ALFRED KRUPP AND HIS WORK AS A CAST STEEL MANUFACTURER.

No. I.

BY the death of Alfred Krupp, who died on the 14th, and was buried at Essen on the 18th inst., with an immense following, Prussia and Germany lose the widest-known, most prominent, and wealthiest member of the industry of the country. Although the secret of the manufacture of cast steel had been known in England from the middle of last century, nothing was known about it until the beginning of the present century in Germany. It was the closing of the Continent by Napoleon to English manufactures—cast steel being one which till then had been exclusively imported from there, and the want of which at that time was keenly felt—which gave an impulse to men's minds in Germany to try and discover the secret of its manufacture, and it is said that a Bergrath of Westphalia, whose name is now forgotten, had in 1810 succeeded in discovering it. It is also reported that Gotlob Jacobi, who in the following year founded the great and still well-known firm of Jacobi, Haniel and Huyssen, Gutehoffnungshutte, at Sterkrade and Neu Essen, had also been possessed of the secret for some years before; and again it is said that a company at Wald, near Solingen, was also acquainted with the cast steel manufacture. Be that as it may, it appears that one F. Nicolai, of Essen, was the first to invent in cast steel in the country, for he not only secured a patent in Prussia, in 1815, but produced a cast steel which was pronounced to be in all respects equal to the best of English make. In the November of that year he associated himself with Friederich Krupp, a workman of Essen, for the purpose of making and selling steel.

Friederich Krupp, the father of Alfred, born in 1787, worked at the Guttehoffnungshutte at Sterkrade, which from 1800 to 1808 was the property of the family, but which after the latter year was sold to the above-named firm. It was after that sale had taken place that Friederich Krupp conceived the idea of improving and introducing the manufacture of cast steel into the country, and without detailing all his experiments and disappointments it is enough to know that in 1816, after his association with Nicolai, he possessed a small tilt works driven by water power, situated at the west side of Essen, now in the centre of the present works there, in which he commenced making crucible cast steel. In 1822, before which date Krupp had separated himself from Nicolai, the manufactures of the former, consisting of rolls and dies for coining purposes, shear plates for cloth shears, &c., were pronounced by the Prussian officials to be quite equal to the very best cast steels then known, and in some particulars even superior. Unfortunately Friederich Krupp, after sacrificing a not inconsiderable fortune, was not permitted to enjoy the fruits of his great exertions, for he died in the thirty-ninth year of his age in 1826, "deceived in all his hopes," leaving—as Alfred Krupp once mentioned to his workmen—a dilapidated works, employing only very few men, and no means. He left three sons, Alfred, born in 1812, Herman, and Friederich. His widow, subsequent to her husband's death, announced by circular in 1826 that the secrets of her husband had not died with him for, as fortune would have it, Alfred—the eldest son—had been to some extent instructed by his father in the melting-house; that the business would be carried on by herself and Alfred; and that the manufacture would suffer nothing in quality in the future. Thus Alfred was taken away from school at fourteen years of age to become a steel manufacturer. Again addressing his workpeople in after life, he said of that period, "I stood alongside my workmen on the wreck of the original of these works, which was the whole of my inheritance. The wages of smiths and melters I had raised from 18 steivers to 7½ silver groschens—9d.; and a week's earnings amounted to 1 thaler 15 silver groschens—4s. 6d. For fifteen years I only earned money enough to pay my workpeople their wages, while all I had for my exertions and anxieties was the consciousness of having fulfilled my duty." As a fact, the works only advanced by very slow degrees. In 1832 only ten men were employed, which next year were reduced to nine; and it was ten years later than this before any real advance became perceptible, when altogether the workpeople and staff amounted to ninety-nine in number.

About this time Alfred Krupp invented the rolls for rolling metal spoons, for which he secured patents in England, France, Austria, and in his own country. He received so handsome a sum for the invention in England that it set him up and enabled him to increase his works and extend his experiments, which from that time forward till now he has sedulously continued to do. In order to carry out his invention well in Germany, it was necessary for him to associate himself with a capitalist. After fruitless negotiations with the first banking house in Elberfeld, he was more fortunate in Vienna, where he associated himself with the firm of Alexander Schöller, with whom, in 1844 he established a metal manufactory at Berndorf, under the title of Krupp and Schöller. The technical management of the works, which soon grew to be of first rank, was conferred on his younger brother Hermann, who afterwards, with Schöller, founded the nickel factory at Losoncz, in Hungary.

In 1848 Alfred Krupp became sole proprietor of the Essen works, on the retirement of his youngest brother, Friederich. This year, as a consequence of the European convulsion, the number of his workpeople sank to seventy-two, from ninety-three in 1847 and from 122 in 1845, when the highest number till then was employed. Just at this time Krupp was in the midst of his experiments endeavouring to discover the most suitable quality of steel for ordnance. In 1847 he had already constructed a 3-pounder, which in 1849 was proved at Berlin in presence of the Prussian Artillery Commission, and gave even more favourable results than had been expected. This, as also others which were shortly afterwards made, was a smooth-bore muzzle-loader, after the model of the then existing bronze and cast iron guns. But at this time, and not until experiments with rifling had been carried out, the advantages of steel for artillery were not discovered or understood. We shall return to this part of the subject in a second short article, and therefore now continue to touch only upon other general points.

As a result of the restless activity at the Essen Works in 1851, when the staff and workpeople had increased to 192 in number, a block of crucible steel weighing 2 tons, highly polished rolls, and a 6-pounder gun were sent to the Exhibition in London, for which exhibit the firm received the Council medal. This first brought Krupp into general prominence. The gun was presented to the King of Prussia, who from that time forward till his death took a special interest in the firm, and decorated Krupp in 1853 with an order of the Red Eagle. The gun was placed in the Museum of Arms at Berlin, where it caused sensation a generation ago.

The year 1853—in which the former number of workmen had been doubled, and now amounted to 352—was an important one for Krupp, for it was in that year that he obtained patents in the chief States for his celebrated weldless cast steel tires, the enormous advantages of which need not be explained to readers of THE ENGINEER. But this apparently simple invention—entirely Krupp's own—was not arrived at and finally carried out without many costly experiments and much time; but he had his reward, for this was for a long time the most lucrative branch of his business, as the profit was enormous at that time. He also threw himself into the manufacture of axles, springs, and such-like material for railways with full force, and it was with the profits accruing from the sale of these articles that he was enabled to carry on his experiments for the improvement of cast steel guns, the manufacture of which only began gradually to show any profit from the year 1859.

