksteed's machine worse in this respect than the ordinary multiple lever testing machine? and we think there can be but one answer. It is not worse, or if it is, the defect admits of being readily overcome. No matter how we reduce the weights on the levers, the actual strain on the specimen must be the same. Consequently, reduction of weight means augmentation in the virtual length of the lever. Thus, instead of a ton moving through 1in., we may have

in practice one-tenth of a ton moving through 10in. But, the extreme strain brought to bear on the specimen in the latter case may be greater than in that which we have just considered, for the energy stored in a moving body varies as the square of its velocity. In other words, the power possessed by the weight in a testing machine of jerking the specimen—we cannot think of a better word—is expressed by the formula $\frac{W}{2g} v^2$. Now, a weight of one ton in falling less than 1in. will acquire a velocity of 2ft. per second, and its energy will be represented by $\frac{2240 \times 4}{64{\cdot}4} =$ 139 lb. But a weight of 224 lb. falling, let us say, through about 9in., will acquire a velocity of 7ft. per second, and its power of straining the specimen will be represented by $\frac{224 \times 49}{64{\cdot}4} = 170$ lb. Thus it will be seen that it by no means follows that because we use a very heavy instead of a very light testing weight that the sample will be spared shocks. Of course it may be said that it is always open to us to reduce the travel of the weight, or, in other words, of the lever which causes it. This is just as true of Mr. Wicksteed's machine as of any other. If the rise and fall of the weight in a multiple lever testing machine be reduced, say, to 1in., it is conceivable that Mr. Wicksteed could reduce the play of his levers to one-tenth of an inch. It is quite clear, however, that if we reduce the play of the weight in a multiple lever testing machine to something very small, the effect of extensions of the specimens may come to be hardly recorded at all, being lost, so to speak, in the unavoidable deflection of the levers, play of the knife edges, and so on. Thus, for example, a leverage of 1000 to one being used in a testing machine, it is obvious that a stretching of 0·001 of an inch in the bar would suffice to let the weight drop 1in., but it would not be easy to say whether this drop was due to the stretch of the bar or to some other cause. However this point may be argued on a theoretical basis, in practice, at all events, it is certain that the range of motion in the weighted lever unavoidably extends over some inches. We think we have said enough on this point to show that Mr. Wicksteed's machine will not lose by comparison with multiple lever machines.

Here we wish to explain that for ordinary sample testing we attach no importance whatever to the strains brought to bear on the specimen by the oscillation of the weight, it being of course understood that the tests are conducted with moderate care by a competent man. For what we may term the higher or more scientific class of tests, however, we believe that all such strains should be carefully eliminated, and for this purpose we would advocate the use either of a wedge or a screw under the point of the testing lever, which being withdrawn would permit the weight to be brought on the specimen for testing. In this way the first steps of the process would remain as they are now; but as soon as it was reasonable to suppose that the elastic limit was nearly reached the end of the lever would be caused to rest on the supporting wedge or screw, and the weight could be then moved out a certain distance. The wedge or screw could then be quietly withdrawn, and the sample could then be left to support the weight without being exposed to any jerking whatever. As tests are usually conducted the weight is run out on the lever pretty quickly, and the lever flies up and down between the stops. Extremely accurate testing cannot be done in this way. The use of the wedge or screw would greatly prolong the process of testing, and for this reason it is not advisable to adopt either in ordinary work, but only under circumstances when minute accuracy is demanded; but it is worth considering whether the adoption of a cataract, dashpot, or some similar expedient in all testing machines might not be desirable as a means of controlling oscillation, reducing jerks, and saving the knife edges of the machine from excessive wear and tear.

THE SIMPLON AND ST. GOTHARD RAILWAYS.

Although the rates charged by the St. Gothard Company are rather high, and the railway has been but a short time in operation, the traffic has far exceeded expectations, and it is clear that the loss which the French railways are already feeling will grow, as the management of the St. Gothard becomes more complete. Seeing the effect this line was likely to have on French railways and on France, M. de Freycinet instructed M. Amédée Marteau to prepare a report on the subject, and this report has been published. M. Marteau seems to look with little short of dismay on the loss which the new line will occasion France in various ways, especially if the French railways persist in their high tariffs and their disregard of the convenience and requirements of passengers and freighters. He seems to think, however, that the deficiency will be more upon the loss of passenger traffic than on merchandise, and says it will be a national misfortune if English travellers should discontinue to pass through France as they have done from time immemorial. He says, "he looks upon any combination likely to divert them from their wonted route as extremely prejudicial to French interests, moral and material. The English must not lose the habit of going through France and Paris. We must not let them travel by a road that takes them near Germany. That in this there is an interest more than commercial I need not point out." Having given various reasons for looking upon the diversion of the traffic to the St. Gothard route, M. Marteau recommends as a solution of the difficulty the proposal made by M. Noblemain, the manager of the Paris and Lyons Railway, and president of the St. Gothard Commission, namely, the tunnelling of the Simplon by the Swiss Western and the Paris and Lyons Companies in combination. This would connect Milan, the commercial capital of Italy, with Paris by the shortest of all routes, the distance being only 835 kilos., as compared with 942 by Mont Cenis, 935 by Mont Blanc, and 891 by the St. Gothard. Hence, a Mont Blanc line would only duplicate the Mont Cenis, while the Simplon line along Rhone Valley would enable France to compete with Germany for the through English traffic and the direct trade with Italy. Meanwhile, unless the French companies do more to meet the requirements of their foreign customers, the traffic both in passengers and in goods will rapidly turn over, as it has begun to do, to the St. Gothard line. The French goods tariffs are so high, and customs and other formalities such nuisances, that the increase in the small goods traffic through Basel and thence by German and Belgian lines to Ostend, and in heavy goods to Antwerp or Hamburg, is already very marked, and the extra business is especially beneficial to the Great Eastern Railway Company through its Harwich and Antwerp route. The French quick trains are still all first-class, and no return tickets are granted as on the German lines. The Simplon line will probably not be decided upon very quickly, and it will then occupy a long time in construction, so that there will be plenty of opportunities for the existing railway companies to improve their reputation and to learn the advantage of a liberal policy towards travellers.

THE FREIBURG RAILWAY ACCIDENT.

The fearful railway accident near Freiburg—Baden—is exciting public opinion in Germany to a great extent. The official figures about loss of llfe and injuries have been given at 56 killed and 104 injured. This accident, resulting from the train running off the line, stands almost alone as to its importance in railway history, and it is no matter of surprise that from all sides questions are put as to the cause of such an unheard-of disaster. Two theories prevail—first, according to the driver of the train, a telegraph pole was blown across the rails throwing the engine off, and second, that the road itself was damaged by the stormy rains of the day. The latter seems hardly possible, and the first suggestion seems the most credible. The German papers make a general complaint as to the lack of brake power on the train as having highly contributed to the extent of the calamity. The engine and tender went first off the rails, breaking up the permanent way and ballast, and thus checking the twenty-seven following vehicles, which were running without any brake power at all. This produced such a crushing action that the first few carriages were also pushed off the rails from the engine, thereby increasing the obstruction against which the rest of the train acted with an enormous momentum, which the middle carriages could not resist, and consequently were crushed to pieces by telescoping one into another. The rear carriages, as in most cases of that kind, exerted a strong pushing action, but remained comparatively unhurt. An accident of the same nature, but with quite different results, happened on the 25th August between Petersburg and Moscow, near Kilu Station, to an express train which was running at high speed. Either by a broken rail or some rotten sleepers the train ran off the rails. The engine and tender broke away from the carriages, and thereby the Westinghouse brake, with which the train was fitted, came at once automatically and with full force into play, arresting the carriages and withholding them from telescoping one into another. The train came to a stand in about 45 yards, nobody was killed, and only seven passengers and one guard were slightly hurt, and there is no doubt that in this case the automatic brakes saved a great deal of life and property. There has been lately in this country a somewhat similar accident on the Great Eastern Railway, where the engine of a train was thrown off the line at high speed, and where the train was stopped in about 100 yards by the quick and powerful acting of the same brake with which it was provided—as most trains on that line are—and there is no doubt that but for the energetic action of the brakes there would have been an enormous accident and many lives lost. The lesson to be drawn from these three accidents is instructive. The train at Freiburg was not provided with any powerful means of checking automatically and quickly the speed in case of danger, and the accident therefore had results far more fatal than if the train had been properly equipped.

THE COAL TRADE AND WAGES.

At the same time as the Miners' Conference was resolving that an early increase of wages should be sought for, an attempt to sell a colliery in one of the most ancient of our mining districts was taking place. It was the Longwitton Colliery, in Hartburn parish, and on the Rothbury railway, and it was offered by public auction as a current going concern. Attached to the colliery are limeworks and ganister quarries. The colliery royalty is over 486 acres, the limeworks over 100 acres, and the shaft of the colliery is 26 fathoms deep, well fitted; whilst a railway a mile and a-half long connects the colliery with the main line. When the lease was first granted the fixed annual rent was £200, and the royalty 8d. per ton on the coal; but in the period of depression the head-rent was reduced to £100, and the royalty to 4½d. per ton of coal. But though there was this moderate rental, the colliery, with its valuable adjuncts, remained unsold; it was started at £1000 and rose to £3800, and was then withdrawn—the reserve being £5750. At the same time there was being circulated the report of the Cardiff and Swansea Smokeless Steam Coal Company, which showed that during its recently closed year, with a production of over 200,000 tons of coal, there had been a loss of £4195. These two facts are telling comments on the state of the coal trade, and on the ability to grant a large general increase of wages. It is quite true that at this season of the year there is an increase in the consumption of that class of coals that in some of the coal-producing districts are sold at high prices—household coals; but there is a lessened exportation of the steam coals from Northumberland which are almost equally dear; and thus against the gain in the average price is to be set that of the loss. For years some of the coalowners have been accumulating losses by working, and now that they have some hope of an increase of price it is not to their gratification that they receive the news of a general notice for increased wages or a general strike. But it is forgotten that over a large area of the production of coal, sliding scale and other arrangements have been entered into which will prevent any notice even being general, so that the resolution of the miners is broken by the arrangements they have entered into and which they are bound to keep. There are indications of better trade and higher prices of coal; but it cannot be forced, and it would be only retarded by the suggested movement of the miners.

IS IT SCIENCE?

If the reports furnished by the daily papers of the doings at the sections of the present year's meeting of the British Association are correct, science can hardly be said to be advanced by some of them. In the *Times* for Tuesday, August 29th, is a report of the meeting of the Mathematical and Physical Science section, under the presidency of Lord Rayleigh, at which a paper was read by Professor Schwedofe on the origin of hail. He describes the fall of some enormous hailstones, and considers that they come from ultra-terrestrial regions—that they are of cosmical origin in short. Mr. S. P. Thompson, who translated this paper, and, on the strength of this, expressed his opinion, supported it as worthy of investigation, and endeavoured to trace a connection between hail storms and meteor showers; it is, however, quietly added in the *Times* report that Professor Herschell's replies were not reassuring. Sir Wm. Thomson, as well as Professor Herschell, was fortunately present, and he thought that the theory might be put forward as a joke, but it could not be accepted as a serious proposition. Later came Professor Schuster with a report of a committee on meteoric dust, and he appears to have confined himself to mentioning a paper by Tissandier, who, we believe, published the paper referred to in 1877. Then came Captain Abney, who read a paper on the light of the sky at high altitudes, who states that the benzine and alcohol, which had been found to exist in the atmosphere, actually increased in strength in the higher regions, and he could only suppose that benzine and alcohol are not of terrestrial formation, but came to us from space. The chairman remarked that those who doubted the diffusion of alcohol throughout the universe might be glad of an opportunity to refute it. Then Professor S. P. Langley, of the United States, spoke on the distribution of energy in the solar spectrum, and he, too, was induced to support Abney's conclusion on the existence of benzine and alcohol in space. But, we would ask, given that spectral lines are sufficiently marked to identify them with those of organic compounds such as these, how do they, the compounds, escape oxidation when a red hot meteor dashes through the air contained in their neighbourhood? Is this science?

THE ROAD TRACTION ENGINE.

The three thousand road traction engines which are now doing good and economical work in different parts of the kingdom are not allowed to have the easiest of lives. Counties and boroughs alike have an occasional tilt at them. Yet they are irrepressible, and are steadily growing in number; for their value to the trading and mercantile interests becomes increasingly demonstrable. The private owners of horses whose education has been so neglected as not to include the necessary element of familiarity with the iron steed which is taking the heavy work off their shoulders, demand that the traction should not be abroad when they too are driving. They ask that it should not be allowed to come out till they have gone in. "Let the open hours in our neighbourhood be from six in the afternoon till midnight," say the majority of the magistrates in County Quarter Sessions at Exeter; and "in our borough," say the Corporation of Wolverhampton, "let the open hours be from five in the afternoon till nine in the morning." And both authorities ask the Local Government Board to give legality to their bye-laws framed with that object. "Steady," respond the traction owners afflicted, "we must have our say;" and they memorialise the imperial authority not to sanction such prohibitions. By their inspector the Local Government Board lately heard evidence for and against in the Devonshire case, and on Wednesday last in the Wolverhampton case. The Devonshire justices will have taken little by their latest opposition. What is likely to be the issue of the Wolverhampton inquiry may be inferred from the suggestion of Mr. Thomas Carrington, who held the court, to the effect that the locomotives should be allowed to travel in the daytime over the roads in the outskirts of the borough. But as the Wolverhampton authorities repel the suggestion, and ask to have the bye-laws "confirmed without alteration," the formal pronouncement of the imperial authority will in that case also have to be made.

NICKEL VERSUS BRONZE.

A financial committee of inquiry, appointed to consider the question of substituting a nickel for the bronze coinage at present in use in France, has finally decided in favour of the project, which, it may be mentioned, has already been adopted by other countries, and notably by Germany, Belgium, and Switzerland. The work thus thrown upon the mints of Paris and Bordeaux will be gigantic, it being estimated that there are 500,000,000f. worth of bronze coins in circulation; but the necessary appliances are already in hand, and the work will be rapidly proceeded with. It should be known that coins of copper-nickel have been introduced in North America, Peru, Brazil, and Honduras; and in 1869 Professor Graham, the last Master of the Mint, issued a coinage of the same kind for the Island of Jamaica in penny and halfpenny pieces, and very handsome coins they are. It has been pointed out by Dr. Walter Flight, of the British Museum, South Kensington, in the *Journal* of the Chemical Society for April of this year, that he was informed by Professor Graham in 1869 that he should have advocated the issuing of a coinage of the same kind in the British Isles if only a sufficient supply of nickel could at all times be obtained. Our sources of nickel have been materially increased during the twelve years interval. It is a matter of no little interest, as pointed out by Dr. Flight, that more than 2100 years ago copper-nickel coins were used in Bactria by the kings Agathokles, Pantaleon, and Euthydemus, the composition of which were identical with those now coined, although nickel was only discovered in 1751 by Cronstadt.

LITERATURE.

A History of Coal Mining in Great Britain. By Robert L. Galloway. London: Macmillan and Co. 1882.

In this useful little volume the author has endeavoured to delineate the principal features in the growth of the great coal industry, with special reference to improvements in engineering by means of which it has become possible to procure and bring to the surface the vast quantities of coal which are now annually drawn from the mines of this country. The earlier chapters contain a review of the scattered notices in chronicles, and the grants of powers made by the crown and monastic corporations during the middle ages, both in England and Scotland, and notices of the rise of the Tyne coal trade in the seventeenth century, consequent upon the demand for domestic fuel in London and the south of England. After which the main subject of the difficulties progressively encountered and overcome in the winning and working of deep mines, chiefly in the north of England, is treated in a series of sketches arranged in admirable logical sequence. Thus we are shown how, when the level free collieries of the Tyne were worked out at the beginning of the seventeenth century, and the exhaustion of the coal supply was considered to be already within sight, the real work of coal mining only commenced, and with the sinking below the water level, the wet period of coal mining, and that of inefficient draining appliances commenced, the chain of buckets and rag and chain pumps driven by horse gins or water wheels being the only mechanical means employed during the whole of the seventeenth century, the use of pumps having not become general until after the year 1710, and full advantage of the change was not realised until the introduction of Newcomen's steam engine a few years later. With increased depths the underground water diminished, but the more formidable enemy fire-damp took its place, and thenceforth the interest turns mainly upon the question of ventilating and lighting fiery workings. When gas was first encountered at Mostyn the workmen made sport of it,

until one morning a collier entering his working place when the gas was present in larger quantity than usual, it exploded at his candle, knocking him down and disabling him for some time. This led to the firing system, a miner more resolute than the rest being detailed to go down in advance and clear out the accumulation of gas by crawling in on his belly and lighting it by a candle at the end of a long pole, he being protected from the blast, which passed over his head, by being covered with a wet sack and lying at full length. In South Staffordshire a somewhat less primitive system—that of the firing line—was used. This was a copper wire by which a lighted candle was drawn into the place where gas accumulated to explode it by pulling the end from a safe barricaded place in the mine stable. This operation was in some cases repeated three times daily. How the natural and imperfect ventilation of these early workings by mere face airing, to the neglect of the goaves, was improved by Spedding's introduction of the method of air covering or compelling the current to travel as a whole through the workings by means of doors and stoppings, and still further by John Buddle's method of compound ventilation with split currents and crossings combined with the laying out of the mine in isolated panels, and the introduction of the dumb draught for the return air in 1810, is well described by the author; and the transactions that led to the mention of the safety lamp by Davy are given with such detail as to form one of the most interesting chapters in the book. The discoveries and improvements of late years, involving no great original principles, are less fitted for popular description than such great features as the improvement of the steam engine, the introduction of underground tramways by Carr, of Sheffield, and of cages and guides by T. Y. Hall, and they are therefore treated with less detail perhaps, in some cases, they have been rather neglected by the author as, for instance, in the case of modern winding engines and pit frames, which might have received more ample notice with advantage. The history of the various committees and commissions that have investigated the more disastrous explosions of the last forty years, and the introduction of Government inspection, are very fully treated. We note, however, one omission, namely, the Duke of Argyle's Commission on Coal Supply, which, although not appointed with a view to legislation, is historically interesting on account of its very elaborate report. Taken as a whole, the volume is certainly one of the best popular sketches of coal mining history yet published, and will, we trust, secure a large number of readers.

The Sanitary Engineer. Vol. V. New York: The Sanitary Engineer Office, and London: E. and F. N. Spon. 1882.

In America there is more room for practical sanitary reform than in this country, though we may hardly be said to have more than entered upon the general adoption of satisfactory sanitary measures and appliances. The need of reform was the cause of the existence of the *Sanitary Engineer*, which was started in 1878 as a monthly periodical, and has, owing to the liberality and thoroughness with which it is conducted, passed through the monthly and fortnightly stages, and is now published weekly. It has acquired an authoritative position, and in its twenty pages, sanitary engineering proper occupies the largest space, though much attention is paid to all questions relating to the purity of foods and hygienic matters generally. It is edited by a large departmental staff, and its contributors comprise the best known writers in America, and a considerable number of well-known English sanitary engineers and chemists. Its pages are fully illustrated, and good use is made of the lessons taught by failures as well as of the most recent successful practice. The proprietors obtain special assistance for original investigations on subjects of leading interest, and as a result of some of these, and the persistent attack of abuses, they have been chiefly instrumental in obtaining several valuable legislative enactments. Their journal has thus acquired a character which makes it valuable to all interested in sanitary questions.

THE SOCIETY OF ENGINEERS.

VISIT TO PORTSMOUTH.

On Wednesday one of the summer excursions of the Society of Engineers took place, Portsmouth dockyard being visited. A special train was provided by the London, Brighton, and South Coast Railway Company, consisting of two saloons, two brake vans, and four first-class carriages, drawn by The Stephenson, an engine very similar to the celebrated Grosvenor. Mr. Michael Reynolds, of the locomotive department, was in charge of the train, which was fitted throughout with the Westinghouse brake. It would not, perhaps, be possible to find a better example of the perfection to which the appliances for passenger traffic have been brought, than was afforded by this train with its engine. The train left Victoria punctually at 9.20, and reached Portsmouth Harbour station at 11.19; making the run, eighty-five miles, without a stop, in 1 hour 59 minutes. The actual weight of coal burned on the run did not exceed 12 cwt., or about 17 lb. per mile.

On reaching Portsmouth Yard a large number of the party proceeded to Southsea, where they lunched, but others preferred to visit the old Victory, Duke of Wellington, and other men-of-war in the harbour. At 1.15 they all met in the dockyard, and divided into two parties. The first, with the president, visited the Vernon Torpedo School, where some interesting experiments were carried out for them, while others entered a dockyard train and were conveyed on board the Excellent, where gun drill was watched with great interest. The guns used are not similar to any in the service, being 6½-ton smooth-bore Armstrongs, firing 9in. round shot. Salvoes of four guns at a time were fired by electricity, and there was also single firing at ranges of 600 to 1100 yards. The drill was perfection.

From the Excellent the party proceeded under the charge of Staff Lieutenant Barrow, of the Excellent, in a steam launch and a barge which the launch towed, to Whale Island, which is practically artificial, being a spoil bank from the dock works. Here were witnessed experiments with machine guns, the Nordenfelt, Hotchkiss, and Gardiner being used. The Nordenfelt is too well known to our readers to require description here. The Hotckkiss gun is really a collection of five cannons in a group, each capable of throwing a shot or shell 2in. diameter, and weighing about 2½ lb., with a charge of 12 oz. of powder. Steel projectiles were fired at an iron plate 2in. thick, which they are just able to get through at 300 yards range. The Gardiner single-barrel gun is a new weapon, very light, very simple, and of great power, firing ordinary Martini-Henry ammunition at the rate, if desired, of about 240 rounds per minute.

On the return of the party from Whale Island they entered the railway trucks again and were taken round to her Majesty's ship Dreadnought, now undergoing some repairs. This is one of the most powerful ironclads in the world, she has a displacement of 10,800 tons, and is propelled by twin-screws driven by compound engines capable of indicating 8000-horse power, and giving her a speed of about 14½ knots, or over 17 statute miles an hour. She mounts four 38-ton rifled muzzle-loading guns in two turrets, which are fitted with all the most recent improvements; both turrets and their guns were worked for the visitors. Compressed air is employed in driving all the cranes about the dockyard, and a stout hose pipe being carried on board the Dreadnought and coupled on to the hydraulic engines, they were worked as though by steam, and the system is regularly practised in the dockyard.

The air-compressing plant consists of a pair of vertical condensing engines developing about 250 indicated horse-power, and driving a pair of double-acting horizontal compressing pumps. The clearance spaces of the pumps are kept filled from a tank connected with the main, so that the air taken in at each stroke is compressed in contact with this water, and pumped into a series of large accumulators up to a pressure of 60 lb. The capability of the machinery is limited by the fact that it is not found possible to move the pumps at a greater speed than 100ft. per minute, the movement given to the water at a higher speed tending to throw it over into the accumulators, and thus to arrest the action of the pumps. The total accumulator capacity is now about 9200 cubic feet, and is divided between four large cylinders of wrought iron plating 10ft. in diameter by 30ft. high. Two of these accumulators have been recently added, and it is shortly intended to fit two other similar ones. The great advantage of the compressed-air system over hydraulic power for such intermittent work as is required in the dockyard lies in the accumulators. The engine usually pumps them up early in the morning, and the supply of stored power is sufficient to meet the general wants of several hours. The large space covered by the extension works would make communication with the engine house whenever a capstan was wanted an impossibity; and although it was found, by a long series of trials, that the hydraulic system was about twice as economical as compressed air for continuous working, yet for intermittent and occasional use, that the advantage lay with the other motor. The benefit in handiness and the reduced necessity for supervision were also considered sufficient to make an increase of the air system desirable. The compressed air is conveyed from the accumulators by means of a pipe 20in. in diameter, and is branched off by means of smaller pipes as necessary to the machines scattered about the various docks and basins. There are at the present time connected with the accumulators two 20-ton cranes, five sliding caissons, and twenty-four capstans, besides numerous penstocks and other machinery.