Royalty seems to have specially favoured the Krupp works, for in 1852 the Prince of Prussia—now Kaiser Wilhelm—paid them a visit; and again, since he has become Emperor, not to specially mention the visits of half the crowned heads and princes of the world, many of whom have been Krupp's private guests enjoying the hospitality of his seat near Essen.

THE RIVETTING OF IRON AND STEEL SHIPS.

THE importance of the rivet as an element in the construction of iron and steel ships has been very clearly recognised by all writers upon shipbuilding, and by the several registration societies in the rules which they have formulated for the guidance of shipbuilders. However satisfactory may be the structural arrangements in a ship, and however good may be the materials of which she is built, it is impossible to obtain a satisfactory result unless the fastening is good. This is true in wood shipbuilding, and certainly no less so when the material is iron or steel, and the fastenings therefore are far more numerous than are required for the proper union of planks and timbers. The hull of a wood ship is made water-tight with oakum, but the fastenings in the greater part of an iron or steel ship must be spaced close enough together to secure water-tightness without the aid of any caulking material between adjacent surfaces. It is true that iron and steel ships are also caulked, but then the caulking in such a case should be only a superficial squeezing together of material already in contact, and rigidly held together by a sufficiently close spacing of due proportioned rivets. Any other description of caulking is inadmissible in a well-built ship of iron or steel. Well-fitted and properly rivetted work in iron and steel should require very little caulking to make it watertight. This is especially the case in regard to the butts of bottom plating, which, if planed and carefully fitted, will require very little at the hands of the caulker after the rivetting is completed. Already one eminent firm of shipbuilders has made an effort to dispense with the caulking of these butts, believing, with good reason, that the rapid wasting through corrosion at the butt joints of a vessel's plating, which is so common a source of vexation and expense to shipowners, is largely due to the disturbance of the material by caulking. But to avoid the use of the caulking tool, or even to diminish in any degree the necessity for its employment, it is necessary that the rivets shall be closely spaced, and this necessity is emphasised in the comparatively thin plating of steel ships. It will thus be seen that the tendency at present is to diminish the spacing of rivets, and therefore to increase their number in a vessel. This tendency has so far shown itself most markedly in the construction of steamers for carrying petroleum in bulk—a departure in ship construction of comparatively recent date which seems likely to furnish a growing demand upon the skill of our shipbuilders. Petroleum oil will find its way through a joint which resists the passage of water, and consequently the fitting and rivetting of an "oil steamer" demands more than ordinary attention and care. Moreover, the spacing of the rivets must be closer than is usual in ships, in order to obtain oil-tight work.

Now, in considering this important subject of rivetting and rivetted work in ships, it will at once be apparent that one of the first conditions necessary for the attainment of satisfactory results is the use of good rivets. In ships built of iron the rivets have likewise in all cases been made of that material; and, probably in consequence of the amount of rolling which the iron must undergo before it is brought to bar form of the proper diameter, the quality of iron rivets is generally found to be at least equal, and generally superior, to that of the iron plates and angles which they unite. If the iron rivet is only fortunate enough to escape maltreatment at the hands of the rivet boy who heats it, its quality when hammered up is generally good. The ordinary rivet hearth is not, however, all that could be desired, nor is the boy himself a wholly trustworthy individual. It is to be feared that a large percentage of rivets heated in the ordinary rivet hearth are raised to too high a temperature, or are what is known as "burnt." This is sometimes done at the request of the workmen, in order to make the rivet softer, and therefore easier to hammer up; but oftener it is the result of negligence or want of skill. A burnt rivet is always brittle, and therefore bad. In favourable contrast with the rivet hearth stands the rivet oven, or portable reverberatory furnace, which is employed for machine rivetting, because of the greater rapidity with which it is able to furnish the heated rivets to the swift working hydraulic rivetter. Not only does the oven furnish a large and rapid supply of hot rivets, but the rivets are properly and uniformly heated throughout; whereas in the common hearth the points of the rivets are submitted to a higher temperature than the heads. There are no doubt many difficulties in the way of the general employment of the rivet oven for the shell-plate rivets of a ship. The oven, as at present constructed, cannot well be carried into the interior of the ship, where all the rivets for plating, keelsons, stringers, bulkheads, &c., must be heated in order that they may be hammered up while at the desired temperature. Such an oven as is at present employed will serve very well for the machine-rivetting of frames, floors, reverse frames and beams while lying on the ground, because it can be brought close to where the men are at work. But if a reverberatory furnace of any kind is to be employed for heating the other rivets in a ship, it must be smaller than the ordinary rivet oven and fed with the air blast by means of a flexible hose. Subject to proper precautions, there seems to be no reason why a small oven of this kind should not be used inside a vessel, up to the time her woodwork is put in, after which the ordinary hearth should be resorted to.

The desirability of having a more trustworthy means of heating rivets increases with the more general use of steel rivets for steel ships. At first steel ships were, for the most part, fastened with iron rivets; but it is satisfactory to observe that the employment of steel rivets is now becoming very common. Steel is, however, a material which suffers even greater injury than iron from being over-heated; and, indeed, in every respect it is important that more care and intelligence should be exercised in the manipulation of steel than has generally been brought to bear upon the working of wrought iron. A steel rivet is harder to clench than an iron one of the same size, and this is particularly the case when the higher diameters of one inch and upwards are reached. There is consequently an inducement to burn the points of large steel rivets such as does not exist to the same extent with iron, and, as already seen, the consequences of burning are in such cases very much more serious. Upon this account, then, it is even more important that means should be taken for uniformly heating steel rivets by the use of such a portable oven as has before been alluded to.

After ensuring that good rivets shall be put into a ship, it is next essential that they should be properly spaced. This matter has already been referred to, and its relation shown to the question of water-tightness. From four to four and a-half diameters of the rivet have always been considered sufficiently close for water-tight work in iron ships; but with the reduced thicknesses allowed in steel ships of the same size, the spacing in such vessels should be no more than three and a-half diameters. Such a close spacing will undoubtedly result in a disturbance of the molecular condition of the thicker steel plates when rivet holes are punched, and thereby render either annealing or rimeing all the more necessary in order to recover the natural ductility and tenacity of the material. It is to be regretted that the conditions for water-tightness make such a close spacing necessary, for upon no other grounds is it desired. Iron and steel ships have not, as a rule, shown a deficiency of rivets in their butt and edge connections when they have come to grief; for fractures almost invariably occur by tearing through plates at the rivet holes, and very rarely by the shearing of rivets.

A third condition for good rivetting is the existence of good rivet holes, properly punched—or better if drilled—and in close agreement with each other. Much improvement has taken place of late years in the templating and punching of ships' plating. The piecework system is not inherently conducive to good results, so that we must seek for the cause of this improvement outside the system of work which is in vogue. The close inspection of Lloyds' surveyors may fairly be credited with a large share of the improved workmanship at our shipyards, and the slackness of trade, which gives employers the pick of the workmen, is probably accountable for the remainder. But despite careful inspection and good workmen, the drift punch, and too often the gouge also, is still brought into requisition by the rivetter when he gets to work. A moderate use of the drift is unavoidable under existing circumstances, although it is to be hoped that the time is not far distant when it may be wholly dispensed with. But facing rivet holes by gouging is an abomination which is never practised under a surveyor's eyes, but only too plentifully in some cases behind his back. Holes which should be rimed are gouged, the countersink is cut away—sometimes wholly and always in part—and rivets are driven, by hook or by crook, into holes in no way fit to receive them. Unfortunately, when hammered up no trace is presented of the true state of matters, and the bad work passes muster as good. In view of this unsatisfactory and very possible condition of affairs, one cannot but wish that success may soon attend the efforts of those who are seeking to dispense with punching altogether by drilling the plates of ships in place. The invention of Mr. Rowan for this purpose was referred to in our columns a few weeks ago, and if, by the method he proposes or in any other way, it becomes possible to drill and countersink the plates of ships *in situ* economically, a great and beneficial result will have been attained, and a new departure made in the art of iron and steel shipbuilding.

Although the work of a rivetter does not strike one as being calculated to demand much intelligence or give scope to the exercise of much skill, yet there is a considerable difference in the rivetting performed by different squads both in regard to the quality and finish of

their work. As an illustration of this it may be mentioned that not long since a vessel, which had just come off her first voyage, when seen in dry dock was observed to be differently corroded at different parts of her bottom. Upon closer inspection it was seen that the differences in the corrosion were limited to the rivet joints, and that the rivets in transverse belts of plating were distinguished from those in other belts by being uniformly either more or less corroded. Each belt of rivetting had, in fact, a distinct degree of corrosion and characteristic appearance. Upon investigation it was found that each belt marked the area of the work performed by a separate squad of rivetters. What was shown by the corrosion of these rivets is confirmed by testing the rivetting performed by different squads of workmen. The corrosion was, it is true, only a matter of appearance, but in the quality of work the differences are of a more serious kind, and point to the necessity for close inspection and careful testing of all rivetted work performed by hand. Comparing such work with the uniform excellence of that turned out by the hydraulic machine, the desirability of substituting machine for hand labour throughout the whole of the rivetting of a vessel is forcibly suggested. Various schemes for machine rivetting the steel plating of a ship have been tried, amongst them being the electro-magnetic rivetter invented by the Mr. Rowan to whom reference has already been made. This machine was described at the same time as the driller invented by the same gentleman, and all that we will say of it now is that it at least deserves success, and may probably attain that result.

So large a proportion of the efficiency of a rivetted point being due to friction between the surfaces in contact, it becomes a matter of the highest importance that the parts should be carefully fitted, and that in the process of rivetting they may be firmly closed. It is this closing of the work, and the increased friction thereby set up between the surfaces in contact when the point is under strain, which constitutes the chief value of machine rivetting. It is, of course, cheaper too than hand work, when applied to frames, floors, beams, &c., which fact will perhaps, more than any other, account for its common use by private shipbuilders. No rivetting machine intended for the shell plating of a ship will be successful which fails to unite the points with at least the same degree of closeness as is obtained by hand labour. This point must be kept in view by whoever would seek to substitute machine for hand labour at this or any other part of the structure. Rivetting machines performing their work by compressive means are better calculated to close the parts rivetted together than those acting percussively; and if a percussive force is employed the blow must be heavy, and the resistance of the "holder-up" should be of the most solid and substantial character. But while well-hammered rivets and properly closed work are essential to a soundly built ship, something more is wanted to make any rivetting machine commercially profitable. Speed of execution is a factor in the question of as much importance to the success of the invention as well executed work; for unless the rivetting can be done speedily it cannot be done cheaply, and therefore will not be done at all. Time and money are convertible terms in the employment of labour, and time has often a value in shipbuilding over and above the sum expended upon the wages of workmen. A quickly built ship is, generally speaking, a cheaply built one also; but circumstances often occur in which speedy completion is an important condition of a contract; and in such a case no process of rivetting, however good its results, could be adopted that was not likewise speedy in its operation. The ordinary hydraulic machine rivetter produces the very soundest work and performs it at a very rapid rate. It has the further good quality of doing its work cheaper than rivetting can be obtained by hand labour. These are the results which must be obtained by any rivetting machine to be successful in its application to the shell plating of a ship. Even under the most favourable circumstances, the difficulties attending the economical machine rivetting of a ship's shell plating are far greater than have been hitherto experienced in the application of rivetting machines. For ship's frames and boiler shells, round or "snap" headed rivets are very properly employed, and a similar form is given to the "bats" or hammered points. Such heads and "bats" are easily shaped by the cup-like jaws of the rivetter, but the hammering up of a flush rivet is not quite so simple a matter. The projecting surplus, which has to be chipped off while hot in hand rivetting, will still exist when a machine is employed, and means must be devised for removing it. Whatever plan be adopted for that purpose will necessarily involve the expenditure of time and money, and therefore add to the cost of the rivetting. These matters are not mentioned with the view of deterring inventors from attacking the problem of machine-rivetting a ship's shell, nor of suggesting that the solution is economically impracticable. On the contrary, we believe that in the future the greater part of the rivetting in shipyards will be performed by machines, and that such rivetting will be more trustworthy than the generality of hand work. But before the problem can be satisfactorily solved, the requirements to be fulfilled and the difficulties to be overcome must be clearly recognised and properly understood.