The extension works are of great interest. They cover an area of 178 acres, and when the various basins and docks are completed, the Portsmouth yard will be considerably more than double its original size, being increased from 115 to 293 acres, which is about 34 acres beyond the total area enclosed at Cherbourg.

In the same building as the air-compressing machinery are the two large main pumps for pumping the docks and basins. The double-acting plungers are 6ft. in diameter and 6ft. stroke, and are driven by a compound engine of 1200 indicated horse-power. These pumps are capable of pumping out the docks at the rate of about 24,000 tons per hour. Owing, however, to the type of construction, which permits heavy shocks to come on the large cast iron pipes, the cost of repairing cracks is exceedingly great, and centrifugal pumps will, it is said, be substituted. A drainage engine for the docks is also contained in the same building. A new brick building with a tank for fire purposes above is about to be erected, at a cost of £19,000, to supersede the present temporary shed. The wall which is to enclose the convicts while employed upon the structure has been erected.

A considerable number visited the workshops and H.M.S. Marlborough, used as a training school for engineer students, and the dock works now in progress, principally by convict labour.

After leaving the yard, the visitors proceeded to Southsea and dined at the Pier Hotel, and returned to London by the special train leaving Portsmouth at 7.10. The return journey was made in about two hours. Nothing was left undone by the officers in charge of the various departments to make the visit thoroughly satisfactory; Lieut. Barrow in particular was unwearying in his exertions. A large number of engineer students were detailed to accompany the visitors and rendered important service.

In all about 130 members of the Society and their friends visited Portsmouth. Among those present were—Mr. Church, the president; Mr. Williams, hon. secretary and treasurer; Mr. Bernays and Mr. Spicer, past presidents, besides several members of Council. The arrangements were in all respects most satisfactory, and reflected much credit on Mr. Reed, the secretary.

KAMPANG KERBAU BRIDGE.

Our engravings on page 198 illustrate a bridge in Singapore which has been re-built so as, by a new superstructure, to reduce the steep rise which existed over the old bridge, and secondly, to widen the roadway. In Figs. 1 and 2 are shown the skeleton elevations of the bridge as it was and now is. The spans are of very limited dimensions, and it would have been an easy matter to have thrown a single-span girder across the canal and removed the central pier. The great rise and almost semicircular form of the arches of the old structure are no doubt due to the fact that at the time it was re-built Chinese and other native craft were in the habit of plying upon the canal. This, as well as every other description of traffic, no longer takes this route, and there was consequently no valid reason for increasing the navigable waterway by the removal of the central pier, and, at the same time, no impediment to lowering the soffit of the bridge to such a level as would be best adapted to the adjoining thoroughfares. The retention of the existing pier, moreover, permitted the use of the arch as the type of girder, a type of construction which, in an esthetical point of view, is superior to any other.

The difficulty of procuring timber of the necessary dimensions, of the necessary quality, and in a proper condition for the purposes of construction, is increasing every year in the Straits Settlements. A wood called Jampenis, which, so far as durability is concerned, is almost everlasting, can no longer be procured in any scantlings worth mentioning except at a price which is practically prohibitory. Another excellent wood termed Balloer is also becoming scarcer, and more difficult to obtain of that superior quality which formerly was quite common. Under these circumstances the Commissioners, upon the recommendation of their engineer, determined to build the new superstructure entirely of iron, and thus avoid the incessant repairs and corresponding expense which timber bridges invariably entail.

The girders, which are shown in Figs. 3, 4, 5, and 6, are of cast iron, having a clear span of 20ft. 6in., a rise of 2ft. 6in., and are true segments of a circle. They were cast in one piece, and have a uniform depth of 14in. The upper and lower flanges are 6in. in width and ⅜in. and ⅞in. respectively in thickness, as shown in the sections in Figs. 7—10. The face girders are similar in form to the others, but the width of the flanges is diminished on the outside so as to form a plain head on the face. The spandrils are of the open upright kind, and in the face girders are filled in with scroll work. The main girders were braced together both horizontally and diagonally, as shown in the plan Fig. 4A and cross section 4B. The bracing was of L iron 2½in. by 2½in by ¼in., with the rib forged down, where it is bolted with bolts ¾in. in diameter to the girders, as shown in Figs. 7 and 8. Instead of the plank platform, so common in colonial structures of this description, the roadway is carried upon wrought iron plates $\frac{5}{16}$in. thick, rivetted to cross tee-irons. Where the plates cross the girders, bolts are used instead of rivets.

FIG. 1.
ELEVATION
OF OLD BRICK BRIDGE

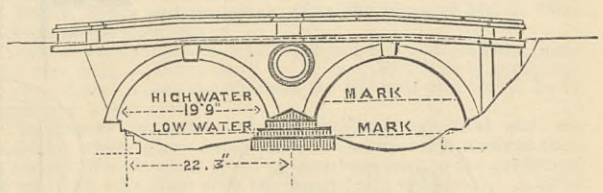
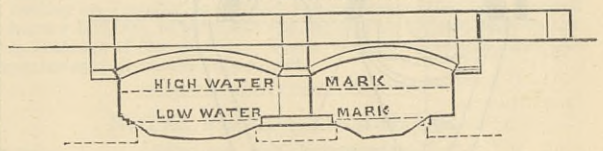


FIG. 2.
ELEVATION
OF NEW IRON BRIDGE

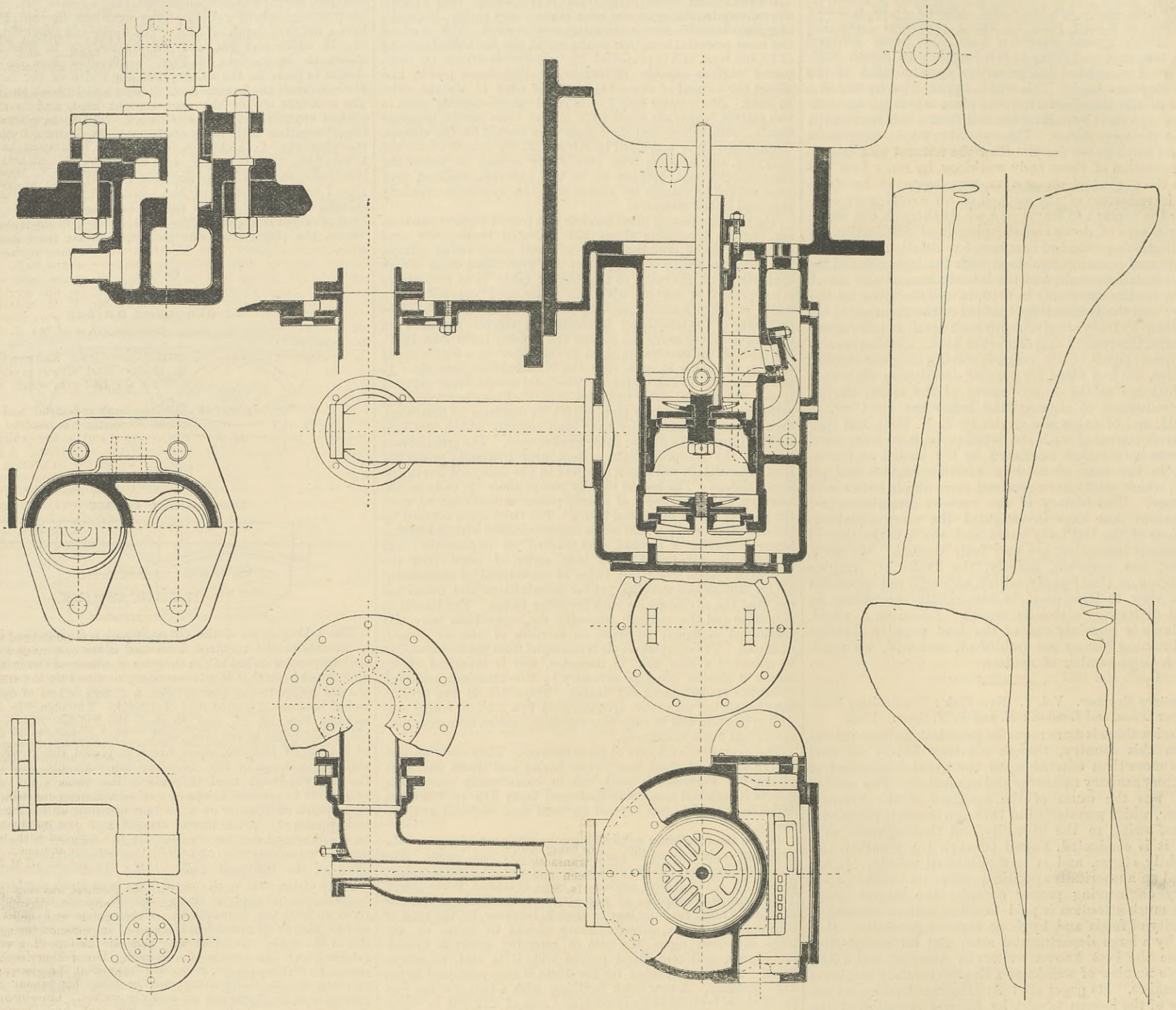


The taking down of the old arch and reducing the pier and abutments to the required form and dimensions was rather a tedious process owing to the extreme hardness of the brickwork. Had it not been that it was necessary to dress these portions of the old bridge to the new profiles, a charge or two of dynamite would have saved a good deal of labour. The plan Fig. 4A and sections Figs. 18, 19, and 20 show the finished dimensions of the pier abutments and wing-walls. The roadway itself consists of a layer of asphalte, upon which is placed the granite road material as shown in Fig. 16. The top horizontal hand rail is the only woodwork used throughout the whole work. As it is impossible to procure bricks of native manufacture which will make joints sufficiently even to bear pointing, all brickwork has to be plastered. A mixture of cement and granite dust makes an excellent and durable compost, which was used in the present case. Fortunately the old foundations were sufficiently wide to allow of the increased width being obtained, otherwise the expense of the new work would have been much greater. This remark does not apply to the wing-walls, which were built new right up from the foundations. Mangrove piles 17ft. in length and varying in diameter from 5in. to 7in. were driven over the site of the walls. Concrete was laid on the top of them, well rammed, and the brickwork carried up from that level. The removal of those parts of the old bridge no longer required, and the dressing and rebuilding of such brickwork as was necessary, was carried out by municipal labour, but the whole of the ironwork was contracted for and executed by Messrs. Howarth and Erskine, of Singapore, from the designs of Mr. Cargill, Memb. Inst. C.E., the engineer-in-chief to the Municipality. The roadway wrought iron plates were tested with a static load of three tons upon their whole area. The deflection was ⅜in., and upon the removal of the load the plates returned to their former level, and, as might be expected, showed no permanent set. The face girders have small ornamental bosses bolted on to them, which, together with the bead and open scroll work, are gilded.

New Clock and Carillons for Bombay University.—A native of Bombay, Mr. Premchund Rogchund, having munificently provided the necessary funds for a large clock and carillons for Bombay University, the India Government entrusted the work to the following firms:—The bells to Messrs. John Taylor and Co., of Loughborough, Leicestershire, founders of the new ring of twelve bells for St. Paul's Cathedral, and of Great Paul; the iron bell frame to Messrs. Westwood, Bailey, and Co.; and the clock and carillon machinery to Messrs. Lund and Blockley, of Pall Mall, by whom the whole of the work has been erected and put in operation in London, preparatory to its shipment to Bombay. The bells are sixteen in number, in the key of C—twelve consecutive and four half-notes. The largest weighs about three tons, and the whole peal about twelve tons, and are contained in a wrought iron bell frame, weighing about seven tons more. The clock will show time on four dials, each 13ft. diameter, glazed with opal glass for illumination, either with gas or electricity; has a two-seconds pendulum about 14ft. long, iron and zinc compensation, and a bob, 600 lb. weight. Inside minute and second dials are provided for setting the exterior hands, and the necessary apparatus is applied by which it can telegraph its time daily to the observatory, and synchronise to correct time all the other clocks in the building, Bombay city, and on any of the railways and in towns having wire communication with it. The escapement is that known as Denison's double three-leg gravity, and the trials made here of the going qualities of the clock show that it does not vary half a second from its daily rate. The quarters—known as the Westminster—are chimed on the second, third, fourth, and seventh bells of the largest consecutive eight, and the hours are struck on the eighth of the same number. The carillon machinery plays sixteen tunes from two barrels of eight tunes each. Each tune will be changed automatically. There are two hammers to each bell, each held by wire connections by a separate catch in the carillon machinery, ready to drop and strike its blow; the pin in the music or change-barrel having only to withdraw the catch—like pulling the trigger of a gun—to discharge the hammer on the bell, the heavy action of relifting being done by a rapidly revolving independent cam; the diameter of the pin-barrel is only 12in., instead of nearly 6ft., as it must have been if constructed on the old chime plan, and the pin of brass $\frac{1}{10}$in. diameter, instead of steel ½in. square, and being made of wood instead of iron, one barrel is easily substituted for another, when it is desired to play eight other tunes, or to chime the changes. The whole is so constructed that any one part can be removed for repair without disturbing the rest.

COMPOUND CONDENSING ENGINE, HALPIN'S PATENT.

MESSRS. MANLOVE, ALLIOTT, FRYER, AND CO., NOTTINGHAM, ENGINEERS.



We illustrate this week a new form of compound condensing engine which has been designed and patented by Mr. Druitt Halpin, of 9, Victoria Chambers, Westminster, and is now being introduced by Messrs. Manlove, Alliott, Fryer, and Co., of Nottingham and Rouen. From the general views it will be seen that the engine is of the intermediate receiver type, having cranks at right angles. The whole engine is perfectly self-contained, and virtually carried on three points, viz., the cylinders at one end, and the feet under the main bearings at the other end. The main frame is of the Corliss girder type, both the frames being united together by a strong vertical plate, which forms the front of the steam jacket; as well as by a horizontal plate, which also serves to carry the condenser containing the air vertical pump. The crosshead and valve spindle guides are bored out, and the crank pins are carried in cast iron counter-balanced disc cranks, the fly-wheel, from which the driving power may either be taken by a belt or gearing, being placed between the main bearings.

Apart from the general arrangement of the engine, its chief peculiarities consist in the methods employed for securing the maximum benefits derivable from steam jacketting, as well as in the automatic expansion gear used for regulating the cut-off in the small cylinder. Each cylinder is cast separately, having its front cover cast solid with it, and this cover is bolted up to the vertical plate forming the back end of the frame. A side elevation and horizontal and vertical sections of the low-pressure cylinder are given, from which it will be seen that the cylinders are covered along their barrels and at their ends with heat ribs, in order to facilitate the transmission of heat from the steam in the jackets to the steam doing work in the cylinders, thus preventing, it is claimed, cylinder condensation as far as is possible, without resorting to the use of superheated steam. Both cylinders are completely surrounded by one jacket, which has covers at the back end opposite the actual cylinder covers, to enable the pistons to be withdrawn. This jacket has also one cover at the top, as seen in plan, to give access to the slide valves. The high-pressure valve works in the jacket containing both the cylinders, without any special valve-chest, and the intermediate receiver is formed by a bent cast iron pipe connecting the high-pressure cylinder exhaust with the valve-chest of the low-pressure cylinder. This pipe is bent in order to get larger volume and some elasticity, and it, as well as the low-pressure steam-chest, is covered both inside and outside with heat ribs. There are no cylinder cocks used, the only drain cock applied being on the bottom of the main jacket. The connection of the indicator pipes which are fitted to both ends of both cylinders are shown.

The automatic expansion in the high-pressure cylinder is effected by means of a single slide valve, without either the lead or the exhaust being affected, and this is accomplished by the simple process of giving the valve two independent motions, the range of one motion being fixed, while the range of the other motion is variable, either by hand or automatically, by means of the governor. In the present case the cut-off is controlled by a high-speed weighted governor, driven by gearing, the load the governor has to lift being carried on a lever passing through a footstep against the governor spindle. The advantages claimed for this arrangement are that the load on the governor can be altered while the engine is running, and that a heavy weight is not kept revolving, as usual, on an overhung spindle. The valve has got a gudgeon on the centre of its back, by which it is carried, and round which it is free to swing partially; this gudgeon fits into a frame which is guided top and bottom and receives a constant motion from an excentric. If this was the only motion of the valve, it is evident that the cut-off would take place in the ordinary way by means of the fixed lap; but as the edges of the valve and the steam ports are oblique, if a second motion is given to the valve round the axis of the gudgeon carrying it, it is evident the steam port will be closed sooner or later in proportion to the time and extent of this auxiliary motion. This second motion is produced by the link shown in the elevator published last week, which carries a block actuated by the governor. This link is carried on a cross shaft between the main frames, this shaft also carrying a lever which works the air and feed pumps receiving from another vertical lever driven by a separate excentric set at a suitable angle for properly controlling the secondary or expansive motion of the slide valve. This compound motion of the valve has the effect of keeping both the cylinder and valve faces very true, but has the disadvantage of necessitating the use of two valve spindles. In his later designs Mr. Halpin employs an arrangement by which the same steam distribution is effected with only one valve and one valve spindle. Our engravings show various sections of the feed pump, which is driven by the same lever as the air pump, and vertical and horizontal sections of the air pump and condenser as well as of the exhaust steam and injection pipes. The air pump is either made with a cover, as shown in the right section, when it is wished to get rid of the discharge water at a high level, or if circumstances will permit of the water flowing away the cover may be omitted, as shown in the left-hand view. In this latter case it is, of course, only necessary to take out one single pin in order to be able to drain and examine the air pump bucket.

Messrs. Manlove, Alliott, Fryer, and Co. lately erected one of these engines at their works at Nottingham, and tested its performances very carefully. The leading particulars of the engine are as follows:—Diameter of high-pressure cylinder, 9in.; ditto low-pressure cylinder, 14in.; stroke, 21in.; mean revolutions per minute, 95·9. The engine was driving a dynamometer placed on the fly-wheel carrying a load of 27·05 horse-power, the total indicated horse-power being 31·2, thus showing a coefficient of efficiency of 86·7 per cent. The trial lasted eight hours, and steam of 65·6 lb. mean pressure was supplied by a portable boiler having 4·06 square feet of grate area and 326·33 square feet of heating surface. The total quantity of feed-water used per indicated horse-power per hour was 17·47 lb., and of this quantity no less than 2·86 lb. were condensed in the jacket, the coal used per indicated horse-power per hour being 1·6 lb. Both the coal and the water were most accurately weighed by independent observers, whose results were found to agree precisely at the end of the trial. The system adopted during the trial was the one used by the Royal Agricultural Society at their tests. The engine was first run until it is well warmed up, the fire-box then raked out, and firing commenced with weighed coal.

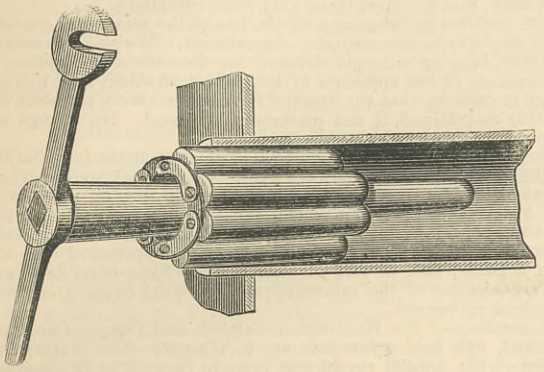
We have no other trustworthy record of the performance of so small an engine which paralells these results. A consumption of 17·47 lb. of feed-water per horse-power is unprecedentedly low for an engine of the size, and is the more remarkable when we consider the small quantity of steam condensed in the jackets. The performance of this engine gives strength to the idea rapidly gaining ground that the efficiency of a pound of steam need not of necessity be less in a small than it is in a large engine. Mr. Halpin has certainly produced an engine of excellent design; the reputation of the firm by which it was made guarantees the workmanship.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—Harry W. Wilkins, engineer, to the Mosquito, vice Scott; and Henry T. Liversedge, engineer, to the Polyphemus, for temporary service.

The Great Eastern Railway Company's New Quay at Parkeston.—Owing to the enormous increase in the continental goods traffic the Great Eastern Railway Company has opened its new quay at Parkeston for the landing and shipment of merchandise somewhat earlier than was contemplated. The quay is so far completed that three berths are available, with a depth of water alongside of from 16ft. to 27ft. according to tide. One of the warehouses on the quay is also completed and part of the station building. During the past week two extra vessels, one from Antwerp and one from Rotterdam with full cargoes, have been discharged and loaded at Parkeston. The company intends running two extra boats a week from Rotterdam and extra boats as required from Antwerp during the present pressure of traffic, and it hopes that the extensive accommodation afforded by Parkeston, where there are nearly five miles of siding already open, will enable it to work the increased traffic without any danger of a block such as it has been threatened with at Harwich. For the present the company's daily service with passengers to and from Antwerp and Rotterdam will continue to run to Harwich, but the booking office, first and second-class refreshment, waiting and retiring rooms at Parkeston are so far advanced that it will not be long before the passenger traffic is also transferred to Parkeston.

IMPROVED TUBE EXPANDER.

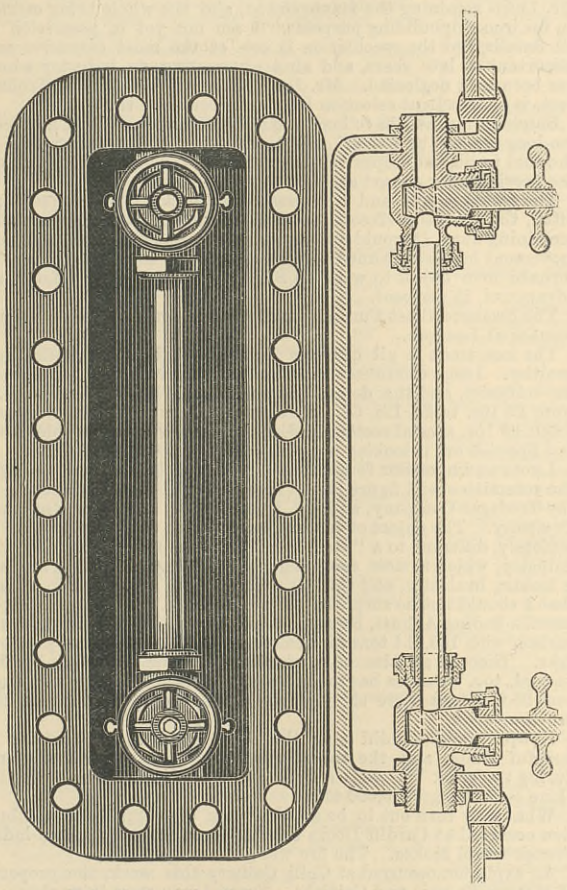
THE accompanying engraving illustrates a new tube expander, now being made by Messrs. Selig, Sonnenthal, and Co., of Queen Victoria-street, and called by them the "Simplex." It is really very simple, and consists simply of a tapered mandrel and tapered rollers held together by six curved links at one end, three of the links having slotted holes to allow for the different size of the tubes. There is hardly anything in it that can get



out of order, and as there is no casing for the rollers to work in, there is no friction on the ends of the rollers, as is the case with rollers working in slots and bearings. A great advantage is that one tool is capable of adapting itself to a variety of sizes of tubes, by using four, five, or six rollers as may be required, thus not necessitating three or four expanders, and making it a very economical working tool. It will adapt itself, it is said, to tubes of unequal shape, caused by expansion and contraction.