The annual distribution of prizes to the students attending the Royal Indian Engineering College, Cooper's-hill, took place on Wednesday at Egham. After the distribution of prizes, the chairman, Mr. Bertram H. Currey, Vice-President of the Council of India, congratulated the governors upon the results which had attended the working of the Institution. The College was now practically self-supporting, and the education it afforded was of the highest and best quality. Some time ago it was pointed out that an addition to the number of scholarships would be of advantage to the Institution, and he desired, with the permission of the authorities, to commemorate his visit by transferring to them the sum of £1000 to found a scholarship to be known as the "Vice-President's." Prominent among the prize winners were Mr. A. H. Gale, who took the Argyll Scholarship, and Messrs. H. A. F. Currie and Smith-Ainsley, who each obtained prizes in several branches of study.

LEGAL INTELLIGENCE.

COURT OF APPEAL.

(*Before* Lords Justices Cotton *and* Bowen.)

CHALLENDER *v.* ROYLE.

This appeal from a decision of Sir H. Fox Bristowe, the Vice-Chancellor of the County Palatine of Lancaster, raised an important question as to the construction of Section 32 of the Patents Act of 1883. That section provides that:—

"Where any person claiming to be the patentee of an invention, by circular, advertisement, or otherwise, threatens any other person with any legal proceedings or liability in respect of any alleged manufacture, use, sale, or purchase of the invention, any person or persons aggrieved thereby may bring an action against him, and may obtain an injunction against the continuance of such threats, and may recover such damage—if any—as may have been sustained thereby, if the alleged manufacture, use, sale, or purchase to which the threats related was not in fact an infringement of any legal rights of the person making such threats. Provided that this section shall not apply if the person making such threats with due diligence commences and prosecutes an action for infringement of his patent.

The defendant, Mr. J. J. Royle, is the owner of a patent, granted in 1879, for a "tap union," a method of temporarily uniting a hose to an ordinary tap, as commonly used for fixing a hose for watering gardens, and ever since 1879 he has manufactured and sold the patented article, and until recently, as he alleges, he has not been aware of any infringement of his patent. In March, 1887, he discovered that a number of other tap unions not made by himself were being sold, and he considered that those articles were infringements of his patent. These articles were manufactured by Mr. Joseph Challender, the plaintiff, who had taken out a patent for them in 1886. Mr. Royle, thereupon, in March, 1887, issued the following circular:—

"Royle's Patents.—It having come to our knowledge that certain of our patents are being infringed—notably, Royle's patent tap union, and patent Archimedean egg beater—we hereby caution our numerous friends against purchasing those imitation goods. It cannot be too generally known that all parties who handle a patented article, from the maker to the user, including also importers, are liable to the patentee. Our patent solicitor has instructions to take proceedings against all infringers."

This circular was aimed at the tap union made by Mr. Challender, and was circulated among customers of his. In April he wrote to Mr. Royle, challenging him to take legal proceedings to restrain the alleged infringement of his patent. On the 24th of May a person employed by Royle purchased from a company called the Manchester Plumbing Company a tap union manufactured by Challender, and warned the company that it was an infringement of Royle's patent, and that Royle would proceed against them if they continued to sell it. On the 15th of June Royle served the company with a writ in an action to restrain them from infringing his patent. The writ in the present action was issued on the 11th of June, but not served till the 16th. By it the plaintiff claimed an injunction to restrain Royle from threatening by circulars or otherwise any person with legal proceedings or liability in respect of the manufacture, use, sale, or purchase of the plaintiff's patent tap union. The writ also claimed damages. The Vice-Chancellor granted an interlocutory injunction, from which the defendant appealed.

Mr. Moulton, Q.C., and Mr. S. Hall, for the defendant, argued that the above circular was not a "threat" within the meaning of section 32; it was only a warning to the public. Section 32 was aimed at a definite threat of legal proceedings addressed to an individual in respect of an alleged part infringement of a patent. It was not necessary that the "action for infringement" mentioned in the proviso at the end of section 32 should be brought against the "person aggrieved" mentioned in the former part of the section; it was sufficient that it should be brought against some other alleged infringer if it raised the same question which would be raised against the "person aggrieved" if he were the defendant. The action against the Manchester Plumbing Company was therefore sufficient to exclude section 32, and that action had been commenced with "due diligence."

Mr. Finlay, Q.C., and Mr. Bousfield, for the plaintiff, urged that the defendant could not defeat his right to bring an action under section 32 by subsequently commencing an action for infringement against someone else. Moreover a comparison of the two patents showed that the plaintiff had not infringed the defendant's patent. The action against the Manchester Plumbing Company might be a collusive one, and it was not commenced with "due diligence."