SLATER'S PATENT WATER GAUGE.

THE accompanying engraving illustrates a mode of fixing water gauges patented by Mr. H. Slater, Uttoxeter Old-road, Derby. It will be seen that a rectangular hole is cut into the boiler, into which is fitted an iron box, and that the gauge unites the top and bottom of the box, leaving a clear way through.

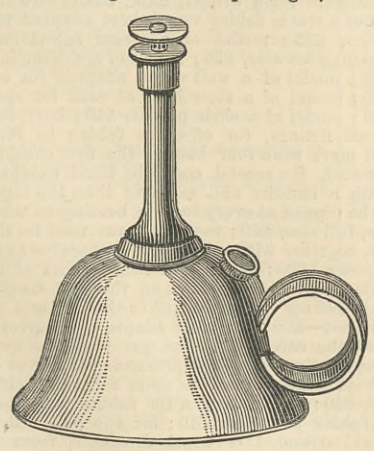


The result is that while the gauge is well protected from accident, it remains quite free from deposit.

One of these gauges has been fitted to a 25-horse boiler, and has been in work for the last five weeks. During that time the taps have never been touched, and the glass tube is perfectly clean, although the water used is very bad. This is an excellent arrangement, well worth the attention of boiler users.

VAPOUR LAMP.

MR. J. W. BOLTON, of Ashton-under-Lyne, is introducing a hand lamp, of useful and handy size, for workshop use. It is a modification of the small hand benzoline sponge lamp, the tube carrying the wick being somewhat prolonged, and carrying at



the top a cap having two flanges, between which are five very small holes, from which issues the gas or vapour of the hydrocarbon employed. Upon holding a light between these flanges, the wick and tube are sufficiently warmed to cause vapour to be given off in jets, which may then be lighted. The generation of vapour is continued by the heat given off to the flanges by the jets. A very bright light is given by the lamp; it cannot be blown out by ordinarily rapid moving about, and the wick is not burned. The liquid employed can, it is stated on the lamps, only be obtained from Mr. Bolton, which, if true, must hinder the sale of the lamp. Benzoline is, perhaps, not safe. The wick tube projects nearly to the bottom of the can, and the cap at top is not fixed.

THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS.

(From our own Correspondent.)

ALIKE in North and South Staffordshire the colliers have met and determined to require higher wages, and to strike if their demands should be refused.

Animation, which has not before appeared since the July quarterly meetings, characterised the business to-day—Thursday—in Birmingham and yesterday in Wolverhampton. The desire to buy forward was general, for the impression prevailed that the declared marked iron prices of the next quarterly meetings will be an advance of 10s. per ton upon those now current.

Very little finished iron of any sort could be got on either Exchange at the prices of a fortnight ago. Makers of different grades have been selling small lots of bars, rods, strips, angles, and plates, during the week, and one merchant reported in his own case aggregate purchases in that time to the extent of 2000 tons; but neither in Birmingham or Wolverhampton could either consumers or merchants place orders upon terms which buyers would consent to give; they generally required a rise of from 2s. 6d. to 5s. in respect of orders, with deliveries limited to a month hence, beyond which period they declined to cell.

Marked bars are in larger outturn at £7 10s. to £8 2s. 6d. firm; medium bars sell better at from £7 down to £6 10s.; common bars are to be had in small quantities at £6 5s. to £6. The prices for medium are higher upon the week by from 2s. 6d. to 5s., and of common by 2s. 6d.

Hoop orders are sought for at the rates of a fortnight ago unaltered for present delivery. Quotations are invited by Liverpool merchants for shipment to North and South America and Australia, but the inquiries are only seldom followed by orders. Lock strip in improved request is a shade firmer. Tube strip is likewise looking up, but consumers were not generally prepared with specifications so as to secure prompt delivery.

Sheets of medium sorts were rarely to be got at the prices which mostly operated last week. Lattens were in demand at £10, but makers declined to accept less than £10 5s., and asked £10 10s. Doubles were firm at £9, and singles could not be secured below £8 with favourable specifications. All the mills are full of work, and are unable to deliver with the required promptitude, the galvanisers being particularly pressing. The demand in the week has been brisk for all kinds, from best stamping down to rail sheets.

There were negotiations either to-day or yesterday for galvanised sheets at less than £14 10s. for 24 w.g., delivered in Liverpool. Merchants who have sold forward, but have not yet placed their orders, were upon the market, and there were reports of some one or two firms having recently sold at under previous prices; but no such quotations were made either in Wolverhampton or Birmingham. Indeed, galvanisers mostly sought a rise of 5s. per ton upon the prices which they would have accepted three weeks or a month ago. All the galvanising firms report themselves full of work on account alike of the leading export and the home market.

Boiler-plate orders have come in with more freedom, and buyers have been less reluctant to give the advance of 5s. which last week some firms were quoting. Tank and girder plates have likewise been in more demand, and a rise of from 2s. 6d. to 5s. has been occasionally secured, minimum prices being from £8 2s. 6d. to £8 5s.

Considerable activity has marked transactions in pigs during the past few days. The business has been mostly at old rates, but others have been at a rise of from 1s. 3d. to 2s. 6d., according to quality. Northampton pigs, that might last week have been bought at 47s. 6d., were quoted firm to-day at 50s. Cinder pigs, before at 40s., were 41s. 3d.; part mine, hot blast, were from 52s. 6d. to 57s. 6d., according to the proportion of mine; all mine, hot blast, were from 60s. to 65s., 67s. 6d., and 70s., the last-named figure being less rare than for six weeks past. Sales of 1000 tons in a line have distinguished this week's transactions in medium forge pigs. High-class pigs for best foundry, and also for sheet-making purposes, were demanded more freely than they could be supplied. Best hematites continue to be behind in deliveries, and consumers are much complaining in consequence.

Ironstone was up yesterday from 3d. to 6d. per ton, both as to South Staffordshire and Shropshire raw qualities, and likewise North Staffordshire calcined. The rise in coal, which was last week conspicuous with respect to best domestic sorts, is this week, in various degrees, extended to mill and forge, and general manufacturing sorts. The additions required, and in some cases given, varied from 3d. to 1s., the last-named rise distinguishing transactions in which rough qualities had been bought at very low terms.

The South Staffordshire colliers met on Tuesday at Dudley, and resolved that the chairman of the coal trade should be asked to call the masters together to meet a deputation of the men to consider the wages question; and that in the event of no advance being conceded, a general strike should take place. The resolution of the North Staffordshire men is to ask for 10 per cent. advance to be conceded on the 1st of October; and at some of the collieries notices to this effect have already been handed in. This movement affects in North Staffordshire some 18,000 coal and ironstone miners.

Constructive engineers keep steadily occupied, some of them upon important works for abroad. The Patent Shaft and Axletree Company, Limited, are constructing a railway bridge of large dimensions for Benares, which is to be wholly of steel.

The galvanisers are quite busy in their constructive departments on roofs for the agricultural districts at home and for export. Indeed, the demand for roofs from estate agents and other similar buyers is larger this season than almost ever before. The colonies and India are important export buyers; and to some foreign markets complete buildings made almost wholly of galvanised iron are going away from Birmingham and the district. One such contract which is under execution at the Crown Galvanised Ironworks, Wolverhampton, of Messrs. Davies Bros. and Co., is for China. There are four buildings in the order, and they are to be erected for mercantile purposes. Two of them are each 150ft. long by 60ft. broad, and the other two are each 100ft. long by 60ft. broad. A portion of the contract will shortly be on its way.

The pipefounders are less active than the engineers; still, from one works heavy deliveries are going forward in satisfaction of a thousand-ton order to meet the requirements of the Birmingham Corporation.

The leading makers of galvanised iron hollow wares in Birmingham, Wolverhampton, and some of the surrounding towns have resolved to advance prices all round. The amount of the advance is to be determined by a sub-committee, which has been appointed, and which will draw up a new trade list of all classes of goods. For a long time past prices have been very low.

The Birmingham Town Council having applied to the Local Government Board for permission to borrow £88,200 for works in connection with the disposal of refuse, and for street improvements, Mr. J. Thornhill Harrison, C.E., attended at the council house on Tuesday to hear evidence in support of the application. £27,000 is required for extensions and improvements at Montague-street Sewage Wharf, and of this sum between £13,000 and £14,000 is to be expended in machinery and attachments as follows:—£800 for three mechanical stokers; £2700, platforms for machinery; £6000, four "Farmer's" dryers and fixing; £2400, six multitubular boilers; £800, three tanks, 23ft. by 14ft. by 6ft. At the present time the Corporation have six Farmer's dryers in use.

The Health Committee believe that the result of the new treatment which they propose at the Montague-street Wharf will be that instead of an average loss of 8s. a ton on the refuse removed, there will be a saving of 10d. or 1s. per ton. The application for the loan met with no opposition.

A number of manufacturers in South Staffordshire have joined together to form the nucleus of a new company, to be called the South Staffordshire Electric Lighting Company, Limited, which proposes to supply electricity for lighting, heating, and other motive power. The nominal capital is £100,000, in £5 shares, and the new venture has already been registered.

Not only was the lighting of the Town Hall of Birmingham at the recent Musical Festival a great improvement, but the ventilation and heating was very greatly improved. The new arrangements include the provision of capacious flues, deriving fresh air from gratings in the pavements, large skirting ventilators, having a total area of 45 superficial feet, and iron cores, with an arrangement of gas jets, placed over the large ceiling gratings to draw out the heated air from beneath the ceiling. When the apparatus is in full action fresh air equal in volume to twice the cubical capacity of the hall is introduced in an hour. The warming system is upon Haden's method, and combines the hot air and hot water processes. In cold weather the outer air entering the flues is brought into contact with warming surfaces in conduits provided at each side of the basement of the hall. The warm air supply is controlled by means of valves, and when desirable the whole quantity can be turned into the side corridors. The new appliances have been erected by Mr. E. M. Mitton, of Cambridge-street, Birmingham; and the structural work executed by Messrs. Jones and Bengough, from the plans of Mr. J. Cox, engineer to the Corporation.

The half-yearly meeting of the Shropshire Union Railway Company was held at Shrewsbury on Friday, Earl Powis presiding. The report stated that the dividend for the half-year would be at the rate of 10 per cent.

The general committee of the excellent industrial and art exhibition which is now being held at Worcester has resolved that an auction of such works of art as have been sent to the exhibition for sale shall take place after the close of the exhibition. A little more than half the the period during which the exhibition will remain open has now elapsed, and the receipts have amounted to £5300, while the number of admissions has been about 120,000.

Major Hector Tulloch held a Local Government Board inquiry at Dudley on Tuesday, to consider the proposal of the Town Council to borrow £10,000, to complete the payment of the accounts on the deep drainage of the district. There was no opposition, and the inspector said he would duly report.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—So far as actually new business is concerned there has again been very little coming forward in the iron market here during the past week. Both producers and consumers seem to be waiting to see which will be compelled to come into the market first; and on the one hand are working on with deliveries against iron already sold, and on the other, running off contracts to meet present requirements rather than show any anxiety to enter into further transactions. Of course, this state of things cannot go on for an indefinite period, and the probable result may be approximately judged by such indications as the market affords. Makers are keeping up prices pretty firmly, but with merchants in many cases willing to book orders at under quoted rates, a fall in the market would seem to be anticipated at least in some quarters, and if anything, a slightly easier tone is already noticeable. Pig iron is chiefly affected by the present inactivity of the market; but although finished iron makers are kept well supplied with work, they are busy more on the execution of orders for shipment than for home requirements, which at present are not at all of large proportions.

At the Manchester market on Tuesday business was very quiet, I could hear of no inquiries for pig iron of any note stirring, and local makers, although they are still kept going with deliveries, seem to have done next to no business of importance during the last two or three weeks. District brands are also meeting with a very slow rate at present in this market. For delivery equal to Manchester, Lancashire pig iron is still quoted at 46s., less 2½ per cent. for both forge and foundry qualities, but other brands show a little giving way in the top prices lately quoted. Lincolnshire is now offered at 47s. to 48s. 6d., less 2½ per cent., and Derbyshire can be bought at as low as 48s., although the quotations of the best makers still go up to 50s. per ton, less 2½ per cent.; g.m.b. Middlesbrough is quoted nominally at 52s. 10d. per ton net cash, delivered equal to Manchester. In finished iron prices are steady, on the basis of about £6 7s. 6d. per ton for bars delivered equal to Manchester or Liverpool.

The engineering branches of trade are generally still kept fully employed with work in hand; but the reports to which I have previously referred, that there is a falling off in the quantity of new business coming in, appears to get more emphatic, and I hear that some of the large machine-making firms in the district are reducing the number of their hands.

The stimulus which was to have been given to some branches of the engineering trade by the progress of electric lighting does not appear to have yet been realised. Talking to an engineer the other day, he remarked somewhat grimly that they were waiting for the promised demand for steam engines and other descriptions of motors for electric lighting purposes, but they had not seen it yet.

I hear a report that the railway rolling stock required by the army in Egypt is being supplied by the South-Eastern Company.

The Mutual Insurance Association, which was formed after the passing of the Employers' Liability Act in connection with the Iron Trades Employers' Association, with the view of covering the members against claims made under the Act, held its first annual general meeting on Thursday last at the offices of the Association, Cooper-street, Manchester, and a most satisfactory report of the first year's working was presented. The revenue for the year had greatly exceeded the expectations; equitable and prompt settlements had been effected of all claims which had been justly made; a large balance had been carried over to the current year, and added to the incoming and increasing revenue upon the policies covering the year 1882-3. In the formation of the Association, I may add, care was taken to obtain reliable data upon which to work. For many months the promoters were engaged upon an inquiry which probably no other association could have organised and carried out, and they had carefully collected data as to accidents in all the leading branches of the engineering and iron trades over a series of years in all parts of the United Kingdom. Having classified the returns, they ascertained, for the first time probably in the history of the several industries, the ratio of risks they had to meet and provide against by insurance. The scheme was then entered upon, not as a commercial speculation or an adventure for profit, but with the object of adopting the lowest scale possible with due regard to risks and security to the funds of the Association, and the result was that they were able to adopt a scale of rates, according to classified risks, 300 to 400 per cent. below what had been proposed by insurance companies to cover claims under the Liability Act. The result is that employers in the engineering and iron trades are protected by the Association, which is strictly mutual in its character, at a very moderate rate against claims under the Act, which even if necessary, might become vexatious and unjust in its operation, and the hope was expressed by Mr. Richard Peacock, the president of the Association, that before long the insurance of members against claims under the Act would be a part of the ordinary operations of the parent society, covered by one payment and maintained by one

common fund. The meeting, which was regarded with great interest as the first that had been held since the Association issued policies to cover employers in the engineering trades against claims under the Liability Act, was well attended, and in addition to the passing of the report and the usual votes of thanks, the committee of management of the previous year was reappointed, with one or two additional members for important districts not hitherto represented on the Board.

Amongst the exhibits at the Royal Manchester and Liverpool Agricultural Society's show at Preston last week, which attracted considerable attention, was the stand of Decauville Ainé, of France and London, with a complete equipment for his portable railway, of which you have already given a description, and with reference to which I need not add any further details here, beyond stating that a silver medal was awarded to the exhibitor for the portable railway and the attachments.

The coal trade is developing considerable activity so far as the demand for house fire classes of fuel is concerned, and the pits generally are getting on to about full time. No doubt the apprehension of a disturbance in trade by the agitation for an advance of wsges, and the probability of an advance in prices, have induced consumers, as was the case last year, to give out their orders for winter requirements early on in the season. Up to the present, however, although here and there slight advances of about 6d. per ton are being made on one or two classes of coal, there is no general upward movement, but colliery proprietors will not sell forward at current rates, and it is more than likely that the close of the month will see prices go up all round for coal. The demand for ironmaking and manufactusing purposes continues fairly good, but enlargement of requirements in this direction can scarcely be expected. Activity at ironworks shows a tendency to decrease rather than increase, whilst the prospect of short time in the cotton trade must unfavourably affect the market for engine fuel. At the pit mouth, prices average about as under :—Best coal, 8s. 6d. to 9s.; seconds, 6s. 6d. to 7s.; common coal, 5s. to 5s. 6d.; burgy, 4s. 3d. to 4s. 6d.; good slack, 3s. 9d. to 4s.; and common, 3s. to 3s. 6d. per ton.

Shipping has been moderately good, but vessels are difficult to obtain, and freights have gone up. House coals coming into Liverpool from some districts have been advanced 1s. per ton during the week, but the cargo trade has not been materially affected, and steam coal delivered at the high level, Liverpool, can still be bought at about 7s. per ton. The tendency, however, is to stiffen.

The wages agitation amongst the men has commenced, and at a meeting of the miners in the Bolton district a resolution has been passed to ask for an advance of 10 per cent. next month, and in the event of a refusal, a general strike is recommended.

Barrow.—The position of the hematite pig iron market is practically the same as reported last week. Business is steady, sales have been large, enquiries are numerous but prices are unchanged. This state of things, however, cannot last, as the price of foreign hematite ores has gone up considerably, consequently the cost of production is equal or nearly so to the selling price. With the present demand for pig iron makers are not likely to be content to work large contracts at a nominal profit, and it is very likely that prices will in a short time show a considerable advance. I am in a position to state that makers in one or two instances have refused to do business at present rates. Stocks are decreasing and second-hand parcels are very rare. The business done on continental account has improved very materially, and several contracts of heavy tonnage have been made. The steel trade maintains its activity. Each department is fully employed, but the rail mills are employed day and night except Sunday. Merchant qualities are in good request and larger sales of blooms have taken place, and a much heavier tonnage is being shipped to America. Iron ore selling largely at 14s. 6d. to 16s. per ton at the mines. Spanish and Irish ores are being consigned in large parcels. Iron shipbuilders having got further orders are likely to be active through the winter. Engineers, ironfounders, boilermakers, and others steadily employed. Shipping active.

The Barrow Shipbuilding Company launched from their yard on Tuesday a splendid steamer, which was named the Eden, for the Royal Mail Steam Packet Company. A first attempt was made to launch the steamer about a fortnight since, but, owing to some defect in the ways she refused to move, and the launch had to be postponed. The Eden is 300ft. long between perpendiculars, 36ft. beam, 24ft. 6in. in depth of hold, schooner rig with handsome clipper bow and figure-head. She will be fitted up with one pair of compound inverted direct-acting surface-condensing engines, with cylinders 38in. and 74in. diameter, stroke 54in., and capable of indicating 2000-horse power. Steam will be generated by four boilers with twelve furnaces. Accommodation for 100 first and twenty second-class passengers has been provided, and on the upper deck is a music saloon and another for ladies.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

A DESPERATE effort is being made at present to induce the miners of South Yorkshire to run the risk of a great strike in the effort to secure an advance of wages. At Wath, on Monday, Mr. Pickard and Mr. Parrott, of the Yorkshire Miners' Association, were present at a colliers' gathering. Mr. Pickard urged that the miners had reason, not only to be dissatisfied with their wages, but also with their working hours. Some of the pits were only working five days a week, or less; but there were men who put in ten shifts. In 1881 they sent out 65 tons of coal per man more than they had in 1874, and yet they got about a guinea less for the work. They were told 1874 was a good year, yet last year they got so much more coal and so much less money. They were told that if they sent plenty of coal to bank, and it could be freely sold, there would be plenty of profit, and the pits would be worked full time. The colliers had increased the output, with the result that capital had been given away and wages reduced, whilst the middlemen stepped in and reaped the harvest at the expense of the workman and the capitalist. The cure for this was known. A resolution was passed approving of the decision of the Manchester Conference to ask for an advance of wages on the first pay day in October, and, in the event of a refusal, to leave work.

The Sheffield and Rotherham district of the South Yorkshire Miners' Association have come to the sensible conclusion "to support no policy which is calculated to lead the district into a strike," though, at the same time, they are of opinion that an advance should be asked for, and that if the advance is refused, the question should be referred to arbitration.

At this moment summer quotations for house coal are still ruling in Sheffield and South Yorkshire generally, though at one or two ports an advance of 6d. per ton has been imposed, and is now being enforced by several Sheffield merchants. For London there has practically been nothing more than one shilling advance on the summer quotations. Last winter exceptional terms had to be made for the metropolitan dealers, who were thus allowed 6d. per ton reduction. This 6d. per ton has now been re-called, and another 6d. imposed. Coalowners state that the railway companies make no distinction in the rates charged for large quantities of coal, as compared with light weights. The private consumer who orders a few tons of coal from the pit can have them delivered at the same rate per ton—8s. from Sheffield, and 8s. 3d. from Barnsley—as the largest colliery firm sending thousands of tons per year.

The Yorkshire Miners' Association have issued a manifesto urging their men to hold meetings and send delegates to a conference to be held at Rotherham on the 25th inst. They declare for a 15 per cent. advance in wages, and say it is as easy to bring about a general stoppage of collieries to limit the supply and increase prices as for one coalowner to set down his pit.

Colliery property in this district is a decided drug in the market. Though trade has improved, and full employment is now generally given, there are pits in which fortunes have literally been sunk, and with no hope of any return ever being forthcoming. The Holmes Colliery Company, an undertaking which was valued at £120,000 in the balance-sheet, cannot find a purchaser at £15,000; and this is not the only instance where colliery property has depreciated most remarkably.

Messrs. William Jessop and Sons, Brightside Steel Works, have announced their intention of paying an interim dividend of 15s. per share, which is after the same rate as last year, and equal to 5 per cent. per annum. Messrs. Jessop are doing a very fine business in steel, especially for the American market, which continues to improve, though the sister staple trade of cutlery appears to be on the decrease, so far as the States are concerned.

There is no change to report in the staple trades of the town. The exports of Sheffield goods to the States for the month of August show a falling off as compared with August, 1881, of £35,524, the deficiency being chiefly in steel rails. Steel has increased by £13,000, and cutlery has decreased by £6575.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THERE was not much business done at the Cleveland Iron Market held at Middlesbrough on Tuesday last, but the tone thereof was nevertheless steady and cheerful. Some uncertainty still prevails as to whether or not the restriction agreement with the Scotch ironmasters will eventually be renewed or not. It appears that negotiations are going on, and there is a possibility that the decision recently announced to restrict no longer will be reversed.

In the Cleveland district the stocks are still being reduced, and so far appear likely to turn out as much in favour of producers at the end of the present month as they were last month. Exports also are going on most satisfactorily. Up to Monday night they amounted to 29,570 tons, as against 28,849 tons for the same period last month. This rate of export is likely to continue for some time, and the activity at the mills and forges will certainly maintain the local demand. For prompt delivery iron is quite scarce at the moment, and considerable pressure has to be put upon both makers and merchants in order to get them to keep up their deliveries. The stock in Connal's stores is now 130,386 tons, being 2495 tons less than a week ago.

Prices of pig iron have not altered much during the week, and may be taken to be now 44s. per ton for No. 3 prompt f.o.b. iron. This is the merchant's price; makers generally ask about 6d. more. Warrants are not in good request, and not more than 43s. 6d. to 43s. 9d. can be obtained for them. A few American orders have come to hand, one for 1500 tons for prompt delivery being at present under execution.

In the manufactured iron trade the demand is quiet in anticipation of labour difficulties. Ship-plates are still quoted at £6 15s., and angles and bars at £6 to £6 5s., all f.o.b. less 2½ discount.

The steel rail trade is still in rather a depressed condition. An attempt is being made to get up a combination of producers, so as to avoid undue competition. It is said that steel makers, both in Cleveland, Cumberland, and South Wales, have expressed their willingness to co-operate in this direction.