Lord Justice Cotton, after stating the facts, said that the law applicable to such a case, independently of statute, was stated by Sir George Jessel in "Halsey *v.* Brotherhood"—15, Ch. D., 514. If it were not for the Patents Act, the plaintiff would have no reasonable ground for his action. The two inventions in their mode of appliance and construction were almost alike. The plaintiff contemplated a slightly different way of putting on the contrivance, but it was possible to put it on in the same way as the defendant's article, and the two things then acted in the same way. As to the statute, it was to be observed, first, that the section contemplated final judgment and did not refer directly to interlocutory proceedings, because it spoke of damages being recoverable. It was doubtful whether the circular was a threat within the section, but there had undoubtedly been a threat against the Manchester Company. It was clear also that the plaintiff was a "person aggrieved." The Court had to be satisfied that the instrument complained of was not an infringement of any legal right of the person making a threat. It was not necessary to say where the burden of proof would be; *primâ facie* it would be on the plaintiff, but he could rebut the case and shift the burden to the defendant. The question whether the patent of the person making the threat was valid might come into consideration; for if the patent was invalid, there could not be an infringement of a legal right. It was desirable to make that statement, because it seemed that Mr. Justice Chitty had intimated an opinion in "United Telephone Company *v.* Barney"—28, Ch. D., 394—that the validity of the patent could not on proceedings under the section come into consideration. Such were the rights of the parties at the trial of the action, independently of the proviso in the section in question. As to interlocutory applications, the Vice-Chancellor, acting on a judgment of Mr. Justice Kay—"Walker *v.* Clarke," 4, Rep. Pat. Cas., 111—had said that it was not necessary to enter into the question whether there had been any infringement, but that it was only necessary to consider the balance of convenience. That view must be dissented from. It was true that in all applications for interlocutory injunctions it was right to consider the balance of convenience, but the question was whether the plaintiff had made out a *primâ facie* case, and whether it was probable that he would succeed at the hearing, and the Court would grant an injunction on a case made out to entitle the plaintiff to that particular remedy, not merely on the ground of the balance of convenience. If it were necessary to decide the point in the case before the Court it seemed that the plaintiff had made out a *primâ facie* case, but it was not necessary to decide that question, because the case was entirely outside the section by reason of the proviso. The proviso, in fact, settled the matter. Just after the plaintiff had issued his writ, but before notice of it had come to the defendant, an action had been commenced by him against the Manchester Company, and with due diligence after the threat. The interval of two or three months was not, in the circumstances, an unreasonable time to be occupied in deciding whether an action should be brought. Then the section said the action should be duly prosecuted. That was a matter in *futuro*. It was said that the action was suspicious because it was not brought against the plaintiff. But the Manchester Company were actually selling the articles, and though the plaintiff had a patent it did not appear that he was actually making and selling them. There was no evidence that the action was collusive. If it should not be duly prosecuted application could be made to the Court. To bring the case within the proviso there must be an honest action as to the validity or infringement of the patent, whichever might be in question, and there was no evidence that the action against the Manchester Company was not honest and would not be duly prosecuted and honestly defended. As to the person against whom the action must be brought for the case to come within the proviso, it was not necessary that it should be the "person aggrieved." A rival patentee was naturally a person aggrieved, and if he only granted licenses and did not make and sell the patented article an action could not be brought against him in which damages could be obtained. The action must be founded on some act done—"in fact an infringement;" it must be honestly brought to test the validity or infringement of the patent, and following up a threat against some person to whom it was made. The order appealed against was wrong, and must be discharged.

Lord Justice Bowen, in stating his judgment to the same effect, said that the threat must not be a mere warning, but a threat of legal proceedings or liability in respect of an alleged, not merely a proposed, manufacture of the patented article. Of course a general warning might be issued, and it was important that it should be understood that it did not follow because on the simple grammatical construction of the warning it applied only to the future that it might not be applicable to an act done. It should be added that the Court was not expressing any final opinion as to the validity of the patent or as to the fact of infringement.

LETTERS TO THE EDITOR.

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

SANITARY REGISTRATION OF BUILDINGS BILL.

Sir,—I have read your articles on this Bill, to which I have given considerable attention, with great interest. I wish, however, to be allowed to differ from your statement that Clause 10 should be dispensed with. This clause specifies certain requirements which must be complied with before a sanitary certificate can be granted for any building, and you consider that the provisions of this clause are insulting to the knowledge and capacity of sanitary engineers. It would, under these circumstances, be supposed that sanitary engineers would be anxious to get rid of the clause, but so far as I have been able to learn—and I have spoken to several on the subject—instead of there being any desire on their part for the omission of this provision, they consider that the specification should be much more full and definite; and if all sanitarians are practically agreed as to the necessity for the adoption of certain requirements, there can be no hardship to any one in including the fullest specification of them in the Bill; if they be not agreed, there is the greater necessity for an agreement, and the omission of a specification is a danger to the public.

If the specification be omitted, the penal clauses are a farce, for no form of reference or arbitration is provided for in the Bill, and therefore each licentiate could only be a law unto himself, and could not be in any way punished for faulty design. Also if a form of reference had been provided, its machinery would be costly, and it is infinitely preferable that the requirements without which a certificate could not be granted, should be included in the Bill. Again, if there be no specification, what is to prevent one licentiate from condemning the work of another, and insisting on a whole system of drainage being revised, to the great loss of the owner of the building. Such a result would also bring the Bill into contempt, and destroy its usefulness. My objection to this clause is not that it exists, but that it is far too vague and indefinite to answer the purpose for which it is designed.

You object to the length of the term for which the certificate is to be granted. This objection might, I think, be met by allowing a licentiate, if he finds the pipes, &c., to be old and worn, the power to reduce the period for which the certificate is available. You do not, I think, make any remark on the omission of boarding houses, bakeries, butcheries, dairies, and all places where food is stored, manufactured, or whence it is distributed, from the compulsory requirements of the Bill. Surely it is just as, if not more, necessary that these places should be in a sanitary condition than those specified, namely, schools, colleges, hotels, asylums, hospitals, and lodging houses.

Reginald E. Middleton,
49, Parliament-street, S.W. M.I.C.E., M.I.M.E.

THE CLARK PROCESS.

Sir,—Those chemists who for the last twenty or thirty years have been employed to advise Government in the matter of water supply have not sufficiently insisted upon the desirability of having a supply of soft water for London. It has seemed, indeed, as if the question of organic purity had excluded every other consideration, and it now becomes the duty of the chemist to press on the attention of the public the advantages of soft water over hard water. That hard water consumes more soap than soft water will not be denied by any one, but that thorough cleanliness is an impossibility with hard water is quite lost sight of, but is nevertheless quite true.

In London, as is notorious, a very high price is paid by the inhabitants for the water used for domestic purposes, and yet the water is so hard that it only imperfectly discharges some of its main functions. The cost of softening the London water is not heavy. It would be less than one penny per thousand gallons.

J. Alfred Wanklyn.
7, Westminster-chambers, S.W., July 26th.

Sir,—Your remarks on this process, as regards its application at Bristol, well merit the serious consideration of the public generally; but it would appear that your article has excited very little interest in engineering circles. You may well express considerable surprise that a process so simple and inexpensive has not met more encouragement, and it seems even incredible that engineers and manufacturers, and steam users in general, are so slow to appreciate a process which renders such invaluable services, and at such a small outlay. The reason may be, however, that as the Clark process only deals with carbonates, and as the majority of waters contain a large proportion of sulphates, the application of the Clark process alone only removes one half of the evil. Another reason, no doubt, is that the original Clark process occupies too much space. There are, however, in the market several apparatus capable of utilising the Clark process, and, comparatively speaking, occupy a small space. My apparatus is one of these.