The coal trade is somewhat improved, especially for household coals, and rather better prices are being obtained.

A meeting of the employer members of the Board of Arbitration for the North of England iron trade was held at Middlesbrough yesterday. The present condition of the trade was fully discussed, and the decision was arrived at that it was no better than it was a year ago when wages were 12½ per cent. lower than at present. A large number of the employers present considered that nothing less than a 12½ per cent. reduction would give them the necessary relief. It was eventually decided, however, to be content with a smaller reduction, and the following resolution was passed, viz.:—"That this meeting resolves to give notice to the operatives for a reduction of 9d. per ton on puddling, and 7½ per cent. on other forge and mill wages, to take effect at the termination of the present wages agreement on the 28th October next." The assembled employers also took into consideration a resolution passed at the recent Ironworks' Conference at Leeds, approving the principle of the sliding scale, and a strong desire was expressed that it should be made known to the ironworkers that employers were by no means averse to that mode of settling wages rates. It was pointed out that an extra 5 per cent. was awarded by Mr. David Dale two and a-half years since in consideration of the advantages gained to the trade by the sliding scale. These advantages, after having continued for a year and three-quarters, were lost by the action of the men in February last. It is, therefore, considered that if the men do not return to some such agreement, a further claim of 5 per cent. reduction will soon have to follow. As has already been announced, the workmen have made a claim for 7½ per cent. advance, but this is believed to be merely a device to blind the eyes of an arbitrator as to the necessity of a reduction.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE Glasgow warrant market has been very quiet during the past week, fluctuations in prices continue small, and the amount of business done even among brokers inconsiderable. The volume of the legitimate trade, however, has not in the slightest degree abated. It is true that the shipments amounted to not more than 10,000 tons for the week, but those of the preceding week exceeded 16,000 tons, and it is expected that in succeeding weeks the export will be very good. At no time in the history of the trade has the demand for pig iron come from so extensive an area on the Continent and elsewhere, the consignments to foreign countries being at present larger than they were ever known to be before. Another cheering feature of the trade is that, notwithstanding the low prices which prevail in Canada and the United States, the shipments there are better than they have been for a considerable time, and the freights of pig iron, which were recently down so low as 8s. per ton, are becoming firmer. The abandonment of the agreement between the Scotch and Cleveland ironmasters to restrict production has had very little influence either for good or evil here. Reports have been current in England to the effect that the arrangements are likely to be renewed, but there is no likelihood of such a proposal being entertained, at least in the meantime. The supply of the best brands of Scotch iron is limited, and the prices are consequently very firm. The hematite trade is fairly active, and the quotations are steady. In the course of the week about 900 tons of pigs have been withdrawn from Messrs. Connal and Co.'s stores, and it is satisfactory to find that, with the prospect of a few furnaces being re-lighted at the end of the present month, the stock of iron continues to decrease.

Business was done in the warrant market on Friday from 49s. 8d. to 50s. cash. On Monday forenoon transactions took place from 49s. 11d. to 50s. 1½d., and 49s. 10½d. cash, and from 50s. 2½d. to 50s. 3½d. and 51s. one month; in the afternoon the quotations were 49s. 9d. to 49s. 11d. cash, and 50s. and 50s. 1½d. one month. The market was a shade firmer on Tuesday forenoon, with business at 49s. 11d. to 50s. ½d. cash, and 50s. 1½d. to 50s. 2½d. one month. The afternoon's market was quiet, with quotations at 50s. 2½d. and 50s. 2d. one month, and 50s. ½d. to 49s. 11½d. cash. Business was done on Wednesday at 50s. 2½d. cash, and 50s. 5d. one month. To-day—Thursday—transactions were effected at 49s. 10½d. to 49s. 11d. cash, and 50s. 3½d. one month.

Owing to the good demand for makers' iron, prices of all sorts show but little alteration, and quotations are as follows :—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 62s.; No. 3, 54s.; Coltness, 66s. and 55s.; Langloan, 64s. 6d. and 56s. 6d.; Summerlee, 63s. 6d. and 54s.; Calder, 61s. 6d. and 53s.; Carnbroe, 56s. and 52s.; Monkland, Quarter, and Govan, each 51s. 6d. and 49s. 6d.; Shotts, at Leith, 64s. and 56s. 6d.; Carron, at Grangemouth, 53s. —specially selected, 56s.—and 52s.; Kinneil, at Bo'ness, 51s. and 49s. 6d.; Glengarnock, at Ardrossan, 56s. and 52s.; Eglinton, 52s. and 50s.; Dalmellington, do. do.

The malleable iron trade is active, with good orders on hand at almost all the works, prices being fairly well maintained. The prospects of the trade are very good—at least during the whole of the present year. Engineers, marine and general, likewise continue very busy, and founders make very little complaint.

The coal trade, taken as a whole, has rather slackened, particularly as regards the shipping department. We will presently, however, have an enlarged demand for domestic consumption, in consequence of the approach of the colder weather, and there is every probability that the demand for manufacturing purposes will be fully maintained, if not materially increased. No change can be noted in prices, which are very firm.

Rumours have been in circulation, originating in the iron market, to the effect that the colliers are likely to request a general advance of wages on the 1st of October, and strike if they do not receive it. From inquiries made among the leaders of the men, I find that this report has very little foundation in fact. Were a strike to occur, it would no doubt tend to advance the prices of coals and iron a little; but, so far, nothing definitely has been done, and the organisation of the miners appears too weak to carry out such a general movement.

A meeting of the Huntington Sulphur and Copper Company-Limited, was held a few days ago in Glasgow—Mr. Wright pre, siding—when special resolutions brought forward at the previous meeting, on the 16th August, were confirmed, providing that the capital of the company shall be increased to the extent of £25,000 in £1 shares, which are to have a preference, and to be issued as the directors may see fit.

The Clyde Coal Company, Limited, has agreed to sell its Spittal Hill Colliery, with plant and machinery for £14,000, a sum believed to be much below its value.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

THERE is a revival of the Old Bute Ironworks on foot, which, coupled with additions, promises well. Scott Russell started these works, or rather re-started them, some years ago, with the idea of making Cardiff a rival to the Tyne, but his effort, and that subsequently of Maudslay, failed. Messrs. Morell Bros., Gibbs, and Lewis have them in hand, with a view of supplementing them with a large graving dock and the extensive foundry at Treherbert, Mr. Lewis retaining the management, and the whole being carried on for iron shipbuilding purposes. I am not yet in possession of all details, but the speculation is one of the most extensive and important of late years, and aims at creating an industry which has been long neglected. Mr. Lewis, Henry W. Lewis, of Treherbert, is an excellent selection for the direction of the works.

Shipbuilding, as I have long pointed out in this column, has been too long ignored by Cardiff, but now, with the flush prevailing in the coal trade, and improving character of the local iron industries, the prospects for a start are fair, to say the least.

The Swansea coal and iron trades are brisk. There is only one hitch, the partial strike at the Old Works, the furnace men still remaining out. It would appear that the temperance and religious movement has been fanned to such a degree in the district that the furnace men object to work on Sundays, even though offered an advance of 2½ per cent.

The Swansea Blast Furnace Company has again started a second furnace at Landore.

The iron trade in all quarters is firm, and business sound and healthy. Large clearances of Welsh mine have taken place from the collieries, and the demand is sustained. Bars are quoted at from £5 10s. to £5 12s. 6d. Steel rails are stiff at £5 2s. 6d., and reach £5 15s. special sections. Enquiries improving for old iron, and Spanish ore is looking up, principally in the Cardiff district.

I note an important formation of a "steel band," and amongst the committee will figure Mr. Whitworth, M.P., representative of the Tredegar Company, and Mr. Henry Tyler, M.P., the Rhymney Company. The object of the company, which may be regarded as remotely different to a "steel ring," is to improve, generally, the industry, which is now assuming colossal proportions. Tin-plate is looking healthier, and there is such a visible reduction in stocks that I should not be surprised at an advance. During the eight months ending August, Swansea sent away 181,856 tons, in comparison with 155,514 tons for the corresponding months of previous year. There is an idea of re-starting Caerleon Tin-plate Works. In coal, too, Swansea has made a stride of late. During last week over 25,000 tons were shipped, an advance of 4000 tons on the previous week.

Newport and Cardiff give the same gratifying indications of hopeful trade, and the round total of coal sent from all parts during the week was only a little short of 210,000 tons. Cardiff alone sent foreign 130,000 tons.

What may turn out to be another case of spontaneous combustion occurred at Cardiff Docks this week on board the coal-laden French vessel Mokta. The fire was got under speedily.

An explosion occurred at Gelli Colliery this week, the property of Messrs. Thomas and Griffiths. Several men were injured.

I am glad to note an act of thorough kindness on the part of the Ocean Colliery in providing a free library for their men at Cwm Park. Mr. Wm. Jenkins, the promoter of this, has given an excellent example, and one I hope to see generally followed.

Cyfarthfa has begun the initiatory steps for its new railway connection with the works.

THE Gare de l'Ouest at Paris has been illuminated with the Edison incandescent light. The same system has also been introduced into Besancon, the motive power being furnished by a waterfall about a mile distant.

AMONGST the prizes offered by the Committee of the Great International Fisheries Exhibition, London, 1883, are: for apparatus and gear complete for a trawler—sail or steam, £15; apparatus and gear complete for a drifter, £15; model of a steam trawler, £25; model of a steam fishing vessel, best adapted to herring and other fisheries, £25; model of a steam fish-carrier, £52 10s.; model of a sailing trawler, £25; model of a drifter for the herring fisheries, £25; model of a well vessel adapted for cod and other fisheries, £10; model of a stow boat as used for sprat and other fisheries, £10; model of a shrimp boat, £10; boat, full size, complete with all fittings, for off-shore fishing in rough weather, requiring not more than four hands—the first consideration being stability in a surf, the second, cost, the third weight, £15; model of a boat with a handier and safer rig than the lug-sail, and not requiring to be dipped at every tack in beating to windward, £10; rowing coble, full size, £10; model of boat used in the whale and seal fisheries, together with all kinds of apparatus and tackle used in those fisheries, £20; model of a fishing boat of not less than 45ft. keel, adapted to the fisheries on the east coast of England and Scotland—having special regard to the rig and prevention of shifting of ballast—£25; boat best adapted for conveying fish from the catcher to the carrier, £60; no prize will be awarded unless the boat is especially adapted to preserving the lives of her crew; model of a boat adapted for the drift fisheries both of mackerel and pilchard, £10; steam capstan for fishing purposes, £10; hand capstan for fishing purposes, £10; for the best full-sized lifeboat adapted to aid stranded or wrecked vessels, from the shore, in gales of wind and through heavy broken seas and surf, £600; life-saving apparatus of every description, £25; illustrations, by models or otherwise, of methods of breaking the force of the waves at the entrance of harbours, £50; the best method of communication from the shore to fishing fleets, £25; the best method of protecting submarine cables from injury by fishing operations, £10.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

**** *It has come to our notice that some applicants of the Patent-office Sales Department, for Patent Specifications, have caused much unnecessary trouble and annoyance, both to themselves and to the Patent-office officials, by giving the number of the page of* THE ENGINEER *at which the Specification they require is referred to, instead of giving the proper number of the Specification. The mistake has been made by looking at* THE ENGINEER *Index and giving the numbers there found, which only refer to the pages, in place of turning to those pages and finding the numbers of the Specification.*

Applications for Letters Patent.

** When patents have been "communicated" the name and address of the communicating party are printed in italics.

5th September, 1882.

4211. SIGNALS, P. Lofthouse, Radcliffe.
4212. PRODUCING CARBONISED MATERIALS, &c., J. H. Johnson.—(*A. Caron, Paris.*)
4213. LOADING and UNLOADING VESSELS, A. M. Clark.—(*J. W. Brown and J. W. Brown, jun., Baltimore.*)
4214. AMMONIACAL, &c., SALTS, J. Forbes, London.
4215. CARRIAGES, H. Mueller, London.
4216. ROLLING WIRE RODS, W. Morris, Oakengates.
4217. LUBRICATORS, H. J. Haddan.—(*F. R. P. J. Duvernay, Cluny, France.*)
4218. SEPARATING DUST from AIR, W. B. Dell.—(*G. T. Smith, Middlings Purifier Company, Michigan, U.S.*)
4219. DECORATING BRICKS, TILES, &c., I. B. Shaw, Tunstall.
4220. ELECTRICAL REGULATION of ENGINES and PUMPS, A. W. Reddie.—(*A. Krásza and J. Schaschl, Gratz.*)
4221. STEERING VESSELS, &c., W. Pepper, Kingston-upon-Hull.
4222. TRAMCARS and OMNIBUSES, C. P. Evans, Birmingham.
4223. ELEVATING GRAIN, &c., G. J. Hone, London.
4224. STARCH, W. R. Lake.—(*J. H. Ross, Buffalo, U.S.*)
4225. PITCH CHAINS, &c., S. Pitt.—(*J. M. Dodge, Chicago, U.S.*)
4226. SOAPS, W. Green, Thanet.
4227. FIRE-ESCAPES, A. M. Clark.—(*G. W. Smith, Harlansburg, U.S.*)

6th September, 1882.

4228. SHUTTLE-BOX SHIFTING MECHANISM, D. Anderson, Glasgow.
4229. VENTILATING VEHICLES, J. Leather, Liverpool.
4230. CIGARETTES, CIGARETTE HOLDERS, and PIPES, E. L. Delaney, London.
4231. PROTECTING TREES and SHRUBS, J. H. Johnson.—(*F. Kettinger and N. Ott, Vienna.*)
4232. HOLDING and RELEASING BLIND CORDS, &c., J. Hudson, Bolton.
4233. PACKING and COMPRESSING FLOUR, TEA, &c., J. Joyce, Edmonton.
4234. DIGGING POTATOES and FORKING, &c., LAND, S. Corbett, Wellington.
4235. HOLDER for FILAMENTS in ELECTRIC INCANDESCENT LAMPS, L. R. Bishop, London.
4236. METALLIC FENCING, R. J. George.—(*E. M. George, Sutna, Central India.*)
4237. INDICATING the SPEED of REVOLVING SHAFTS, H. J. Haddan.—(*E. Lambinet, Rochefort.*)
4238. INCANDESCENT LAMPS, W. Crookes, London.
4239. HOLDERS for WIRE ROPE, T. Archer, jun., Gateshead.
4240. LIFTS, HOISTS, &c., J. S. Stevens and C. G. Major, Battersea, and D. P. Edwards, Roath.
4241. PURIFYING STEAM BOILERS, &c., M. Coulson, Spennymoor.
4242. STRAINERS and STRAINER PLATES, G. Tidcombe, jun., Watford.
4243. SPRIT SAILS, W. Rowden, Whitstable, and C. E. Doughty, Margate.
4244. DRYING and CONDITIONING GRAIN, &c., in BULK, G. M. Capell, Passenham.
4245. ROTARY ENGINES, W. R. Lake.—(*I. Lojda, New York, U.S.*)
4246. ELECTRIC SIGNALLING APPARATUS, W. R. Lake.—(*J. H. Cary, Boston, U.S.*)
4247. UTILISING PNEUMATIC PRESSURE as MOTIVE POWER, W. R. Lake.—(*G. V. Sheffield, New York.*)
4248. GALVANIC BATTERIES, G. C. V. Holmes and S. H. Emmens, London.
4249. REMOVING BONE-BLACK from FILTERS, &c., A. M. Clark.—(*J. O. Donner, New York, U.S.*)
4250. DYNAMO-MAGNETIC ELECTRIC MACHINES, T. Donnithorne, London.
4251. OBTAINING and UTILISING ELECTRIC CURRENTS, T. Slater, London.

7th September, 1882.

4252. CUTTING PAPER, W. H. and F. C. W. Latham, Bolton.
4253. STEEL FRAMES and PIN PLATES for PIANOFORTES, E. Parr and J. R. Gibson, London.
4254. VOLTAIC BATTERIES, F. Durham, New Barnet.
4255. PLATING IRON and STEEL with SILVER, H. S. Elworthy, Stratford.
4256. ORNAMENTING GLASS, METALS, &c., W. H. R. Toye, London.
4257. GLASS COVERINGS for KEYS of MUSICAL INSTRUMENTS, L. A. Groth.—(*B. Kohl and K. Voigtritter, Dresden, Saxony.*)
4258. SETTING and DISTRIBUTING TYPE, J. C. Mewburn.—(*A. A. Low and L. K. Johnson, Brooklyn, U.S.*)
4259. UMBRELLAS and SUNSHADES, W. E. Knight, Stoke Newington.
4260. ELECTRIC GOVERNORS, &c., A. Blechynden, Newcastle-upon-Tyne.
4261. SADDLES, J. P. Rees, Dalston.
4262. PURIFYING GAS, W. W. Box, Crayford.
4263. "MULE-THROSTLE" SPINNING and DOUBLING MACHINERY, W. Lancaster, Accrington, and E. Slater, Burnley.
4264. BOXES or TRUNKS, C. H. Stanbury, London.
4265. WASHING APPARATUS, W. B. Nation, London.
4266. STORING ELECTRICAL ENERGY, T. Slater, London.
4267. HANDLES for CUTLERY, J. Fee, Sheffield.
4268. TRANSMITTING ROTARY MOTION by FRICTION, T. Foster, Manchester.
4269. DISTILLING COAL, W. Crowther, Huddersfield.
4270. GENERATING ELECTRICITY, W. R. Lake.—(*E. Brard, La Rochelle, France.*)

8th September, 1882.

4271. AUTOMATIC PRESSURE and VACUUM BRAKES, J. C. Peache, Crewe.
4272. COATING IRON with NICKEL, E. Edwards.—(*F. Blauda and A. Dumas, Bordeaux.*)
4273. CASTING METALS or ALLOYS, &c., H. Woodward, London.
4274. PORTABLE RECEPTACLE for HOLDING DISINFECTANTS, &c., N. Rapp and H. Herbst, London.
4275. WHITE LEAD, &c., W. V. Wilson, London.
4276. OBTAINING ANTHRACENE, &c., from RETENE, R. Irvine, Edinburgh.
4277. TREATING STARCHY SUBSTANCES relating to BREWING, &c., W. Lawrence, London.
4278. LAMPS, F. Siemens, Dresden.
4279. LOOM SHUTTLES, J. Riley & A. Orrell, Bradford.
4280. ROTARY ENGINES, R. Wagstaff, Hyde.
4281. PEAT, S. Heimann, London.
4282. RING SPINNING, &c., E. Clarke, Todmorden.
4283. TREATING COAL to OBTAIN COKE, &c., R. de Soldenhoff, Merthyr Tydvil.
4284. ORNAMENTING WOODEN, &c., SURFACES, W. A. Hunter, Plumpton.
4285. CUTTING SHEETS of GLASS, &c., W. R. Lake.—(*H. Thivollet, Lyons.*)
4286. ELECTRIC BELL and SIGNAL APPARATUS, T. R. Brailsford, London.
4287. OPEN FIRE-GRATES, S. C. Jervoise, Torquay.
4288. GOVERNING APPARATUS, J. Dewrance and E. Wimshurst, London.
4289. NEEDLE INSTRUMENTS for SPEAKING TELEGRAPHS, E. J. Houghton, London.

9th September, 1882.

4290. WORKING VALVES for SANITARY PURPOSES, W. G. Stuart, London.
4291. GAS BURNERS, J. J. Shedlock, London.
4292. LAWN-TENNIS BATS, A. A. Trimmings, London.
4293. MULTIPLE-CYLINDER ENGINES, F. Wynne, London.
4294. RAISING, LOWERING, and CONVEYING MATERIALS, F. J. Harrison, Rock Ferry.
4295. IRON and STEEL, W. W. Chipman, London.
4296. DRYING ORGANIC SUBSTANCES, &c., R. Remmers, J. Williamson, and W. Fairweather, Glasgow.
4297. COMBINATION PIPE JOINTINGS, C. Hinksman, London.
4298. KEYBOARD INSTRUMENTS, A. W. L. Reddie.—(*C. T. Virot, Paris.*)
4299. ACCUMULATORS, W. A. Barlow.—(*L. Encausse and Canèsie, Paris.*)
4330. STEAM ENGINES, C. Jones, Liverpool.
4301. DISTRIBUTING WATER in GARDENS, &c., J. T. Foot, London.
4302. INDICATING the AMOUNT of SALT in the WATER of STEAM BOILERS, J. W. Plunkett, Dunstall Priory.
4303. ELECTRICAL STORAGE BATTERIES, E. Frankland, Reigate Hill.
4304. ELECTRIC LAMPS, J. G. Stattier, Snapethorpe.
4305. TELEPHONE RECEIVERS or TRANSMITTERS, C. A. Teske, London.
4306. FIRE-ESCAPES, P. K. Klein and E. Allen, London.
4307. UTILISING WASTE HEAT of SUGAR REFINERIES, W. R. Lake.—(*S. M. Lillie, Philadelphia, U.S.*)

11th September, 1882.

4308. AUTOMATIC SMOKE CONSUMER and FUEL ECONOMISER, J. Butler, Nottingham.
4309. FOWLING PIECES, G. L. Jeffries, Birmingham.
4310. MATCH-BOXES, E. de Pass, London.
4311. STEERING ENGINES, T. Davison, Glasgow.
4312. CARBONISING COAL and COAL SHALE, &c., J. H. Hardman, Milton.
4313. RATCHET BRACES, H. J. Haddan.—(*Bruer, Schumacher, and Co., Kalk, Germany.*)
4314. SHOT, T. Spence, Gateshead-on-Tyne.
4315. BOILERS for HEATING WATER, &c., M. J. O'Riordan, Cork.
4316. SECONDARY or STORAGE BATTERIES, F. J. Cheesbrough.—(*A. K. Eaton, Brooklyn, U.S.*)
4317. SECONDARY or STORAGE BATTERIES, F. J. Cheesbrough.—(*A. J. Eaton, Brooklyn, U.S.*)
4318. BOTTLE STANDS, H. Wigfull, Sheffield.
4319. ROLLERS for GRINDING, &c., CARDS, J. Sykes, Lindley, near Huddersfield.
4320. ROLLERS for GRINDING, &c., CARDS, J. Sykes, Lindley, near Huddersfield.
4321. SHELLS or PROJECTILES for SMALL-ARMS, A. J. Boult.—(*J. Christophe, Seurre.*)
4322. COUPLING and UNCOUPLING RAILWAY CARRIAGES, &c., G. F. Hopkins, Kensworth.

Inventions Protected for Six Months on Deposit of Complete Specifications.

4233. PACKING, MOULDING, and COMPRESSING FLOUR, &c., J. Joyce, Edmonton.—*6th September*, 1882.
4249. REMOVING BONE-BLACK from FILTERS, &c., A. M. Clark, Chancery-lane, London.—A communication from J. O. Donner, New York, U.S.—*6th September*, 1882.

Patents on which the Stamp Duty of £50 has been paid.