I quite agree with you, the Severn Tunnel water can be softened by the Clark process. All the carbonate of lime and magnesia can be precipitated, and I consider the water a very easy one to treat. I have no pretension whatever to pose myself as a chemist, and I leave to others the task of proving whether the softened water is good or bad for domestic purposes, but I think I may be allowed to make a few remarks as to the advantage of softened water for industrial purposes, and I will give you the proofs from users of water softened by my apparatus.

In the engineering and industrial world there seems to be a general aversion to any chemical process. They seem to run away with the idea that it is not only expensive, but that the mere fact of a chemist being employed the result must be detrimental in some shape or form.

They do not take the trouble to examine for themselves the principle employed, or consider how easy it is to render a hard and objectionable water soft, and suitable for all purposes; they

prefer to go on spending money in cleaning boilers or on some fancy-named solution or powder which is supposed to prevent incrustation. It must be admitted that the common-sense view of the matter is to purify the water before it enters the boiler, and not to attempt purification after.

The following letter refers to one of my apparatus, softening and purifying well water for five water tubular boilers, the re-agent is lime and soda; before the application, the boiler had to be cleaned every fifteen days. M.M. Spanaghe et Moreau, of "Manufacture Royale Toiles et Tapis cirés, Toile Américaine, etc.," Anderlecht, where the apparatus is being used for softening well water for five water-tube boilers which used to have to be cleaned out every fifteen days, says:—"L'eau avant son entrées dans l'appareil, marque 58 deg. et à sa sortie elle ne contient plus de chaux et marque 18 deg. Nous avons ouvert un de nos générateur Collet après un mois de marche; les tubes étaient restés propres et la chaudière n'avait pas besoin d'être nettoyée."

As proof of the advantages to be derived from the use of the Clark process, I may refer to the results obtained by the engineer of the waterworks here, and also to the similar experience of a well-known firm of engineers and boilermakers who have apparatus which occupies a space of 39in. square by 7ft. high, by which the water is reduced from 29 deg. to 7 deg., with an expenditure of 4½ lb. of lime per day for a 60-horse power boiler.

In another case a sugar manufacturer found it almost impossible to continue on account of the hardness of the water at 40 deg. By the lime and soda process the water is reduced to from 4 deg. to 5 deg. On the Continent steam users are not so slow to appreciate the advantage of soft water, as pointed out by you.

ANDREW HOWATSON.

46, Boulevard Anspach, Bruxelles, July 25th.

SIR,—For some years Messrs. Bryan, Donkin, and Co., of London, have used a lime and soda process for softening boiler water. The details of the process have never been published. Perhaps some of your chemical readers will say if it is generally applicable to all hard water, or only to special cases. C. J.

Cardiff, July 25th.

SHIPS' BOATS.

SIR,—As the very important subject of boats for passenger ships is now engrossing the attention it deserves, I think it my duty to request the aid of your excellent journal in making known the information which a very long and successful experience has enabled me to impart.

The Berthon boats invented and built by me are now in general use, having been largely adopted by all the maritime Powers, and there are now more than £60,000 worth of them in all parts of the world. In the French navy there are 550 of these boats, and the royal navy of Italy will soon have a greater value of them. They are carried by all H.M. troopships, and we have supplied many of the steamship companies in England and France. Notwithstanding

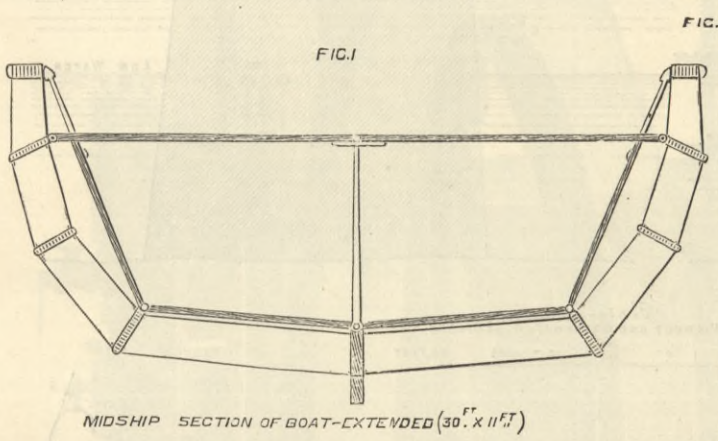


FIG.1

MIDSHIP SECTION OF BOAT-EXTENDED (30FT. X 11FT.)

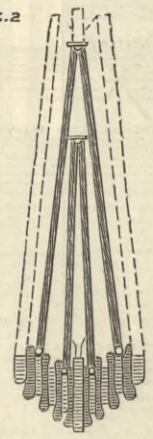


FIG.2

MIDSHIPS SECTION COLLAPSED

all this, it still appears that many shipowners are unaware of the very great advantages of my system, and, moreover, some of them, in their laudable desire to increase the boat accommodation of their ships, are making experiments, of which the results will certainly be disappointing.

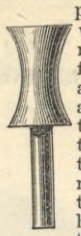
It would appear to be an invidious task for one inventor to point out the defects in the invention of another, but a higher motive than mere money considerations compels me to do so.

Mr. Shepherd, of Glasgow, has invented a folding boat, and were it really calculated to supply the need, and promise security to lives at sea, I would bid him Godspeed, for there is plenty of room for him and me. But knowing what I do, after thirty-seven years' experience with canvas boats, I am bound to say that his system is most dangerous. Mr. Shepherd's boat is composed of a single skin of canvas in two plies. This is attached to a keel and keelson below, and to a movable gunwale on each side. Six or seven ribs of steel and wood are made to swivel on the keel, standing nearly fore and aft when the boat is shut, and slewed athwartships when open. Now by this construction it is unavoidable that the canvas is totally unprotected outside the ribs; and it runs the greatest risk of injury when rubbing against a ship's side in lowering, or in coming in contact with any solid body; and as there is only one skin, any perforation of it would be fatal. But there is one thing which I alone have had the opportunity to discover, and which involves a serious and unexpected danger to such a structure as Mr. Shepherd's. When a boat of this kind plunges violently in a sea, the blows received by the canvas upon or against the ribs cause it to be worn through when continued for some time. In fact, the canvas is just as if placed between an anvil and a hammer. I need not say that this boat can have no pretension to be called a lifeboat, for it would certainly sink when filled by a sea. In marked contrast to the above, the Berthon boats are all essentially insubmergible lifeboats, that will carry all their crews and passengers when full of water. As they have eight separate water-tight compartments, an injury, should it occur, to the outer skin is of little or no consequence. A reference to the accompanying section will explain that the Berthon is actually two boats, one inside the other, and the intervening space divided into eight separate air cells. Its expansion is automatic and instantaneous, as the boat flies open by its own weight when, on letting go the end pendants, the weight falls on to the thwartship spans, hanging on the tackles of the davits. This boat cannot be stove in lowering from a rolling ship, and it is the very safest and most seaworthy ships' lifeboat, as has often been proved, but especially in a stormy voyage of 800 miles in the Atlantic and the Bay of Biscay. It will carry sail in a gale of wind, when no other boats, save those of the National Lifeboat Institution, could do so. E. L. BERTHON.

Romsey, Hants, July 26th.

SELF-RIGHTING BOATS.

SIR,—Since I wrote to you on the necessity of providing some means of releasing a self-righting lifeboat from its cable and anchor when the boat capsizes, it has occurred to me that it would be better to make the bollard so that it would fall out of a socket when the boat was wrong side up. To do this, the bollard would have to be of cast iron, with a square lower part, shipped into a square socket bolted to the boat's side. The bollard might be hollow to make it lighter. Its form might be as sketched, the lower part being tapered to ensure it falling out of the socket when capsized. The Southport accidents proved the necessity of providing some means for releasing the boats from their cables when they are capsized. It is nearly always necessary to veer a boat down on to a wreck from an anchor, the cable being rendered off the bollard. In the event of the boat capsizing, the man holding on to the cable would most likely cling to it, and thus prevent the turns coming off the bollard. If the bollard was made to fall out the cable must go with it. The idea of the movable bollard struck me some time ago, but I have had many other things to attend to, and so had not time to write about it. I understand that the Institution are making their boats narrower to ensure their righting. But how about their wronging?



Some years ago the people of Sizewell observed at sea an object which caused them much astonishment. On going off to it they found it to be a small self-righting boat, which righted and wronged with amazing rapidity. Its occupant was clinging to it in an exhausted state. He and it were brought ashore. The boat was named the Tiny Ark. The old man had a wonderful pair of self-feathering paddles, made of whalebone, much like—in action—a duck's foot. After a few days the old man resumed his voyage, and, like John Bunyan, "we saw him no more." Has not this tale a moral for a great and mighty institution?

Sizewell, July 26th. J. W.

EARLY ROLLER MILLING.

SIR,—In reference to the letter from Mr. J. A. Arnold Buckholtz in your paper of the 1st inst., I reiterate my previous statement that your article not merely gave Mr. Buckholtz the credit of having "designed the first automatic roller plant in the world," but also pronounced the system a success, for you say "this great improvement made the roller system popular in Great Britain, as its enabled the miller to work the roller plants in the most economical manner." To this I re-assert that at a meeting of the National Association of Millers in April, 1880, Mr. Buckholtz said of this system, "it is not suitable for general milling in this country." Mr. Buckholtz should either withdraw his public announcement of April, 1880, or renounce your advocacy of his right to have made the automatic system "a success."

London, July 21st. J. HARRISON CARTER.

[It is not doubted that the roller mill plant erected by Mr. Buckholtz, at Bilston, in 1878, was automatic, and any subsequent expression of opinion on his part cannot alter that fact. The dividing of the honours of more recent date is another matter. —ED. E.]

TECHNICAL EDUCATION.

SIR,—At the laying of the foundation-stone for the building of the new College of Physical Science at Newcastle, Lord Armstrong recently made some observations on the necessity for a better technical education for British workmen. He said that hitherto they had seemed to be content with a high degree of skill as handicraftsmen in their several specialities, and had been in the habit of regarding as of little value that cultivation of the intellect by which alone the work of the hands could be directed so as to keep pace with requirements of civilisation. The truth of these remarks is continually being confirmed by the experience of every one who has anything like a close acquaintance with operatives in this country.

It is only two or three weeks since that a buyer of machinery was walking through the Exhibition at Newcastle. Passing along that part of the building where there are a number of steam pumps by rival makers, he visited a stand where a large plunger pump was in operation. He asked the attendant, who appeared to be a respectable and intelligent workman, what was the diameter of the plunger and of the steam cylinder, with a view of ascertaining the capacity of the pumps; but he could get no information on these vital points. It seemed never to have occurred to the man to measure them. He was evidently quite competent to set the pump going, to stop it, to oil it, to keep it clean, and, perhaps, to attend to other matters, but to tell a stranger the leading dimensions was apparently not his business, and to ascertain them did not interest him at all. Having obtained a two-foot rule and measured them approximately himself, the visitor then went to another stand, and asked similar questions of a similar representative of another firm, and with precisely the same result. In fact, the ordinary British workman, though he may be very skilful in his own narrow sphere, seldom cares to acquire knowledge in others, for its own sake, or for the improvement of his mind. He regards it as not being his business, and he does not see why he should trouble himself about it.

A similar instance has been mentioned by another gentleman, who, travelling by rail, happened to sit opposite to and enter into conversation with a young man, who by his dress was evidently in the Royal Navy. It came out that he was a ship's carpenter who had been on leave of absence, and was just returning to his ship. He was generally intelligent and sociably inclined; he had lately come home from a voyage which had lasted eighteen months; he knew the duties of a carpenter on board ship well; he knew all about his pay and privileges, and what they were as compared with bluejackets, stokers, and engineers; he was a teetotaler, and, being a steady man, was saving money. His travelling companion thought he would test his knowledge on some subject of which he must have had abundant opportunities of obtaining information, but which was not exactly within his speciality. He therefore asked him the weight of the guns belonging to his ship, and of the projectiles used, and the diameter of the bore. But, although he had been shut up with these appliances for eighteen months, and the questions asked had relation to leading facts only, he could not give any information. It was out of his department; he had never thought of asking, because it did not concern him. Such is the British workman, and so long as he allows his mental faculties to operate in such narrow grooves, he is very likely, as Lord Armstrong has so well pointed out, to be beaten by foreign competitors, who go on more intelligent principles.