3558. LOCOMOTIVE ENGINES and TENDERS, J. Sharp, Sheffield.—*4th September*, 1879.
3566. FISHWAYS, A. M. Clark, London.—*4th September*, 1879.
3613. DISTILLING COAL TAR, G. C. Trewby and H. W. Fenner, Beckton.—*9th September*, 1879.
3633. COMPRESSING SUGAR in LOAVES, &c., R. Pzillas, Brieg, Breslau.—*11th September*, 1879.
4045. STEAM ENGINE INDICATORS, H. J. Haddan, Westminster.—*7th October*, 1879.
3570. ICE SAFES or REFRIGERATORS, G. Kent, London.—*5th September*, 1879.
3589. LOADING SHIPS, &c., F. Service, Llandaff.—*6th September*, 1879.
3590. DISINFECTING APPARATUS for WATER-CLOSETS, &c., V. E. Etienne, Ealing.—*6th September*, 1879.
3601. NAILS, RIVETS, &c., W. Taylor, Worcester, and H. Bianchi, Bushey.—*6th September*, 1879.
3579. OBTAINING GUM from PHOSPHATES of ALUMINA, G. W. Bremner, Clapham.—*6th September*, 1879.
3594. TREATING EXCRETA, &c., J. Turner, Bury.—*6th September*, 1879.
3603. SHIPS' BERTHS, &c., L. A. Groth, London.—*8th September*, 1879.
3617. STAYS or CORSETS, A. M. Cavé, Clapham.—*9th September*, 1879.
3623. PROPELLING SHIPS or VESSELS, D. H. Sisson, Goole.—*9th September*, 1879.
3644. TRAP for URINALS, PANS, &c., R. W. Armstrong, Belleek.—*11th September*, 1879.
3658. PERMANENT WAY, &c., W. L. Wise, London.—*12th September*, 1879.
3913. AIR-COMPRESSING ENGINES, A. Davis, London.—*29th September*, 1879.
3638. ADHESIVE MATERIAL, J. Eberhard, London.—*11th September*, 1879.

Patents on which the Stamp Duty of £100 has been paid.

3137. OBTAINING HYDROCARBON VAPOURS from GASES, W. Young, Clippens.—*7th September*, 1875.
3138. PROTECTING SHIPS, &c., B. L. Thomson and T. Connolly, London.—*7th September*, 1875.
3427. LOCKING RAILWAY POINTS and SIGNALS, J. E. Annett, London.—*2nd October*, 1875.
3223. BREECH-LOADING SMALL-ARMS, W. M. Scott, Birmingham.—*15th September*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition *29th September*, 1882.

2062. STOPPERS for BOTTLES, &c., J. Bussey, London.—*2nd May*, 1882.
2067. PREPARING COFFEE in a SOLID FORM, G. W. von Nawrocki, Berlin.—A communication from E. Geist.—*2nd May*, 1882.
2101. RAILWAY, &c., WHEELS, R. Hadfield, London.—*4th May*, 1882.
2103. BOX IRONS HEATED by GAS, G. W. von Nawrocki, Berlin.—Com. from A. Brecher.—*4th May*, 1882.
2105. IRON, &c., FENCING, C. J. Dawson, Leeds.—*4th May*, 1882.
2114. PERAMBULATOR WHEELS, T. Cooke, Manchester.—*5th May*, 1882.
2117. MACHINERY for GRINDING, &c., J. Goodwin, Stoke-upon-Trent.—*5th May*, 1882.
2121. WATER-CLOSET BASINS, &c., T. W. Helliwell, Yorkshire.—*5th May*, 1882.
2127. MECHANICAL PLAYING of KEYBOARD INSTRUMENTS, R. H. Bishop, & W. Down, London.—*5th May*, 1882.
2133. CONSTRUCTING STOVES for BURNING PETROLEUM and other OILS, F. J. Duggan, Bristol.—*6th May*, 1882.
2139. VELOCIPEDES, B. Bennett, Coventry.—*6th May*, 1882.
2140. SAFETY PINS, G. F. Redfern, London.—A communication from F. S. Peshine.—*6th May*, 1882.
2141. TEACHING the RUDIMENTS of MUSIC, E. M. Easson, Buckingham.—*6th May*, 1882.
2186. INCANDESCENT ELECTRICAL LAMPS, H. Lea, Birmingham.—*9th May*, 1882.
2209. GRAINING and otherwise ORNAMENTING SURFACES, S. J. J. Kelly, London, and C. B. Lindsay, Blackheath.—*10th May*, 1882.
2317. POWER WHEELS or PULLEYS, &c., A. W. L. Reddie, London.—A communication from E. W. Merrill.—*17th May*, 1882.
2445. STOPPING and STARTING TRAMWAY CARS, J. H. Betteley, London.—*24th May*, 1882.
2649. PIQUE GLOVE SEWING MACHINE, J. Helyar, Yeovil.—*6th June*, 1882.
2668. PORTABLE CHAFF ENGINES, R. Maynard, Whittlesford.—*7th June*, 1882.
3058. ROLLERS for TRANSFERRING, PRINTING, &c., E. C. Hancock, Worcester.—A communication from D. W. Grüne.—*28th June*, 1882.
3156. ENGRAVING MACHINES, &c., H. J. Haddan, London.—Com. from J. Earle.—*4th July*, 1882.
3163. SPINNING FRAME, A. M. Clark, London.—A communication from G. Jaquith.—*4th July*, 1882.
3488. COUPLINGS for HOSE PIPES, &c., J. H. Heathman, London.—*22nd July*, 1882.
3606. ROLLING STEEL, &c., METALS, W. T. Beesley, Sheffield.—*29th July*, 1882.
3614. ILLUMINATING GRATINGS, &c., T. Hyatt, London.—*31st July*, 1882.
3697. CLEANING INTESTINES, E. de Pass, London.—A communication from S. Oppenheimer.—*3rd August*, 1882.
3920. BALANCES, H. J. Haddan, London.—A communication from F. A. Roeder.—*16th August*, 1882.

Last day for filing opposition, *3rd October*, 1882.

2146. LIQUID MEASURING, &c., APPARATUS, E. G. Rivers, Thornton Heath.—*6th May*, 1882.
2148. TRICYCLES, &c., W. Dawes and J. Tankard, Leeds.—*6th May*, 1882.
2153. PENHOLDERS, W. Sinclair, East Linton.—*8th May*, 1882.
2158. LAMPS for BICYCLES, &c., H. F. D. Miller, Birmingham.—*8th May*, 1882.
2159. AUTOMATICALLY PLAYING PIANOFORTES, A. Wilkinson, Bradford.—*8th May*, 1882.
2181. REGENERATIVE GAS FURNACES, W. F. Batho, London.—Com. from E. Stoltz.—*9th May*, 1882.
2184. ELECTRO-MAGNETIC ENGINES, C. F. Varley, Bexley Heath.—*9th May*, 1882.
2185. ELECTRO-MAGNETIC ENGINES, C. F. Varley, Bexley Heath.—*9th May*, 1882.
2189. SHARPENING RAZORS, &c., E. Payne, East Moulsey.—*10th May*, 1882.
2207. ELECTRO-MAGNETIC ENGINES, C. F. Varley, Bexley Heath.—*10th May*, 1882.
2212. WIRE WOVEN FABRIC, A. Arnold, Halifax.—*10th May*, 1882.
2258. SHIPS' WINDLASSES, &c., W. H. Whettem, Gateshead.—*13th May*, 1882.
2265. LAMPS for BURNING LIGHT, &c., OILS, J. Hinks, Birmingham.—*13th May*, 1882.
2267. FASTENING DEVICES for GLOVES, W. R. Lake, London.—A communication from W. S. Richardson and P. K. Dumarsq.—*13th May*, 1882.
2283. MAKING GOLD and SILVER THREAD, F. Wirth, Germany.—A communication from C. O. Harz and W. von Miller.—*15th May*, 1882.
2338. ANIMAL CHARCOAL, H. E. Jones, Stepney.—*18th May*, 1882.
2339. ANIMAL CHARCOAL, J. W. Ingham, Bow.—*18th May*, 1882.
2353. WATER CONDUCTORS, &c., J. T. King, Liverpool.—A communication from G. K. Reber and T. W. Irwin.—*19th May*, 1882.
2398. COMPOUND PUMPS for AIR and VAPOUR, H. Egells and W. A. Kux, Berlin.—*22nd May*, 1882.
2431. PRODUCING MOTIVE POWER, W. Muir, New Cross.—*23rd May*, 1882.
2559. TREATING FATTY SUBSTANCES, R. H. Brandon, Paris.—Com. from A. Marix.—*31st May*, 1882.
2580. FENCE POSTS, S. Pitt, Sutton.—A communication from O. Shepherd, E. W. Peck, G. H. Morse, W. A. Crombie, E. R. Powell, and T. S. Peck.—*31st May*, 1882.
2837. WATER TAPS or VALVES, G. Chisholm, sen., and G. Chisholm, Stirling.—*16th June*, 1882.
2992. REGULATING the ACTION of ELECTRIC ARC LAMPS, W. R. Lake, London.—A communication from J. M. A. Gérard-Lescuyer.—*23rd June*, 1882.
3020. WEIGHING MACHINES, H. E. Newton, London.—Com. from E. A. Chameroy.—*26th June*, 1882.
3272. SHOOTING SEATS, H. F. Beaumont, Huddersfield.—*10th July*, 1882.
3332. MAKING BOXES and PREPARING CARDBOARD, &c., A. Millar, Glasgow.—*13th July*, 1882.
3347. MAKING FIRE-CLAY, &c., TUBES or PIPES, P. L. Noel, Cardiff.—*14th July*, 1882.
3501. WOOL CARDING ENGINES, E. G. Brewer, London.—Com. from C. Rüdiger.—*22nd July*, 1882.
3771. MINING MACHINES, W. R. Lake, London.—A communication from G. D. Whitcomb.—*8th August*, 1882.
3779. ELECTRIC LAMPS, B. J. B. Mills, London.—A communication from W. M. Thomas.—*9th August*, 1882.
3783. ASPHALTE APPARATUS, B. D. Healey, Brighouse.—*9th August*, 1882.
3799. STEAM STEERING GEAR, J. H. Smiles, Stockton-on-Tees.—*9th August*, 1882.
3831. EXTRACTING PRECIOUS METALS from their ORES, A. K. Huntington and W. E. Koch, London.—*11th August*, 1882.
3839. MACHINERY for BREAKING UP GROUND, &c., J. H. Johnson, London.—A communication from J. A. Kay.—*11th August*, 1882.
3859. FACING POINTS for TRAMWAYS, H. Scott, Liverpool.—*12th August*, 1882.
3887. MAKING BOXES, &c., J. Mackay, Liverpool.—*15th August*, 1882.
3899. CUTTING MACHINERY for forming TEETH of TOOTHED WHEELS, W. R. Lake, London.—A communication from C. E. Albro.—*15th August*, 1882.
3937. CONSTRUCTING METERS for WATER, &c., J. T. Dann, London.—A communication from A. Schmid.—*17th August*, 1882.
3981. STEAM ENGINES, J. Shanks and J. G. Lyon, Arbroath, N.B.—*19th August*, 1882.
4133. PENCIL CASES or HOLDERS, W. R. Lake, London.—Com. from A. T. Cross.—*29th August*, 1882.
4233. MACHINES for PACKING, &c., FLOUR, &c., J. Joyce, Edmonton.—*6th September*, 1882.
4249. REMOVING BONE-BLACK from FILTERS, A. M. Clark, London.—A communication from J. O. Donner.—*6th September*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 8th September*, 1882.)

1143. SPRING HINGES, E. P. Phillips, London.—*9th March*, 1882.
1146. ACTIONS of PIANOFORTES, A. Squire, London.—*9th March*, 1882.
1148. PRODUCING CUT NAILS from HOOP IRON, &c., J. Maynes, Manchester.—*9th March*, 1882.
1180. DRESS, &c., for PROTECTION AGAINST FIRE, &c., O. Y. Rhodes, Leeds.—*11th March*, 1882.
1189. PURIFYING COAL GAS, W. Watson, jun., Addingham.—*11th March*, 1882.
1215. LOOMS for WEAVING, J. and F. Leeming and R. Wilkinson, Bradford.—*13th March*, 1882.
1217. BLEACHING FIBRES, &c., N. J. Holmes, London.—*14th March*, 1882.
1229. APPARATUS for NAVIGATING FLUIDS, &c., A. W. Lake, London.—*14th March*, 1882.
1253. LABELS for PLANTS, &c., S. Arnold, London.—*15th March*, 1882.
1254. TELEGRAPH RELAY, J. Ebel, New Charlton.—*15th March*, 1882.
1272. APPLIANCE for RECEIVING URINE and other MATTER, C. Rubens, London.—*16th March*, 1882.
1284. PIANOFORTES, H. Witton, London.—*16th March*, 1882.
1294. BREECH-LOADING FIRE-ARMS, H. W. Holland, London.—*17th March*, 1882.
1321. APPARATUS for SCORING NUMBER of RUNS MADE in PLAYING the GAME of CRICKET, F. Dening, Chard, Somerset.—*18th March*, 1882.
1324. ELECTRIC LAMPS, J. D. F. Andrews, Glasgow.—*18th March*, 1882.
1330. DRIVING BELTS, &c., J. Appleyard, Bradford.—*18th March*, 1882.
1338. MAKING HELMETS, &c., J. W. Towell, London.—*18th March*, 1882.
1361. SLIDING BLOCK BREECH-LOADING SMALL-ARMS, J. Rigby and L. F. Banks, Dublin.—*21st March*, 1882.
1384. TIP WAGONS, W. March, London.—*22nd March*, 1882.
1398. CRIMPING MACHINE for USE in the MANUFACTURE of BOOTS, H. H. Lake, London.—*22nd March*, 1882.
1419. SPINNING FIBRES, F. Ripley and T. H. Brigg, Bradford.—*24th March*, 1882.
1428. STEEPING TANKS, R. Free, Mistley.—*24th March*, 1882.
1432. FLUSHING TANKS or VESSELS, W. Bartholomew, London.—*24th March*, 1882.
1434. SEWERS, E. G. Banner, London.—*24th March*, 1882.
1438. STOPPERS for BOTTLES, H. Barrett, London.—*25th March*, 1882.
1456. TANNING HIDES, A. C. Henderson, London.—*27th March*, 1882.
1474. STEAM ENGINES, W. R. Lake, London.—*27th March*, 1882.
1488. LOOMS for WEAVING, J. and J. Hodgkinson, Blackburn.—*28th March*, 1882.
1580. ELECTRIC LAMPS, Sir D. Salomons, Tunbridge Wells.—*31st March*, 1882.
1608. AUTOMATIC WEIGHING MACHINES, C. Reuther, Germany.—*3rd April*, 1882.
1626. ELECTRIC LIGHT and POWER APPARATUS, J. Munro, West Croydon.—*4th April*, 1882.
1702. ROTARY MOTORS, W. J. Gurd, Sarnia, Ontario.—*8th April*, 1882.
1718. DRYING MACHINES for USE in DRESSING, &c., FABRICS, A. M. Clark, London.—*11th April*, 1882.
1748. PNEUMATIC BRAKE APPARATUS, F. W. Eames, Leeds.—*12th April*, 1882.
1754. IGNITION APPARATUS of GAS MOTOR ENGINES, F. Anderson and F. W. Crossley, Manchester.—*13th April*, 1882.
1791. WIRE for USE in MAKING LOCKETS, &c., E. Richardson, Birmingham.—*14th April*, 1882.
1929. MAKING SOCKET SLIDES, W. Randle, Birmingham.—*22nd April*, 1882.
1964. BRAKES for WHEELED CARRIAGES, A. Archer, Liverpool.—*26th April*, 1882.
2130. ARMOUR PLATES, A. Wilson, Sheffield.—*5th May*, 1882.
2424. STEAM and HAND STEERING ENGINES, A. W. Pattie, and G. W. Robertson, Glasgow.—*23rd May*, 1882.
2588. LIFE-SAVING GARMENTS, F. W. Brewster, London.—*1st June*, 1882.
2699. HARROWS, J. Howard and T. Bousfield, Bedford.—*8th June*, 1882.
2968. PROPELLING VESSELS, W. C. Cowie, London.—*22nd June*, 1882.
3126. SIDE SADDLES, G. T. Jenkins, London.—*3rd July*, 1882.
3172. VOLTAIC BATTERIES, J. Imray, London.—*5th July*, 1882.

(*List of Letters Patent which passed the Great Seal on the 12th September*, 1882.)

939. TROUSER PROTECTOR, L. A. Groth, London.—*27th February*, 1882.
1219. SMITHS' FORGES, W. Roberts, South Wales.—*14th March*, 1882.
1227. PASTE or CREAM to be USED in WASHING, &c., LINEN, &c., E. L. Loxton, Horbury.—*14th March*, 1882.
1233. NEEDLE WOVEN TAPESTRY, A. J. Boult, London.—*14th March*, 1882.
1238. METALLIC FASTENERS for ATTACHING BUTTONS, H. Andrews, Birmingham.—*14th March*, 1882.
1240. SEWING LEATHER, &c., W. Hollingworth, Bradford.—*14th March*, 1882.
1243. LOOMS for WEAVING, J. C. Fielden, Manchester, and R. H. Harrison, Dukinfield.—*14th March*, 1882.
1244. EXPANSION VALVE for STEAM, &c., ENGINES, J. Hopwood, Poulton-le Fylde.—*14th March*, 1882.
1256. LOOMS for WEAVING, L. Greenwood, Hawick.—*15th March*, 1882.
1257. STOP VALVES, W. Whiteley, Lockwood, Huddersfield.—*15th March*, 1882.
1258. TREATING DISEASES of the THROAT, &c., E. Chabot, London.—*15th March*, 1882.
1260. STAMPING TYPE MOULDS, E. A. Brydges, Upton.—*15th March*, 1882.
1261. PRODUCING GLASS of ORNAMENTAL DESIGNS, &c., E. Cutler, Birmingham.—*15th March*, 1882.
1283. PLACING FOG SIGNALS in POSITION on RAILWAYS, J. Natt, London.—*16th March*, 1882.
1288. INCANDESCEET LAMPS, J. B. Rogers, London.—*16th March*, 1882.
1298. METAL LASTS, J. Markie, London.—*17th March*, 1882.
1302. ELECTROLIER, R. Brougham, London.—*17th March*, 1882.
1305. PURIFICATION of COPPER PRECIPITATE ORES, D. Watson, Manchester.—*17th March*, 1882.
1306. MAKING HEARTHSTONES, W. Simmons, Maidstone.—*17th March*, 1882.
1315. MAKING CONDENSED, &c., MILK, W. F. Sweetland, Hendon.—*18th March*, 1882.
1346. CAPSULES and STOPPERS for BOTTLES, C. M. Taylor, Snaresbrook.—*20th March*, 1882.
1397. FLOWER-POT STAND for WINDOWS, J. F. Grimmo, Leyton.—*22nd March*, 1882.
1450. SYPHON BOTTLES, H. H. Lake, London.—*25th March*, 1882.
1470. CONSTRUCTING FURNACES, J. Hodgkinson, Bolton.—*27th March*, 1882.
1496. DYNAMO or MAGNETO-ELECTRIC MACHINES, T. J. Handford, London.—*28th March*, 1882.
1502. SEWING, &c., KNIT GOODS, J. H. Johnson, London.—*28th March*, 1882.
1522. APPARATUS for FLUSHING SEWERS, J. B. Denton, London, and G. Butler, Turnham Green.—*29th March*, 1882.
1638. ARMOURED VESSELS, J. H. Johnson, London.—*4th April*, 1882.
1656. WHEELED CARRIAGES, &c., H. J. Barrett, Kingston-upon-Hull.—*5th April*, 1882.
1749. ROOFING TILES, C. Major, Bridgwater.—*12th April*, 1882.
1752. SULPHURIC ACID, W. Weldon, Burstow.—*13th April*, 1882.
1851. INSULATED SUPPORTS for WIRES of TELEPHONES, C. Curtoys, London.—*18th April*, 1882.
1862. ELECTRICAL RAILWAYS, T. J. Handford, London.—*18th April*, 1882.
2052. ELECTRICAL GENERATORS, &c., T. J. Handford, London.—*1st May*, 1882.
2068. SECONDARY BATTERIES, C. H. Cathcart, Sutton, and C. B. G. Cole, London.—*2nd May*, 1882.
2249. REELS for THREAD, &c., A. J. Boult, London.—*12th May*, 1882.
2336. DYNAMO or MAGNETO-ELECTRIC MACHINES, T. J. Handford, London.—*18th May*, 1882.
2403. PRINTING PHOTOGRAPHS, P. M. Justice, London.—*22nd May*, 1882.
2466. TELEGRAPHIC APPARATUS, W. R. Lake, London.—*24th May*, 1882.
2492. CUTTING and BENDING METAL, W. R. Lake, London.—*25th May*, 1882.
2549. BUILDING CONSTRUCTION, &c., T. Hyatt, London.—*30th May*, 1882.
3291. MUSICAL INSTRUMENTS, G. Downing, London.—*11th July*, 1882.

List of Specifications published during the week ending September 9th, 1882.

5508, 2d.; 5731, 6d.; 136, 4d.; 326, 4d.; 377, 6d.; 412, 6d.; 476, 8d.; 487, 6d.; 489, 6d.; 492, 6d.; 497, 6d.; 500, 6d.; 501, 2d.; 506, 2d.; 513, 6d.; 514, 6d.; 517, 6d.; 518, 1s. 2d.; 519, 2d.; 520, 2d.; 522, 2d.; 523, 2d.; 524, 6d.; 425, 2d.; 526, 6d.; 527, 4d.; 528, 2d.; 529, 4d.; 530, 2d.; 531, 2d.; 532, 2d.; 533, 6d.; 534, 2d.; 535, 2d.; 538, 6d.; 541, 6d.; 542, 4d.; 545, 2d.; 546, 2d.; 547, 6d.; 548, 2d.; 549, 4d.; 550, 2d.; 554, 4d.; 555, 4d.; 556, 6d.; 557, 4d.; 558, 2d.; 559, 8d.; 560, 4d.; 561, 6d.; 562, 4d.; 564, 6d.; 565, 2d.; 566, 4d.; 567, 6d.; 568, 2d.; 569, 4d.; 570, 6d.; 571, 4d.; 572, 6d.; 573, 6d.; 574, 4d.; 575, 2d.; 576, 6d.; 577, 6d.; 578, 6d.; 579, 8d.; 580, 8d.; 581, 4d.; 582, 2d.;

583, 6d.; 585, 4d.; 586, 6d.; 587, 6d.; 588, 2d.; 589, 2d.; 590, 2d.; 591, 2d.; 592, 6d.; 593, 4d.; 594, 8d.; 525, 8d.; 596, 2d.; 597, 2d.; 598, 4d.; 599, 4d.; 600, 6d.; 601, 6d.; 602, 2d.; 603, 2d.; 604, 6d.; 605, 6d.; 606, 6d.; 607, 2d.; 608, 4d.; 610, 2d.; 611, 8d.; 612, 2d.; 613, 2d.; 615, 6d.; 618, 2d.; 619, 2d.; 620, 6d.; 621, 6d.; 622, 4d.; 623, 2d.; 624, 8d.; 625, 2d.; 626, 6d.; 628, 6d.; 629, 6d.; 630, 6d.; 631, 4d.; 631, 1s. 2d.; 634, 6d.; 637, 6d.; 638, 6d.; 639, 2d.; 640, 6d.; 641, 2d.; 643, 6d.; 646, 2d.; 647, 2d.; 651, 2d.; 652, 2d.; 653, 2d.; 654, 6d.; 655, 10d.; 656, 6d.; 658, 4d.; 659, 2d.; 661, 8d.; 662, 2d.; 663, 2d.; 664, 2d.; 666, 2d.; 667, 2d.; 668, 2d.; 669, 6d.; 670, 6d.; 671, 2d.; 674, 2d.; 675, 2d.; 677, 10d.; 679, 2d.; 680, 2d.; 681, 2d.; 682, 2d.; 683, 4d.; 684, 4d.; 685, 4d.; 686, 6d.; 688, 8d.; 689, 6d.; 690, 6d.; 691, 6d.; 692, 2d.; 693, 6d.; 694, 2d.; 696, 4d.; 697, 6d.; 698, 2d.; 699, 10d.; 701, 2d.; 720, 10d.; 725, 6d.; 730, 6d.; 738, 4d.; 744, 6d.; 754, 6d.; 758, 6d.; 760, 6d.; 776, 6d.; 786, 6d.; 793, 6d.; 825, 6d.; 845, 6d.; 872, 6d.; 889, 6d.; 955, 6d.; 992, 6d.; 1084, 4d.; 1870, 6d.; 2479, 6d.; 2570, 6d.; 2594, 4d.; 2719, 6d.; 2885, 6d.; 2921, 2d.

*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane, London.

ABSTRACTS OF SPECIFICATIONS.

Prepared by ourselves expressly for THE ENGINEER *at the office of Her Majesty's Commissioners of Patents.*

5222. LADIES' CLOAKS AND DRESSES, *I. Lodjda, New York.*—29*th November*, 1881.—(*Void.*) 4*d.*

This consists in making a cut in the front part of ladies' cloaks or dresses, and attaching a short sleeve to one side thereof, such sleeve being capable of being turned outward to put the arm through, or turned inside and put into a suitable pocket in the lining.

5400. IMPROVEMENTS IN ELECTRIC LIGHT LAMPS OR LANTERNS, *T. Rowan, Coleshill-street, London.*—9*th December*, 1881. 2*d.*

This relates to a means for surrounding the light with prismatic lenses, so that it might be diffused around.

5450. BODY GARMENTS for FEMALES, *G. D. Cardew, London.*—13*th December*, 1881.—(*A communication from D. du Ment, Paris.*—(*Not proceeded with.*) 2*d.*

This consists in forming a slit in the body of each garment opposite each breast, so as to enable infants to be suckled without opening the garments.

5508. PREVENTING EXPLOSION AND FIRE BY THE APPLICATION OF WIRE GAUZE, *J. A. Fisher, London.*—16*th December*, 1881.—(*Provisional protection not allowed.*) 2*d.*

The combustible or other matter is enclosed by wire gauze.

5632. IMPROVEMENTS IN THE CONSTRUCTION OF INCANDESCENT LAMPS, *J. S. Sellon, Hatton-garden, London.*—23*rd December*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the employment of semi-opaque in place of the transparent glass usually employed.

5731. DIRECT-ACTING GAS FURNACES, &c., *R. S. Casson, Brierley Hill, Stafford.*—30*th December*, 1881. 6*d.*

This relates to furnaces used for generating gas, and also to the method for obtaining and utilising a hot blast; further to the use of a puddling or other furnace in combination with the gas producer furnace, and it consists principally in improvements on patent No. 243, A.D. 1876. The gas generator chamber is formed with an inclined front supplied near its base with grate bars, through which air enters from a closed chamber connected by a pipe with a fan or other blast, a suitable valve being provided to regulate the admission of the air. The fuel falls from a hopper on to the grate, its admission being regulated by two sets of valves.

136. GAS OR GAS AND AIR COOKING APPARATUS, *J. A. Slater and M. M. Brophy, High Holborn.*—10*th January*, 1882. 4*d.*

This consists in causing the air to support combustion to circulate through a jacket, so that it is heated before being delivered to the flame of the gas burners.

300. IMPROVEMENTS IN FIRE-EXTINGUISHING AND ALARM APPARATUS FOR USE IN THEATRES, &c., *W. R. Lake, London.*—20*th January*, 1882.—(*A communication from H. S. Maxim, Brooklyn, New York.*) 8*d.*

The invention consists of a circuit-closing device, formed of two metal plates, each forming a spring, and separated from each other by a piece of fusible material insulated from the plates. One of the plates carries a point, and the whole is fixed in the wall or other part of the building. When the temperature reaches a certain height, owing to fire, the strip of fusible material melts, and the plates approach each other and close the circuit, in which is included the following apparatus:—A hammer, the head of which strikes on mechanism for actuating an alarum, the hammer being let loose by the attraction of the armature of an electro-magnet in the circuit. The arm of the hammer at the same time operates a series of levers, which liberate a weight, which in turn acts on a lever which opens a valve, and allows water to flow into a pipe running round the buildings, from whence it can be directed to the seat of the fire. To localise the emission of water, however, at the point where the fire has broken out, the inventor places nozzles at intervals along this pipe, fitted with quick matches, which communicate with a charge of gun-cotton. The explosion of this blows off the cap of the nozzle, and permits the flow of the water. These nozzles are fitted at convenient intervals over the building. By a modification of this arrangement the inventor includes in the circuit an apparatus for producing carbonic acid gas.

326. STAMPED METAL ROOF TILING, *O. Seefels, London.*—23*rd January*, 1882.—(*A communication from H. Klehe, Baden-Baden.*)—(*Not proceeded with.*) 4*d.*

This relates to tiles made of stamped sheet metal, and formed so as to interlock when laid in position, and secured to the battens of the roof by spring clips and tongues.

361. IMPROVEMENTS IN AND RELATING TO ELECTRICAL CONDUCTORS OR CABLES, *W. R. Lake, London.*—24*th January*, 1882.—(*A communication from H. A. Clark, Boston, Mass., U S.*) 6*d.*

To prevent inductive action, the inventor places a body of conductive material of considerable size, relatively to the size of the conductors in the cable, close to the insulating coating of a series of conductors, so that the electric impulses expend their energy on the conducting material. No two conductors, also, are allowed to remain next one another for the entire distance they traverse. The Second part of the invention refers to a method for keeping the wires in a cable at their relatively proper distances from each other during the process of vulcanisation.

377. IMPROVEMENTS IN ELECTRIC LAMPS, *Sir C. T. Bright, Bolton Gardens, London.*—25*th January*, 1882. 6*d.*

The figure illustrates one form of the inventor's lamp. The action is as follows:—When the current passes through the two circuits, A A—thick wire electro-magnets in main circuit — draw up sliding frame C C by attracting armature B, at the same time G—and the opposite similar armature not seen in the drawing—being attracted by poles I of fine wire magnets in shunt circuit — grasps hold of carbon holder J J by jaws at F, and rises with it. K is an armature fixed to contact lever L—shown in side view in Fig. 2. K is attracted by the other poles M M of the fine wire magnet, and thereby brings L into contact with N whenever the arc gets too long. L and K are connected to the fine wire magnet, which, being cut out of circuit, cease to attract G, and the carbon holder is free to fall. L is, however,

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FIG. 1

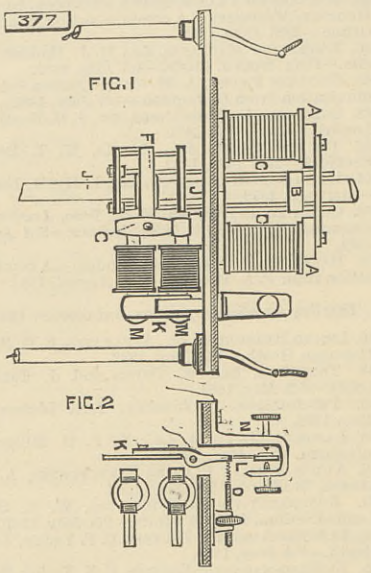

FIG. 2

at once brought back by spring O to its place of rest, the jaws again grasp J J, and the proceeding is repeated till the arc is adjusted to its normal condition.

412. ATTACHMENT OF BUTTONS TO BOOTS, &c., *L. A. W. Lund, Chandos-street.*—27*th January*, 1882. 6*d.*

The staple on which the button is placed has its ends turned slightly up, and when passed through the material the ends are inserted into holes in a plate, and a flap of metal, formed by cutting the metal between the holes, is then turned back and secures the staple.

436. IMPROVEMENTS IN ELECTRIC TELEGRAPH PRINTING APPARATUS, *J. Imray, London.*—28*th January*, 1882.—(*A communication from J. M. E. Baudot, Paris.*) 1*s.*

This relates to an electric telegraph printing apparatvs with multiple transmissions. In this system the sending of a letter includes two operations—First, the transmission by the signal; Second, translation of this signal and impression of the letter. The signals are formed by means of commutator levers, worked either by an operator or automatically by the machine itself. The letters are represented either by the action of a single commutator or by that of several combined. At the receiving station the signals are reproduced by means of movable mechanisms actuated by electrical currents, and corresponding respectively with the commutators of the sending station. The number of transmitting levers and of the corresponding movable receiving instruments depends upon the number of distinct combinations which it is possible to effect with them, and also upon the number of letters to be transmitted. The movements of the movable receiving instruments are communicated at the receiving station to a translating instrument which stores them and effects their translation. During the time employed in translation the line is utilised for transmitting other signals.

476. CIRCULAR SLIDE OR SLUICE VALVES, *W. C. Church, Brixton.*—31*st January*, 1882. 8*d.*

This relates to improvements on patents No. 563 and No. 2469, both of the year 1872, and No. 266, A.D. 1880, and it consists in forming the ports A over which the slide travels, and which are of crescent form, with central ribs to support the edges of the slide and prevent their catching against the edges of the ports. The piece B which supports the middle of the slide has a central, almost elliptical hollow, so that it presents faces projecting upwards, on which work corresponding faces projecting down from the interior of the back of the slide. This piece B is bolted to the metal of the cylinder, engaging under it the head of bolt C, which extends up through a hole in the back of the slide and through the slide-box cover, where it is fitted with a nut. At each side of the slide-box is a straight surface D, along which run rollers mounted on a ring on the slide, and arranged so as to alternately tend to wedge themselves between guide D and the circular edge of the slide, and, by rolling, to turn the slide partly round.

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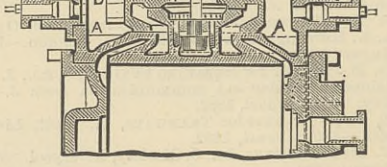

487. BEATING APPARATUS TO BE USED IN MACHINES FOR WASHING TEXTILE MATERIALS, *W. R. Lake, London.*—31*st January*, 1882.—(*A communication from Gillet et fils, Lyons.*) 6*d.*

This consists of a beater of special form, which is made to oscillate on a fulcrum so as to strike the hank or skein of textile material placed on a reel, and which it throws against a stop.

489. IMPROVEMENTS IN ELECTRICAL BATTERIES, &c., *G. Skrivanoff, Paris.*—31*st January*, 1882.

This relates to a "dry" battery, consisting of a plate of retort-charcoal or other similar substance, non-attackable by acids, a plate of amalgamated zinc, and an exciting paste applied to the charcoal. This paste is composed as follows:—Chloro-mercurate of ammonium, Hg. Cl^2 N H^4 Cl., 10 parts by weight, and chloride of sodium, Na. Cl., 3 parts. The charcoal plate, previously treated with paraffine, is covered with a cake of this paste, and on this cake is applied from five to ten thicknesses of Berzelius' Swedish filtering paper or asbestos soaked in a solution of chloride of zinc at 50 deg. Beaumé, and chloride of sodium mixed in equal parts, which solution may also contain a little glycerine.

492. LOOMS, *R. S. and E. Collinge, Oldham.*—1*st February*, 1881. —(*Partly a communication from R. Collinge, New Orleans, U.S.*) 6*d.*

This relates to the tappet or shedding motion, the object being to provide a simple apparatus which can be readily adapted to alter the position of the healds any required number of times in order to weave any required number of picks to the round, and it consists essentially in the combination with the treadle levers of double catch levers, which are thrown into or out of action with oscillating knives or bars by means of curved tappet levers or by catch rods actuated by a pattern chain.

497. IMPROVEMENTS IN ELECTRO-MAGNETS AND ARMATURES, &c., *G. Little, Passaic, New Jersey, U.S.A.*—1*st February*, 1882. 6*d.*

The object of this invention is to obtain the maximum magnetic effect by having the metallic surfaces of the armature and magnets in contact, a rolling motion being given to the armature to avoid sticking between it and the poles. The figure shows how this is done. The magnet is composed of two heads upon a metal tube, with a helix wound between the heads, and each head is divided into poles of a double V-shape as shown in the figure. The armature B is cylindrical.

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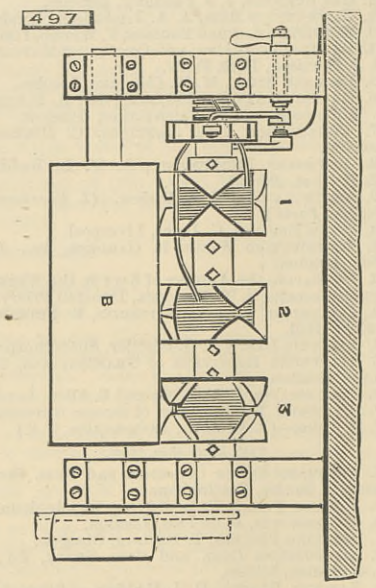

The magnets are charged by the action of a circuit-closing device that admits the current to the helix. The poles are placed so as to operate progressively, that is, as the pole faces of magnet 1 are ceasing to act, the pole faces of magnet 2 come into action, and so on.

500. BRAKES FOR RAILWAYS AND TRAMWAYS, *W. B. Holbech, Huncote, Leicester.*—1*st February*, 1882. 6*d.*

This relates to a brake applied to the carriages, and in which the momentum of the train is caused to apply the brakes, and it consists in bringing a friction pulley in contact with the underside of the carriage by suitable connection with one of the buffers, so that as such buffer is pushed in by the engine being braked in the usual manner the pulley is revolved, and by winding up a chain applies the brakes to the carriage wheels.

501. STEAM ENGINE GOVERNOR, *J. Rettie, Hatton Garden.*—1*st February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the use of a screw which is caused to revolve in a chamber formed in the steam pipe, and which, in combination with a concentric disc travelling with the screw, regulates the passage of steam.

506. CHROMO-LITHOGRAPHIC PICTURES, *H. H. Lake, London.*—1*st February*, 1882.—(*A communication from S. Czeiger, Vienna.*)—(*Not proceeded with.*) 2*d.*

This relates to the use of transfer paper printed with a series of equidistant parallel lines which are transferred to the required parts of the stone, and then crossed by other lines where it is required to produce a darker shade, the parts of the stone not needed in printing being previously coated with a mixture of vermillion and gum arabic.

513. IMPROVEMENTS IN ELECTRIC METERS, *C. V. Boys, Oakham.*—2*nd February*, 1882. 6*d.*

This relates to improvements on the inventor's patent No. 4472, dated 13th October, 1881, for electric meters. According to the present invention a balance is kept oscillating by clockwork, the inventor employing as the spring of this balance a long strip of elastic metal, by which the balance is suspended, the torsion of this strip acting on the balance spring. This spring passes through a long slit in the arm of a lever, which has another arm at right angles to the former, connected to the armature of an electro-magnet in circuit. The armature is drawn in one direction by the attraction of the magnet, and in the opposite direction by an adjustable spring, in such a manner that the slotted arm of the lever takes a position embracing the torsion spring, determined by the current passing through the magnet. The velocity of oscillation of the balance is thus so proportioned to the current, that an index moved by the clockwork which is governed by the balance registers the amount of current passing through the coil in a given time.

514. BLAST OR CUPOLA FURNACES, *J. Brown, Cannon-street.*—2*nd February*, 1882. 6*d.*

This relates to means for regulating the supply of air to each tuyere of the furnace, and it consists in fitting it with a hinged lid or a slide capable of being operated from the outside of the annular air chamber surrounding it; and it further consists in making the action of such lid or slide automatic by balancing it so that it will open or close to a large or greater extent as the pressure of the blast varies.

517. SADDLES FOR BICYCLES, &c., *W. R. Lake, London.*—2*nd February*, 1882.—(*A communication from F. G. Burley, Boston, U.S.*) 6*d.*

The object is to furnish a flexible saddle, easily adjustable, fitting itself to the form of the rider, and securing free ventilation, and it consists in a metal frame over which straps are passed and form the seat.

518. VELOCIPEDES, *A. G. Meeze, Redhill, A. G. Salamon, Clapham Park, and R. E. Phillips, Westminster.*—2*nd February*, 1882. 1*s.* 2*d.*

The pedal shaft is formed with a central three-throw crank connected by rods with a similar crank fitted to the divided axle of the travelling wheels, such axle being arranged so that in steering the vehicle round a curve, the outer wheel is free to over-run the inner or pivot wheel, for which purpose its crank is composed of two discs carrying friction clutches connected to the brake wheels. The invention further relates to means for contracting tricycles in width when required, and also to several details of velocipedes.

519. FIREPLACES, *G. W. von Nawrocki, Berlin.*—2*nd February*, 1882.—(*A communication from R. Müller, Berlin.*)—(*Not proceeded with.*) 2*d.*

The object is to economise heat and prevent smoke. On the grate is placed a cast iron fire-box open below and with a hinged fall-down door in front. A flue is formed on each side the box with an inlet in front, and they continue over the top of the box and enter an uptake through many lateral openings. The air passing through the flues is heated and mixes with the gases from the fire, which are thus consumed.

520. VELOCIPEDES, *J. D. Ellson, Coventry.* — 2*nd February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to velocipedes with more than two wheels, and consists in connecting to the crank shaft, in addition to the treadle cranks, a compound crank with two arms at an angle of 45 deg., and connected to a similar crank on the wheel axle by two vertical links, so that the action is similar to an engine fitted with four cranks set at opposite angles to each other.

522. VACUUM APPARATUS FOR EVAPORATING LIQUIDS, *E. Hunt, Glasgow.*—3*rd February*, 1882.—(*A communication from A. R. Mackenzie, Queensland.*)—(*Not proceeded with.*) 2*d.*

The vacuum is produced by the action of sprays or films of cold water on the steam or vapour rising during evaporation or concentration, the water being got out of the condenser by means of a vertical pipe open at the bottom end, and of sufficient length to contain a column of water corresponding to the vacuum.

523. ROUNDABOUTS, *F. W. Woollacott.*—3*rd February*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to give to the carriages a pleasant, smooth, rolling movement similar to the motion of vessels at sea, and consists in causing the carriages to travel on a track formed with regular undulations.

524. VALVE GEAR FOR MOTOR ENGINES, *J. Jensen, Birkenhead, and C. W. King, Liverpool.*—3*rd February*, 1882. 6*d.*

The gear is preferably applied to engines with two

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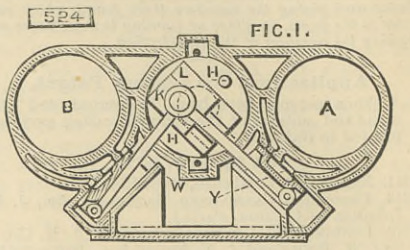
FIG. 1.



cylinders A and B, between which is a steam-space C in which the valve gear works. The shaft D is driven by mitre wheels, and inside the space C is divided into two parts H connected by a crosshead. On H the disc X slides up and down, and is connected to arm R of a bell-crank lever by a link V, the other arm S being connected by link O to the slide K, in which is a pin L. On disc X, which revolves with the shaft, is

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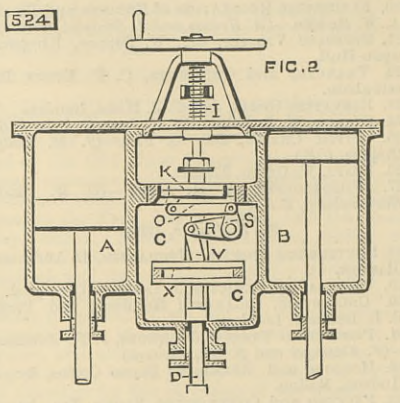
FIG. 2.



a collar G which can be actuated by screw I when required to vary the expansion or reverse the engines. The pin L actuates the valves Y through rods W.

525. BOOTS AND SHOES, *E. Turner-Ross, Hereford.*—3*rd February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in inserting a layer of tin foil or other metal between the inner and outer sole, so as to prevent creaking and the penetration of damp.

526. WEIGHING AND PACKING MACHINERY, *F. Wheeler, Isle of Wight.*—3*rd February*, 1882. 6*d.*

The substance to be weighed and packed falls from a hopper into a measuring chamber and passes through a shoot into a scale, the bottom of which is movable so as to discharge the material into a bag beneath resting on a revolving turntable which carries it to a flap and folder.

527. PRESSING AND BINDING HAY, &c., INTO BALES, *A. Van Wagner, London.*—3*rd February*, 1882.—(*A communication from P. C. Hudson, Fort Dodge, U.S.*) (*Void.*) 4*d.*

This relates, First, to a portable press; and, Secondly, to a stationary press, and it consists in machinery in which the bale is bound by giving it a revolving motion, and when bound it drops away by its own weight.

528. JOINTING PIPES, *J. H. Moore, Bournemouth.*—3*rd February*, 1882.—(*Not proceeded with.*) 2*d.*

One end of each pipe is formed with a rebated socket tapered inside, and at the front end of which is a flange with an undercut groove all round its annular face, into which a compressible ring is sprung. The other end of the pipe has a tapered spigot to fit the socket, and a similar flange with a groove containing a compressible ring. The two flanges are secured together by bolts.

529. CLARIFICATION AND PRESERVATION OF CERTAIN VEGETABLE INFUSIONS, *S. C. Davidson, Belfast.*—3*rd February*, 1882. 4*d.*

Infusions of tea, coffee, cocoa, or ginger are clarified by treating them with tannic acid until a precipitation is produced, which is then removed by filtration or otherwise, after which salicylic acid is added to preserve the infusions.

530. CLARIFICATION AND PRESERVATION OF THE EXPRESSED JUICES OF FRUITS, *S. C. Davidson, Belfast.*—3*rd February*, 1882.—(*Not proceeded with.*) 2*d.*

The juice is expressed from the fruit and filtered, and tannic acid and an aqueous solution of gelatine are added. The precipitate is removed by filtration and salicylic acid added to preserve the juices.

531. SIGNALLING ON RAILWAYS, *J. B. Mayers, Kidderminster.*—3*rd February*, 1882.—(*Not proceeded with.*) 2*d.*

The wheels of a passing train are caused to depress a lever arranged between the rails, and connected by rods to a gong or bell in the signal box.

532. BOILERS FOR HORTICULTURAL PURPOSES, *T. A. Bickley, Birmingham.*—3*rd February*, 1882.—(*Not proceeded with.*) 2*d.*

The boiler consists of a series of pipes slightly inclined and connected to flow and return pipes by socket joints. This boiler is laid above the furnace or in a flue, and connected to a system of hot water piping.

533. APPARATUS FOR THE REDUCTION OF GRAIN, *A. W. L. Reddie, London.*—3*rd February*, 1882.—(*A communication from H. F. Saint Requier, Paris.*) 6*d.*

The apparatus consists of two or more radially grooved metal tables or discs keyed to a vertical shaft and driven at a high speed. Surrounding the periphery of each rotating table is a series of steel blades, presenting a continuous line of perpendicular cutting edges to the grain as it is hurled against them by the centrifugal action of the grooved tables on to the top one of which it is fed, and which when reduced to a certain degree passes by a shoot to the lower table, where its reduction is completed.

534. SIGNALLING ON RAILWAYS, *F. B. Brewer, London.*—3*rd February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in raising the semaphore arms of signal posts by the train as it passes acting on inclined planes, triggers, or other apparatus placed by the side of the rails and connected with the semaphore arms.

535. WINDING YARN OR THREAD, *B. M. Knox, Kilbirnie, N.B.*—3*rd February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates more particularly to means for regulating the building of the thread on the bobbins, and for automatically stopping the motion of any bobbin to prevent the breaking of the thread when there is undue tension on it. The fork to shift the strap is fitted with a weight tending to place the strap on the loose pulley, and when there is undue tension the

thread depresses a spring lever and releases a catch, when the weight shifts the fork. A traversing guide rail regulates the building of the bobbin and is actuated so as to move rapidly when the thread is led on to the top of the bobbin, and slower when laying on the thread at the bottom.

538. IMPROVEMENTS IN ELECTRICAL ACCUMULATORS, &c., *W. R. Lake, London.—3rd February*, 1882.—(*A communication from J. J. Barrier and F. Tourville de la Vernède, Paris.*) 6*d.*

The plates are formed of a lead ribbon, either smoothed, grooved, or perforated; this ribbon is wound upon itself either in circular, square, or other mode. The layers of the ribbon are separated by cement in which the ribbon is wound whilst in a semi-liquid paste. This paste is composed of one part platinised charcoal, one part litharge or very fine powder, and one part glycerine

542. IMPROVEMENTS IN AND RELATING TO APPARATUS FOR REGULATING THE TRANSMISSION OF ELECTRICAL ENERGY, *W. R. Lake, London —3rd February*, 1882. —(*A communication from M. Levy, Paris.*)—(*Not proceeded with.*) 4*d.*

This relates to apparatus for regulating the transmission of electrical energy; also capable of being used as a speed regulator for various machinery.

545. GATE LATCH, *R. Lee, jun., Surrey.—4th February*, 1882.—(*Not proceeded with.*) 2*d.*

A frame carrying a wheel is fixed to the gate-post and has teeth on its periphery, a slot to receive a finger on the gate, and another slot to receive a vertical locking bolt moving in the frame.

546. IMPROVEMENTS IN ELECTRIC FOG SIGNALLING ON RAILWAYS, *E. Moxon, Tunbridge Wells.—4th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a means whereby a gong is sounded on an engine approaching a signal, by the completion of an electric circuit between a certain point on the rails, from whence a wire leads to the signal and a battery and the engine gong.

547. ILLUMINATION LAMPS, *J. Pain, Walworth-road, and W. H. Gritton, Blackfriars.—4th February*, 1882. 6*d*

This consists in the manufacture of such lamps by blowing, and finishing the same in moulds formed in two or more parts hinged together, so as to enable the lamps to be removed when finished.

548. APPARATUS FOR USE WITH STOVES, &c., FOR GENERATING MEDICINAL VAPOURS, *R. George, Tufnell Park.—4th February*, 1882 —(*Not proceeded with.*) 2*d.*

This relates to the arrangement with heating and ventilating stoves of apparatus containing sea moss or seaweed together with sea or other water, so as to generate and diffuse medicinal vapours in the room where the apparatus is used, to serve as an equivalent for sea air for the benefit of invalids and others.

549. BLEACHING FIBROUS MATTER, &c., WITHOUT THE EMPLOYMENT OF CHLORINE, *P. Thomas, Germany.—4th February*, 1882. 4*d.*

This consists in treating the fibrous matter, after having been boiled in caustic soda, first, in a bath of permanganate or hypermanganate of potassa; and, secondly, in a bath of sulphuretted borax.

550. VELOCIPEDES, *R. Harrington, Wolverhampton, and T. Fuller, Southwark.—4th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates, First, to "double driving," mainly applicable to tricycles; and Secondly, to the construction of a chain for transmitting motion in velocipedes.

554. CONCENTRATING MILK, *F. Springmuhl, M.D., Ph.D., Gower-street.—4th February*, 1882. 4*d.*

This relates to apparatus for concentrating milk so that the fat globules are not separated therefrom, and it consists in evaporating the water from the milk in a vacuum pan provided with lens-shaped vessels connected to a hollow axle, and caused to revolve slowly, steam being first passed through these vessels, so as to assist the evaporation, and afterwards cold water to cool the concentrated milk.

555. CONDENSED GRAPE JUICE OR MUST, *F. Springmuhl, M.D., Ph.D., Gower-street.—4th February*, 1882. 4*d.*

The juice expressed from grapes is treated in a centrifugal machine, and then passed through wire sieves, and the pure grape juice thus obtained is heated slightly in steam-heated vessels, and finally 80 or more per cent. of its water is evaporated in a vacuum pan constructed as described in patent No. 554, A.D. 1882—at the lowest possible temperature, which should not exceed 100 deg. Fah.

556. WINDOWS, *E. and J. M. Verity, and B. Banks, Leeds. 4th February*, 1882. 6*d.*

This relates to sliding sash windows, which are also made to swing for the purpose of cleaning and ventilation, and it consists in making the sash frames of two separate frames, one sliding up and down in the usual way, and the other pivotted inside the former, so as to be capable of swinging on the pivots when required. Means are also described for preventing the opening of such sashes, and also for opening them to various degrees on their pivots without the use of radius rods or quadrants.

557. DYEING YARNS IN THE COP OR ON BOBBINS, *F. A. Gatty, Accrington.—4th February*, 1882. 4*d.*

This consists in treating yarns in the cop or on bobbins so as to take away their natural water repellent property, and it consists in impregnating the yarns with saccharine and gummy matters, or other matters which will cause the yarns to absorb liquids.

558. GAS FIRES, *G. W. Wigner, London.—4th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the construction of a gas-burner for open stoves, and in filling such stoves with non-combustible radiating material, consisting of clay and sawdust mixed together with water, a suitable fibrous matter being added thereto.

559. IMPROVEMENTS IN PRINTING TELEGRAPH APPARATUS, *W. R. Lake, London.—4th February*, 1882.—(*A communication from La Société Secondo Roos and F. Ostrogovich, Florence, Italy.*) 8*d.*

This relates to improvements on the "Hughes" telegraph with type wheels, and has for its object the increasing of the speed of transmission; to enable printing by continuous movement and correction for each letter printed to be obtained without lessening the duration of the line current; to make the duration of the current sufficient for communicating directly at any distance, and still preserve the same time for the mechanical movements. To accomplish these ends the inventor makes the operation of the apparatus automatic and increases the number of alphabets on the type wheel, arranging the chariot accordingly. The automatic movement is obtained by a perforated paper band which establishes the communications in the distributor, so that on the passage of the chariot the disengaging of the apparatus takes place at the instant desired for the impression of the letter.

560. BOILERS, CONDENSERS, &c., *J. S. Williams, Riverton, U.S.—4th February*, 1882. 4*d.*

This consists in coating the surfaces of boilers and other vessels of iron or steel with another metal or metallic alloy, by the reduction to a metallic state of metals or alloys from their salts or oxides, or both, by exposing such surfaces to the fumes which are caused to rise from the moistened metallic salts or oxides, through the agency of an electric current or otherwise.

561. DUST COLLECTORS FOR MILLS, &c., *P. van Gelder, Sowerby Bridge.—6th February*, 1882. 6*d.*

The apparatus is intended to supersede the ordinary stive room, and it consists of an apparatus through which the currents of air in passing are caused to bend sharply round, allowing the larger particles to separate by their impetus at this point, and also causing the dusty air to pass upwards through corrugated air filters armed with shaking mechanism, which operates at stated intervals, at the same time as the entrance and exit passages are closed, and other passages opened to allow a current of air to pass through the filters in the opposite direction, so as to clean them.

562. VELOCIPEDES, *E. R. Settle, Coventry.—6th February*, 1882. 4*d.*

This relates to a method of making the handle of bicycles easily detachable, and consists in making the steering head with a half-socket to receive the handle, and a corresponding loose half-socket capable of being screwed or bolted over the same.

564. FLOATING COFFER DAMS, *H. H. Lake, London.—6th February*, 1882.—(*A communication from H. P. Kirkham, New York.*) 6*d.*

This relates more particularly to cofferdams employed to surround parts of a vessel's hull under water when required to be repaired, and it consists in providing a coffer dam with balancing water tanks with watertight partitions dividing each tank, and inlet valves and openings to fill or free them from water, in combination with an angular opening at one end of the dam having hinged doors fixed to the sides, a sliding gate being provided to close the angular opening and secure the hinged doors.

565. PACKING PHOTOGRAPHIC GLASS PLATES AUTOMATICALLY, *A. Cowan, Bayswater.—6th February*, 1882.—(*Not proceeded with.*) 2*d.*

A rectangular box has an opening in the lid, and on each side of it are placed sliding pieces, above which is a strip of paper held in position by a hinged frame, with roller to regulate the paper, and having also on each side a hinged plunger to drive the plate through the opening.

566. FIREPLACES, *T. Redmayne, Sheffield.—6th February*, 1882.—(*Not proceeded with.*) 4*d.*

This relates to grates in which fresh fuel is supplied beneath that already in the grate, and consists in the use of two sets of bars capable of being partially revolved, and one set of which lifts the fuel, while the other set is lowered to receive the fresh fuel.

567. BLASTING, *E. S. Clark, Denbigh.—6th February*, 1882. 6*d.*

This relates to a compound to be used as a lining for the blast holes, so as to absorb the flames arising from the explosion of the blasting charge; and consists of 90 per cent. soda crystal; 7 per cent. chalk, marble, or lime; 2 per cent. peroxide of manganese; and 1 per cent. soap.

568. CHIMNEY COWLS, *C. D. Abel, London.—6th February*, 1882.—(*A communication from H. Hahn, Berlin.*)—(*Not proceeded with.*) 2*d.*

A revolving elbow pipe has attached to its outer end one or more conical fustra, so that its mouth is centrally within the first frustrum, the largest end of which is presented to the mouth, whilst its smaller end enters the larger end of the next frustrum.

569. ROPES, *S. Simmons and J. Tullidge, London.—6th February*, 1882.—(*Not proceeded with.*) 4*d.*

This consists in interlacing or plaiting the strands of ropes so that any number of offsets can be made from such ropes without severing the strands, which will be continuous and the offsets not need joining on.

570. PURIFYING GASES AND CONDENSING VAPOURS, &c., *W. S. R. Jackson, Glamorgan.—6th February*, 1882. 6*d.*

The gases or vapours are caused to pass under a level or slightly inclined shelf placed in contact with a surface of water or other liquid, between which and the shelf the gases pass in thin films.

571. FULLING OR MILLING MACHINERY, *J. W. Crawford and W. Mellor, Leeds —6th February*, 1882. 4*d.*

This relates to apparatus for fulling or milling woven fabrics; and consists in reducing the friction between the guide board and the cloth, at the same time keeping the piece straight in its passage through the machine. The ordinary knocking-off board is provided with a pair of rollers of small diameter, between which the fabric passes.

572. DRYING WOOL, COTTON, &c, *J. Shaw, Huddersfield.—6th February*, 1882. 6*d.*

The wool or other fibre is thrown on to an oscillating inclined sheet or grate by a revolving wheel or travelling apron, and sliding down the sheet drops off on to a second oscillating inclined sheet placed at an opposite angle, from which the wheel again lifts it to the top sheet, the action being repeated until the wool is thoroughly dry.

573. SWELLS FOR SHUTTLE-BOXES, *W. Haythornthwaite, Blackburn.—6th February*, 1882. 6*d.*

The object is to provide durable bearings for the swells and in which the wear can be readily taken up, and it consists in forming in the base of the swell a groove of angular or semicircular section, and securing to the back board a bracket with a projection to fit the groove, and thus form the bearing on which the swell vibrates. The base of the swell enters a recess in the backboard.

574. COMPOSITION TO PREVENT INCRUSTATION AND CORROSION IN STEAM BOILERS, &c., *J. Pover, Liverpool.—6th February*, 1882. 4*d.*

One part of best quality of soda ash is added to one part of best quality soda crystals, one part second quality soda ash and one part of best lime. The whole is boiled in one part fresh water, and when cold one part liquid zinc is added.

575. PURIFYING AND STORING WATER IN MAIN SERVICE FILTERS, *H. R. Lipscombe, Oxford-street.—6th February*, 1882.—(*Not proceeded with.*) 2*d.*

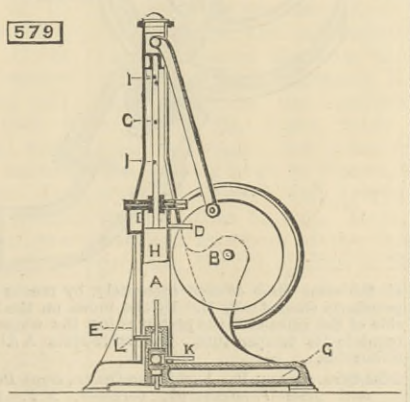
This consists of a cylinder containing another cylinder attached to the supply pipe. The water entering at bottom, and passing through the filtering medium, is allowed to flow to the place where it is to be used.

576. ROLLERS FOR ROLLING LAND, *W. Barford, T. Perkins, and E. J. Chambers, Peterborough.—6th February*, 1882. 6*d.*

This relates to rollers to be loaded with sand, water, or other ballast, and consists in casting them with their ends solid and in one piece therewith. In each end a hole is formed with inside and outside covers to close them.

579. GAS ENGINES, *J. H. Johnson, London.—7th February*, 1882.—(*A communication from A. de Bisschop, Paris.*) 8*d.*

This relates to improvements on patent No. 4342, A.D. 1875, and it consists in arranging the driving shaft B at the side of the cylinder A instead of at the



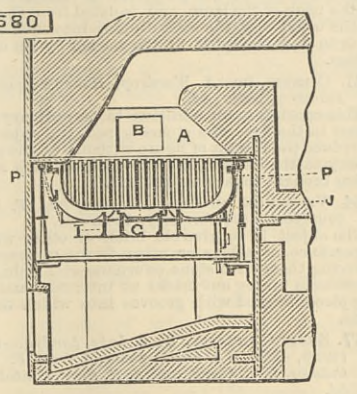
side of the piston rod C, so as to obtain an increase in the length of the stroke, and by increasing the length of cylinder the surface of the cooling or radiating wings on the cylinder can be increased, and the gas more advantageously utilised. D is the air inlet to pump. E is a pipe leading from the pump to reservoir G for compressed air, and which is fitted with an escape valve and a compressed air valve. H are orifices by which water is injected into the cylinder to cool the same. I are orifices in the hollow piston rod C to regulate the compression of the air; K is the gas inlet, and L the compressed air inlet to the cylinder. An improved governor is described to limit the admission of gas to the cylinder.

577. COCKS OR VALVES, *T. Morgan, London.—6th February*, 1882.—(*A communication from La Société Anonyme de Produits Chimiques, Paris.*) 6*d.*

This consists in forming the plug of the cock or valve of a ring or segment split vertically or in the direction of its axis in a plane perpendicular to the line of the ports, so as to enable the fluid under pressure to enter the interior of the plug and press it against its seat, for which purpose, when closing the valve, the plug is turned so as to bring the slit opposite the supply pipe.

580. FURNACES, *W. Morgan-Brown, London.—7th February*, 1882.—(*A communication from A. C. Felton, Massachusetts, U.S.*) 8*d.*

The object is to prevent the formation of clinkers on the furnace walls and to produce more perfect combustion of fuel. The fire-chamber A and fuel-supplying opening B and the ashpit may be of any suitable form. The main horizontal grating G is supported on bearing bars I, resting on piers at the ends of the ash-pit. The side walls of the fire-chamber are inclined



inwards and upwards from the grating, so as to reduce the pressure of fuel on the side walls and prevent adhesion of clinker thereto. The sides of the fuel space are formed by the curved bars J supported at top on a bar extending across the furnace, and the end bars are similarly arranged. The dampers P regulate the passage of air through the side and end bars.

581. TREATING FIBROUS PLANTS FOR PAPER MAKING, *C. D. Ekman, Sweden.—7th February*, 1882. 4*d.*

This relates, First, to the production from flax stalks and other fibrous vegetable substances of ultimate fibres of practically pure cellulose by one operation of boiling under pressure in solutions containing sulphurous acid and magnesia or soda; Secondly, the production from alfa esparto, and similar vegetable substances of paper pulp consisting of practically pure cellulose by one operation of boiling under pressure in solutions containing sulphurous acid and magnesia or soda; Thirdly, the production from vegetable fibrous substances of fibres or filaments by boiling under pressure with sulphite of magnesia or soda; and Fourthly, the production from fibrous vegetable substances of fibres by boiling under pressure with sulphurous acid and magnesia or soda in sufficient quantity to form the sulphite of the base.

582. SEWING MACHINES, *J. Hill, New Oxford-street.——7th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to means for stitching the edges of cloth with a uniform length of stitch and making the seam straight, and also in making button-holes of a uniform size, and to holding buttons while being sewn. The material is secured between clamping plates formed with notches on the edges, opposite each of which the needle and thread of the sewing machine is inserted. Holes are made in the plates corresponding to the size and shape of the button-holes to be formed.

583. TRICYCLES, *B. Roberts, Wolverhampton.—7th February*, 1882. 6*d.*

This relates, First, to constructing tricycles, so as to enable them to fold up or collapse; Secondly, to a novel method of mounting and actuating the steering wheel; and Thirdly, to the construction of the brake.

585. METERS FOR GAS, &c., *W. Airy, Westminster.—7th February*, 1882.--(*Not proceeded with.*) 4*d.*

The meter for measuring fluids of small specific gravity by means of a fluid of greater specific gravity, consists of a measuring drum composed of an outer cylinder connected by three spiral threads with an inner cylinder or core, forming altogether an archimedean screw, the core of which is hollow and open at its ends. The revolutions of the drum are registered by a counter connected by a vertical shaft and a toothed wheel with a worm keyed to the axle of the metal.

586. LASTS FOR SHOES, *J. L. Sharman, Northampton.—7th February*, 1882. 6*d.*

In order to enable the uppers of shoes to be made small at the ankle, and yet allow the last to be withdrawn, the latter is formed with an inclined transverse division starting from the back of the heel at top and carried in a diagonal direction to the forward part of the instep on the underside of the foot.

587. SUSPENDED LEVER WEIGHING MACHINES, *T. Williams, jun., London.—7th February*, 1882. 6*d.*

This relates to weighing machines on the steelyard principle without loose weights, and it consists of a steelyard preferably of round tubing, in combination with which is a transfer lever connected by a shackle thereto, and provided with knife edge centres working on loose self-adjusting swivelling bearings working in hollow cups in the bottom of a rectangular frame, completely enclosing the whole of the working part, and left open at one side to adjust the sliding weights. The fulcrum of the lever is underneath the steelyard and at a point midway between the fulcrum of the latter and its free end.

588. TREATING GRAIN, *W. B. Dell and J. F. Stewart, London, and E. Davies, Cheshire.—7th February*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to split wheat in the crease of the grain so as to remove the germ and the dust that lodges in the crease, and it consists in the use of two rollers, one having a series of longitudinal recesses large enough to receive the grain, while the other has a number of corresponding sharp projections or cutting edges.

589. REFRIGERATORS, CONDENSERS, CALORIFERS, AND VAPORISERS, *G. Lawrence, London.—7th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in the building up of pieces of corrugated metal in pairs, with hinged or detachable ends to serve as inlet or outlet, or both, or to close up and act as stay and distance pieces.

590. REEDS AND REED PLATES FOR MUSICAL INSTRUMENTS, *W. R. Lake, London.—7th February*, 1882. (*A communication from M. Bray, Boston, U.S.*)—(*Not proceeded with.*) 2*d.*

It consists in making a reed and its plate, made in one piece, from a piece of metal by subjecting the same to pressure, to sink the recess to form the throat, and to condense and harden the metal covering the throat, and from which the tongue is to be formed, and then milling or otherwise cutting away portions of the metal upon the side opposite the recess, to separate the reed from the plate along its two sides and one end.

591. FASTENER FOR THE STOPPERS OF BOTTLES, &c., *W. R. Lake, London.—7th February*, 1882.—(*A communication from C. Renauld and M. B. Stafford, New York.*)—(*Not proceeded with.*) 2*d.*

A cap with slots formed in its edges is placed over the cork, and a revolving ring is placed on the neck of the bottle, and lugs formed on it engage with the slots in the cap.

592. TREATING WHEAT PREPARATORY TO GRINDING, *J. A. A. Buchholz, Vauxhall.—7th February*, 1882. 6*d.*

The object is to loosen the natural cohesion which exists between the cuticle of the grain and its flour-forming body, the gluten and starch cells, while toughening the cuticle or bran; and it consists in suitable means whereby the damping process may be regulated so as to avoid any injury being done to the grain, the artificial moisture to effect this being introduced during the process of scouring or screening the wheat. The wheat cleaning machine described in patent No. 1463, A.D 1880, is preferably employed, and in each scouring compartment are fitted rings of perforated pipes to discharge jets of steam or water therein as required.

593. TREATING COAL FOR TRANSPORT AND STORAGE, *T. Rowan, London.—7th February*, 1882. 4*d.*

The object is to prevent the spontaneous ignition of coal, and consists in subjecting the coal in shallow trucks with open bottoms to the action of air heated to about 150 deg. Fah. prior to transport or storage.

594. WASHING, WRINGING, AND MANGLING MACHINES, *H. L. Wilson and J. Clegg, near Accrington.—7th February*, 1882. 8*d.*

This relates to improved end frames for such machines, and to an improved adjustable and folding table and combined guide board to be used when mangling and when wringing.

595. WELDED BOILERS, *Z. Sugden and E. Binns, Halifax.—7th February*, 1882. 8*d.*

This relates to a vertical jacketted tubular boiler wherein great heating surface and a thorough circulation of the water are secured. In boilers for heating water the outer jacket or water space is preferably in the form of a taper or conical cylinder, the upper and lower water ways extending internally and forming annular water ways which are connected at intervals by a number of water way tubes extending round the greater portion of the annular water ways, and the space enclosed by them forms the fire-box, the heat from which acts both on them and on the outer water way or jacket.

596. DELIVERING AND RECEIVING SHEETS OF PAPER FROM RULING MACHINES, *W. C. Pellatt, London.—7th February*, 1882.—(*Not proceeded with.*) 2*d.*

The sheets are delivered from the machine by the bottom canvas and top cords, which, as the latter overlap the former, curve the sheet down upon the receiving board and cause it to slide down at the precise rate at which the machine is working. The board is suspended by weights and cords, so as to be lowered as the sheets accumulate, and thus keep the level constant.

597. FASTENINGS FOR LIDS OF MILK CANS, *E. G. C. Bomford, Worcestershire.—7th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in the application of a piece of paper to the fastening, the tongue of which, when the lid is removed, cuts a nick or slot in the paper, thereby showing that the can has been opened.

598. BREAD MAKING, *A. M. Clark, London.—7th February*, 1882 —(*A communication from Dr. T. H. Poupon, Paris.*) 4*d.*

This relates to a process of making bread without kneading the dough, and it consists in introducing into the flour a solution of elements capable of producing alcohol and carbonic acid in proportions identical with those of the ordinary process, and at the same time introducing an antiseptic agent which prevents the decomposition of the flour.

599. RAILWAY SIGNALS, *A. Gough, Buckingham.—7th February*, 1882. 4*d.*

This relates to working the signals automatically by passing trains, and consists in causing a roller mounted under the guard's van or other carriage to depress an arm connected with the signal, which is thus raised, while the arm of the signal last passed is released and falls.

600. TRICYCLES, &c., *J. G. Smith, Eccles.—8th February*, 1882. 6*d.*

This consists principally in lengthening the rods of the pull handles, and attaching them by connecting rods to the cranked shaft of the machine, so that the rider may use both hands and feet to propel the vehicle.

601. RIBBED FABRICS, *C. H. Openshaw and C. H. Rothwell, Bury.—8th February*, 1882. 6*d.*

This relates to the ribbed fabric known as "cord," and it consists instead of raising one or other of the two warp threads known as face ends between each float of six or four, as the case may be, in raising one, falling one, and raising one again, alternating this more or less frequently with the ordinary system referred to. By this means a very small subsidiary cord is formed between each large cord or rib.

602. JOINTS OR PACKINGS FOR PROVISION RECEPTACLES, &c., *H. J. Haddan, London.—8th February*, 1882.—(*A communication from Dr. B. Kraus, Vienna*)—(*Not proceeded with.*) 2*d.*

The object is to make such joints hermetic, waterproof, and non-combustible, and it consists in introducing between the parts to be joined a liquid mixture of powdered alabaster or gypsum with gum, drying it by contact with air, carefully spreading over it a strip of gummed paper or lead sheet, leaving it to dry for several hours, and then applying a layer of picture varnish.

603. PROPELLERS FOR VESSELS, *G. C. Parini, Lombardy.—8th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the use of two reciprocating propellers, which are moved in opposite directions, and which as they push against the water, are caused to expand or open out, and when they are drawn back collapse or shut up.

604. DECORTICATING TEXTILE PLANTS, *A. Berthet, Paris.—8th February*, 1882. 2*d.*

This consists, First, in breaking or crushing the stalk or leaves of such plants by passing them through fluted rollers, so as to crush and disintegrate the ligneous and pulpy parts; and Secondly, in then bringing the stalks or leaves in contact with a drum having blades or knives arranged round its periphery, and which turns very truly against a curved wooden board, between which and the drum the stalks and leaves are caused to pass, and thereby deprived of all foreign matter.

605. REFRIGERATING MACHINES, *G. Barker, Birmingham.—8th February*, 1882.—(*A communication from J. Chambers, New Zealand.*) 6*d.*

As applied to "cold air machines," the compression pump is arranged to work without suction valves, and with yielding cylinder covers forming valve seats for the discharge valves. The cylinder is jacketted, and can work with or without injection, the cocks for which are applied within the water space surrounding the cylinder. The expansion cylinder has rotary valves arranged so air that enters and is discharged through one port at each end and at the bottom of cylinder. Of each pair of excentrics, one is fast on crank shaft and the other loose, but secured to the fast one so as to admit nice adjustment. The condensers or air coolers are cylinders containing groups of U bent tubes, with a dividing partition between their legs, so as to cause the cooling medium to flow up and down in the opposite direction to the current of air or vapour in the tubes.

606. FLUID METER, *C. D. Abel, London.—8th February*, 1882.—(*A communication from A. Kaiser, Berlin.*) 6*d*.

A cylindrical case contains in its lower part a chamber with a tangential passage having at one end the inlet opening, and at the other the outlet for the fluid. In this chamber is arranged a horizontal vane wheel projecting somewhat into the passage, so that the fluid striking against it causes it to revolve, its motion being transmitted to a counter in the upper part of the case.

607. IMPROVEMENTS IN TELEPHONE TRANSMITTERS, *R. and M. Theiler, Islington, London.—8th February*, 1882.—(*Not proceeded with.*) 2*d*.

This invention relates to improvements in microphones, whereby no diaphragm is used at all, but the vibrations are caused to impinge upon any substance capable of transmitting such vibrations in a longitudinal direction, as, for instance, cane. A series of microphone contacts are fixed on the opposite end or cross cut of the cane, and connected with a battery as usual.

608. TRICYCLES, *J. Beeston, Lymington.—8th February*, 1882. 4*d*.

This relates to the application of a spring motor to tricycles so as to render them wholly or partially self-propelling.

610. WATCHMAKERS' TOOLS, *D. L. Petitpierre, Switzerland.—8th February*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to a watchmaker's lathe, and it consists of a horizontal shaft driven by a pulley. A face plate carrying grippers is fixed on a stud fitted to the end of the horizontal shaft. The pin has a groove to receive an adjustable screw, by means of which the face plate is fixed in position. All the face plates have a pin to fit the central shaft, and a conical end and a groove to receive the screw.

611. CAPSULES FOR BOTTLES, *E. Belmer, Islington.—8th February*, 1882. 8*d*.

The object is to produce ornamental and trade-mark capsules, and consists partly in the application of various different coloured lines or devices extending longitudinally along the plain sides of such capsules either in a vertical, oblique, or slightly spiral direction, the top or sides being afterwards embossed in the usual manner. For this purpose a dividing plate is mounted on the spindle carrying the capsule mandrel, and a thin flexible shield or stencil plate is hinged to an adjustable table beneath. The spindle and its mandrel and capsule is rotated step by step, and the design in the stencil plate is marked on the capsule with different colours at each step by passing a colouring roller over the design. The invention also relates to apparatus for colouring the raised portions of the devices embossed on the capsule.

612. TREATMENT OF DANGWAY BEANS TO MAKE A BEVERAGE, *R. R. Carew, Watford.—8th February*, 1882.—(*A communication from E. B. Sladen, R. McLeod, and C. H. White, British Burmah.*) 2*d*.

Dangway beans or seed, otherwise known as the cassia tora, are roasted and ground and used to prepare an infusion to be used as a substitute for coffee or like drinks.

613. SIGNALLING ON RAILWAYS, *J. White, Bermondsey.—8th February*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to bells or gongs to be sounded by passing trains so as to warn the drivers when the ordinary signals are not visible, and it consists in causing a lever actuated from the signal-box to project above the rails, so that the wheels of a passing train will depress the same and cause the bell or gong to sound.

615. WINDOW SASH AND DOOR FRAMES, *J. H. Miles, Southampton.—8th February*, 1882. 6*d*.

This consists in making window sash and door frames in separate parts of wrought or cast metal, so that they may be readily put together, united, fixed, and built up in their places as the building progresses.

618. BICYCLES, &c., *G. W. Ash, Southsea.—8th February*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to means for adjusting the seat or saddle and thereby at the same time apply pressure to actuate the brake in order to reduce the speed or stop the machine and prevent the pressure coming off when once applied, until it is desired.

619. EXPLOSIVES, *W. F. Reid, Stowmarket; and D. Johnson, Chester.—8th February*, 1882. 2*d*.

This relates to means for hardening the grains of explosive powders containing nitro-cellulose or other solid organic nitro compounds, so as to produce a powder of hard and uniform grain, the use of which is free from irregularities due to the variations of pressure in loading cartridges and guns. The granulated powder is moistened with ethylic or methylic ethers or alcohols, so as to saturate it, after which it is dried, the volatile portions being recovered and used again.

620. TRIPLE ALLOYS OF MANGANESE, *G. Scott, London.—8th February*, 1882. 6*d*.

The triple alloys consist of manganese, the titaniferous steel sand of Tarandki and other places in New Zealand, and carbon known under the names of speigeleisen and ferro-manganese.

621. IMPROVED SYSTEM OF EFFECTING AND MAINTAINING THE CONTINUITY OF DIVIDED AND SUBDIVIDED ELECTRIC CURRENTS FOR LIGHTING PURPOSES, &c., *J. B. Rogers, London.—8th February*, 1882. 6*d*.

A series of negative and positive wires radiate from one central power generating station, and their terminals are connected with other stations, which are also in connection with the several stations of that series, and so on to other series of stations.

622. INCREASING THE DURABILITY OF LEATHER SOLES, *E. A. Bridges, Berlin.—18th February*, 1882.—(*A communication from Heller and Atzler, Saxony.*) 4*d*.

This consists in applying two coats of a mixture consisting of fifty parts linseed oil, ten parts silicate of potassa or silicate of soda, and forty parts finely powdered emery to the soles.

623. COOKING STOVES, *H. Leggott, Bradford; and E. Marsh, Leeds.—9th February*, 1882.—(*Not proceeded with.*) 2*d*.

Near the bottom of the grate is an opening into a flue communicating with the chimney flue, through which the heated gases from the fire are made to pass, and the smoke from the fuel having to pass through the fire to the opening is thereby consumed.

624. DRAW-BAR AND COUPLING APPARATUS, *S. J. Humble and J. Walker, Derby.—9th February*, 1882. 8*d*.

The pin which secures the shackle to the draw-bar hook is lengthened and passes through the heads of two side safety pins, which are passed transversely through the buffer plank and fitted with a metallic or other spring. If the draw-bar breaks the vehicle will still be drawn by the safety pins without undue strain. Several modifications are described.

625. FIRE-GRATES, *J. Winfield, Derby.—9th February*, 1882.—(*Not proceeded with.*) 2*d*.

The air to support combustion enters at the front of the grate and passes on the floor under the grate into a cold air chamber at the back of the fire, whence it passes through a perforated fire-brick back to the top of the incandescent fuel in the grate.

626. IMPROVEMENTS IN ELECTRIC LAMPS, *A. A. Common, Ealing, Middlesex.—9th February*, 1882. 6*d*.

The improvements consist in the use of an upper carbon holder of steel tubing, which is lifted, to establish the arc, by the action of the core of a solenoid combined with a plate lever working on a variable fulcrum together with a clutch and toe piece. To prevent the too sudden drop of the upper carbon when its holder is released by the toe piece, the inventor uses a governor either in the form of a cataract, by filling the upper portion of the tube with mercury and using a rod and piston, or by means of a train of gear wheels and pinions, the differential motion of which sets a fan in rapid motion.

628. TWIN-SCREW SHIPS, *T. R. Oswald, Southampton.—9th February*, 1882. 6*d*.

This relates to improvements to twin-screw ships, and more particularly to the kind described in patent No. 4647, A.D. 1881, and it consists in forming in the vessel apertures or frames to receive the screws, and so situated that the screws may revolve in the same vertical plane, or in planes one of which is more forward than the other in relation to the ship.

629. SIGNALLING ON RAILWAYS, *J. W. Webster, Littleborough, J. Hill, Rochdale, and F. T. and T. Greenwood, Smithy Bridge, Lancashire.—9th February*, 1882. 6*d*.

This relates to apparatus for signalling on railways, and which is also applicable for telephonic or electrical purposes. When applied for railway signalling the apparatus can be connected to the engine, carriages, or guard's van. An inclined rod is laid down parallel with the rail for a certain distance, and a roller mounted on the engine or carriage is raised in passing over it, and actuates a signal on the engine or carriage, while the rod is depressed and actuates a signal in the signal box. The roller in rising might also be made to shut off steam and apply the brakes, and also to start the engine.

630. LAMPS FOR PETROLEUM AND MINERAL SPIRITS, *S. Pitt, Sutton.—9th February*, 1882.—(*A communication from H. Peigniet, Paris.*) 6*d*.

This relates to the storing in the lamp of the spirit with which the lamp is fed, and it consists in forming the reservoir at the bottom of the lamp, and from which it is raised by a pump into a chamber situated in the neck of the lamp, and isolated from the burner in the usual way, the wick dipping into such chamber so as to lead the spirit to the burner by its capillary action.

631. CORSETS, &c., *A. Wardrop, Hanover-square.—9th February*, 1882. 4*d*.

This consists in an addition to an ordinary stay or corset in the form of a stomach pad, the object being to reduce the fulness of figure without undue pressure in any particular part, a strap secured with a buckle being brought to bear on the pad.

634. VENEERING OR FACING WALLS, &c., *T. Brindle, Southport.—9th February*, 1882. 6*d*.

The object is to give old brick or other walls the appearance of ashlar or other forms of masonry by covering them with stone or ornamental slabs, and it consists in taking out bricks at intervals, and inserting pieces formed with grooves into which the slabs slide.

637. SHAFT COUPLINGS, *W. R. Lake, London.—9th February*, 1882.—(*A communication from F. O. Deschamps, E. L. Clark, and E. H. Burr, United States.*) 6*d*.

The coupling is divided longitudinally, so as to form two sections, each composed of a solid central part, semi-spherical ends and flanges. The two spherical sockets formed at each end when the two sections are joined together each receive a sphere keyed to the shafts to be coupled, and screwed pins pass through the coupling and secure the spheres in position.

638. REFRIGERATING APPARATUS TO BE USED ON RAILWAYS, *J. J. Coleman, Glasgow.—10th February*, 1882. 6*d*.

This relates to improvements on patents No. 1034, A.D. 1877; No. 3862, A.D. 1878; and No. 4191, A.D. 1879; and consists principally in so arranging the parts as to make the apparatus conveniently locomotive, being carried on a framing with wheels and adapted to form part of a railway train.

639. PROMOTING ECONOMY IN CONSUMPTION OF FUEL IN FURNACES, AND LESSENING EMISSION OF SMOKE, *J. W. Wood and J. Greenwood, Oldham.—10th February*, 1882.—(*Not proceeded with.*) 2*d*.

This relates principally to furnaces of steam generators, and consists in supplying a portion of the heated gases after they have passed through the flues in the boiler seating to the furnace, either below the grate or at the bridge. A fan or blower is employed to supply these gases to the furnace.

640. STAMPING MACHINES, *J. G. A. Haller, Hamburg.—10th February*, 1882. 6*d*.

The letters or other articles to be stamped are heaped near a platform, above which an endless chain provided with flexible fingers runs over rollers driven by hand or power. The fingers catch the upper letter, guiding it over a roller rotating in the opposite direction to the chain roller, to which an intermittent rotation is communicated. A fork connected with a lever is raised and lowered from and to the roller, and retains the letter while the stamp imprints the mark. The die of the stamp is backed with an elastic cushion.

641. COPYING PRESSES, *S. Mart, Sutton-at-Hone, Kent, and C. W. Bradley, London.—10th February*, 1882.—(*Not proceeded with.*) 2*d*.

The inside of the case contains a movable plate beneath which is a bag connected by a tube to a water supply, and which when expanded by the pressure of water raises the plate and exerts the necessary pressure on the copying book placed in the case.

643. APPLIANCES APPLICABLE TO GAS BURNERS FOR TURNING-OFF GAS, &c., *Honourable J. W. Plunkett, Kent.*—10*th February*, 1882. 6*d*.

This consists in mounting a metallic bar above the gas flame, one end of such bar being supported by a pivotted lever, the other end of which supports the gas supply cock in its open position. Should the flame be extinguished the metallic bar contracts, whereby the lower end of the pivotted lever releases the gas supply cock, which is then closed by a weight or spring.

646. COMPOSITION FOR THE PROTECTION OF WOOD, METAL, OR OTHER MATERIALS FROM FIRE, &c., *H. H. Lake, London.—10th February*, 1882.—(*A communication from J. Wildi, Switzerland, and J. Schambeck, Munich.*)—(*Not proceeded with.*) 2*d*.

This consists in coating the material to be protected with a composition consisting of 20 parts finely ground glass, 20 parts finely ground porcelain, 20 parts of any kind of powdered stone, 10 parts burnt lime, and 30 parts silicate of soda of from 36 to 42 per cent. as generally used.

647. PREVENTING THE FOULING OF VERTICAL SOIL PIPES, *C. Slagg, Leeds.—10th February*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in directing the soil towards the centre of the vertical pipes by means of tapered pipes inserted therein immediately below the inlet of the soil, which in falling down is thus prevented from touching the sides of the vertical pipes.

651. PAPER KNIVES, ERASERS, BUTTON-HOOKS, &c., *C. H. Wood, Sheffield.—10th February*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in making the handles of such knives of metal cast round the tang of the blade.

652. LIFTING APPARATUS FOR STONES, BRICKS, &c., *J. Stainer, Heckmondwike, Yorks.—10th February*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in the use of a ladder, at a certain height of which a frame is placed carrying pulleys, over which a rope passes and carries a basket at each end. The labourer fills the bottom basket, carries a load up the ladder with him, and then, having discharged his load, enters the top basket, when his weight will raise the bottom basket with its load.

653. COMPOUNDS FOR BLEACHING, &c., *J. Young, Kelly, N.B.—10th February*, 1882. 2*d*.

A solution of chloride of lime is first decomposed by means of an alkaline sulphate, and then after having effected the precipitation of the greater proportion of the lime as sulphate of lime, the residual lime or magnesia existing in solution is precipitated by means of alkaline carbonate.

654. LINING FOR VENT FLUES OR CHIMNEYS, *F. Fraser, Aberdeen.—10th February*, 1882. 6*d*.

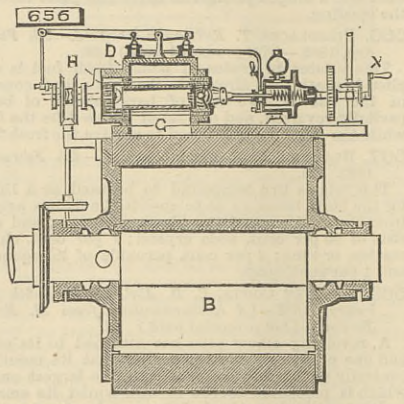
The object is to prevent the adhesion of soot to the inside of chimneys or flues, and consists in forming the clay of which they are formed with annular corrugations or ridges on its inner surface.

655. MACHINERY FOR EXCAVATING, &c., *P. W. D'Alton, London.—10th February*, 1882. 10*d*.

This consists in substituting direct-acting cylinders and pistons for the toothed gearing and chains usually employed to effect the various motions required in excavating machines, the pistons being driven by fluid pressure. These pistons are by lever connections, and by an upright swinging post, made to actuate the scoop or other excavating tool, so that the latter may receive a forward digging or cutting motion, and if desired in a more or less upward or downward direction, a receding motion to get clear of the face of the material acted upon, a swinging motion round the post, and in some cases a partially rotating motion.

656. SUPPLY AND CUT-OFF APPARATUS FOR STEAM ENGINES, *A. Brossard, Swansea.—10th February*, 1882. 6*d*.

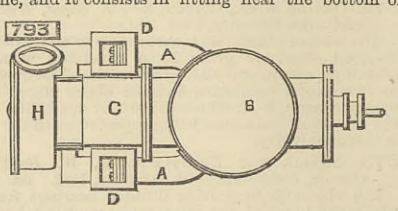
The objects are, First, to distribute steam to cylinders with less friction, and to economise the steam and obtain great regularity of working; Secondly, to regulate the speed as desired; Thirdly, to simplify the control by employing a single handle only; and Fourthly, to produce a supply and cut-off apparatus adaptable to all kinds of stationary steam engines with facility and at a small cost. The drawing shows the application to a rotary engine, and it consists of a valve-box D, in the upper part of which are two chambers, one in connection with one end of cylinder B by means of a pipe, and the other with the other end of this cylinder. Similar chambers are formed in the bottom part of the valve-box, both con-



nected with passages leading to the cylinder. At one end the valve-box is connected to the steam supply pipe. In the valve-box is fitted a hollow cylinder G formed with a slot to allow steam to pass to the chambers in the valve-box, and with circumferential passages in its outer periphery to allow exhaust steam to pass from such chamber to the exhaust pipes. The cylinder G is actuated by handle X through suitable gearing to start, stop, or reverse the engines. Inside cylinder G is a second hollow cylinder H driven from the main shaft, and containing a third hollow cylinder serving to distribute the steam, and being controlled by a governor of special construction.

793. CONDENSER AND AIR PUMPS OF STEAM ENGINES, *A. Craven, Bradford, and G. J. Warburton, Heckmondwike, Yorkshire.—18th February*, 1882. 6*d*.

This relates to fitting to the class of condensers and air pumps known as Wigzell and Pollit's patent (No. 2878, A.D. 1877), an apparatus to improve the vacuum, by which means the condenser is more effectually cleared of water and air, thereby producing a more effective condensation, besides dispensing with a great head of water in the condenser when starting the engine, and it consists in fitting near the bottom of



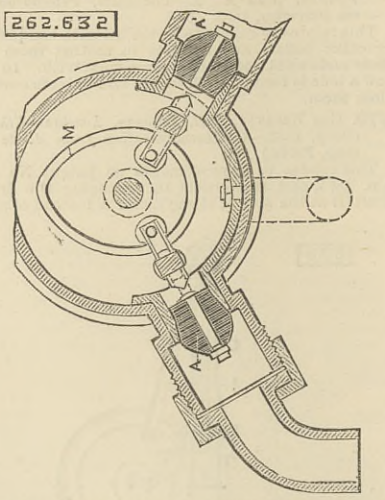
condenser B, and by preference in the centre line of the air pump C, a pipe or pipes A having near the end of the pump barrel a valve-box D containing a valve. These pipes extend from the valve-box and are bent at the end, and connected to the end of the air pump barrel, nearly touching the delivery valve-box H. When the air pump piston is near the delivery valve or at the commencement of the stroke it travels to the other end, and forms a vacuum in the barrel between the piston and the delivery valves, which causes water and air in the condenser to rush through pipes A into the air pump barrel. On the return stroke the valves D are closed, and the water is forced through the delivery valves H and into waste water pipes.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

262,632. FAUCET, *Charles Whittaker, Chicago, Ill.—Filed October 24th*, 1881.

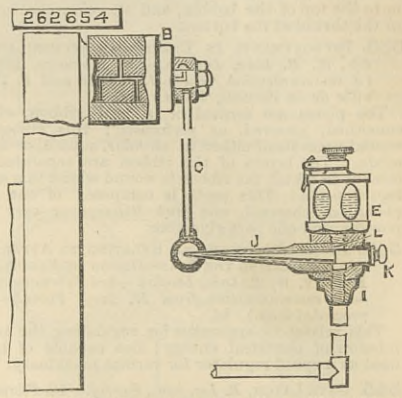
Brief.—The valves controlling the cold and hot water supply are opened or closed to the extent desired, both



at the same time or each separately, by means of a peculiarly shaped cam M. By the index on the outside of the valve-case the person using the water can regulate its temperature. The valve-seats A A1 are removable.

262,654. CRANK PIN AUTOMATIC OILER, *Hugh Duffry and Jesse Vandenburgh, Cortland, N.Y.—Filed April 17th*, 1882.

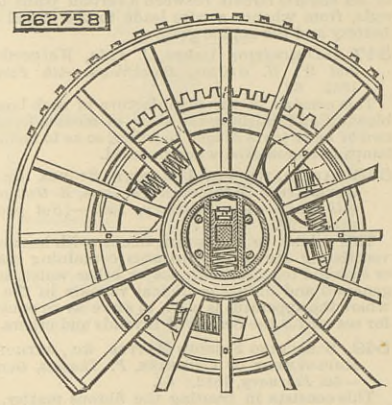
Claim.—(1) The stationary vessel E, chamber L and open connections therewith, and the hollow spindle J, combined with a bulb operating loosely upon said spindle and having open connection with a tube C, which moves with the crank-pin, and which is adapted to feed the oil thereto by means of the centrifugal force, substantially as specified. (2) The grooved or recessed crank-pin B, tube C, moving therewith the



hollow bulb B, having open connection with said tube and with the spindle J, upon which it revolves, the stationary vessel E, chamber L, jam-nut I, and reciprocating piston K, all combined and arranged to serve as and for the purposes set forth.

262,758. TRACTION WHEEL, *Abraham O. Frick, Waynesborough, Pa.—Filed January 25th*, 1881.

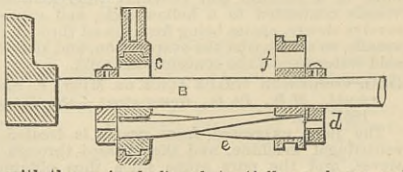
Claim.—A traction wheel for a traction engine, consisting of the combination of a driving gear wheel and parallel ground wheel, each having a separate



axle or bearing and a spring or springs interposed between the axles or bearings, and an elastic link or links connecting the sides or rims of the driving gear and ground wheel, substantially as described, whereby an elastic or spring connection is maintained between the gear and ground wheel, permitting both vertical and rotary play.

262,815. REVERSING GEAR FOR ENGINES, *Thomas Moore, O'Fallon, Il., assignor to himself and James Moore and Robert Rutherford, same place.—Filed January 17th*, 1882.

Claim.—(1) The spiral shaft *e*, carried by arms *d*, and the excentric ring C on the spiral shaft, in combina



tion with the main shaft, substantially as shown and described, for operation as set forth. (2) The apertured disc *f*, lever *g*, spiral shaft *e*, excentric C, and shaft B, substantially as described, combined for operation as set forth.

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