Redcar, July 27th. H. J.

THE EDUCATION OF ENGINEERS.

SIR,—I have read with great interest the various letters on the above subject which have appeared in your journal from time to time, and with your permission will offer a few suggestions on training young men for the engineering profession.

I think it is generally admitted that whatever else the student may learn, he ought at least to have a good practical knowledge of his profession, and to obtain this he should enter the workshops on leaving school, and go through a thorough course of practical training. His aim should be to get a good knowledge of fitting up first-class work, and especially all the details of the steam engine.

The theoretical training ought to be done in the evening, and the student should employ this time—during the winter months, at all events—in attending classes at one of our University Colleges, and in making careful notes with explanatory sketches of all the work he does in the workshops. In making these notes the student should state how the details of the work he has in hand are fitted together, the time taken to do it, and if on piece-work, the price he was paid for it. This practice will give him a very fair knowledge of estimating work.

In attending evening classes, the first aim should be to get a thorough knowledge of drawing in all its branches—freehand, model, plane, and solid geometrical drawing, and machine construction. I do not think a large amount of time ought to be spent on highly-finished shaded and coloured drawings, although one or two of these might be made. A far better plan is to make working drawings, with dimensions of small details of machinery, sketches of which can be taken while in the shops. I am aware it will be urged that engineering firms will not allow their apprentices to make sketches of the machinery; but from my own experience, I think most firms will allow this practice, provided, of course, the privilege is not abused. The student should also attend classes on the following subjects: Properties of steam, principles of mechanism, and if he has time, the study of chemistry and metallurgy would be found very useful.

In commencing the practical training in the workshops, I think the student will find it easier to begin with turning, and should spend about eighteen months on this branch, and then eighteen months on fitting; he should then enter the pattern shop, and while there should go into the foundry as often as he can in order to see how the patterns are used. I think it is better to learn pattern making at this period than at the commencement of the training, as the student will understand more readily the use of the patterns. Having spent six months in the pattern shop, the student should now return to the fitting shop and finish his time on heavy fitting and erecting. During his time spent in the workshops he should pay great attention to setting out work, as he must bear in mind he is not qualifying himself to beat a fitter at his own trade, but to design and carry out good work in the quickest and cheapest way possible. A year ought to be spent in the drawing office, and at the end of this time, providing the student has made good use of his opportunities, he will be a fair draughtsman, and also capable of superintending any ordinary class of engineering work.

It may be urged that this system of training is rather hard for a young man. I am well aware of this, but the apprenticeship of an engineer is a very hard one if he intends to make any headway. In conclusion, these suggestions only apply to the training for mechanical engineers. On the education of civil engineers I am not in a position to express any opinion.

Leeds, July 27th. G. G.

WORKING WOMEN: THEIR PRESENT AND THEIR FUTURE.

SIR,—I beg to be allowed to make an appeal, through your columns, for assistance of a kind not usually asked; that is to say, of a kind which will certainly involve a considerable amount of personal activity and effort, and will call for the exercise of certain qualities of tact, sympathy, and discretion which are not always to be found.

It is proposed by certain persons interested in the present condition of working women, to hold a Conference towards the end of the year, at which the facts of the female labour market may be clearly and dispassionately set forth; the extent, area, and nature of the evils which undoubtedly exist, may be laid down with some precision; and, if that may also follow, remedies or alleviation may be found.

It is true that such a Conference might have been held at once, for the mere purpose of discussing methods of relief for the well-known and widely-spread diseases of "over-work" and "under-pay." It is certain that there are here in London and other large centres, thousands of women continually occupied in miserable toil for wretched wages, who never venture to hope for any cessation or relaxation of the life sentence to which they were doomed at their birth. The Conference might have proceeded on the assumption that these things have long been notorious. Yet the case for the women will be undoubtedly strengthened tenfold by the collection, the classification, and the publication of all the facts, apart from feeling, sentiment, hasty blame, and perhaps misplaced sympathy. This has never been done. True, figures and facts have from time to time been printed in certain journals, and for certain trades; but the whole facts connected with women's industries—the hours and pay, the fluctuations of the demand, the competition of Germans and Jews, the effect of Free Trade, the freaks of fashion, the social and moral aspects of their work—have never been adequately investigated or treated. We do not aspire, of course, to collect and collate the entire facts in the brief time at command before the Conference; but we propose to attempt an indication of them, as it were, on as wide a scale, and in as thorough a manner as possible.

The committee formed by those who have originated this enterprise contains, among others:—The Hon. Miss Maud Stanley, Mrs. S. A. Barnett, Mrs. Rayner, Mrs. Heckford, Mrs. Alison, Mrs. Verney, the Rev. S. A. Barnett, the Rev. Brooke Lambert, the Rev. Fleming Williams, the Rev. Hugh Price Hughes, the Earl of Meath, Mr. George R. Sims, Professor Stuart, Mr. Arnold White, Mr. Verney, Mr. A. A. Knight, and Mr. William Hill. We have divided ourselves for convenience into three sub-committees; one, on existing agencies, associations, trades unions, &c., established by or for working women; one on the relations of work to the social life; and one on wages, hours, and the condition of the work. We have drawn up a set of questions for each of these sub-committees. The questions are not intended to be put seriatim and verbatim, but are proposed as a guide to any who will assist us in this inquiry.

We invite, Sir, through your columns, the assistance of all persons who have the power of collecting information, and can get access to working women. There are in every parish, and belonging to every church and chapel, ladies who spend the greater part of their lives in and among the houses of the working classes. It is more especially to these ladies, whose tact, disinterestedness, and sympathy have endeared them to the people, that we appeal for assistance. But the co-operation of men of all classes really interested in this movement is earnestly desired, and will be cordially accepted.

The committee have no views of their own to advance, and no theories to defend. WALTER BESANT,

Hon. Treasurer of the Committee of the Working Women's Conference.

Adelphi Hotel, Adam-street, Strand, W.C., July 26th.

PORTLAND CEMENT CONCRETE.

SIR,—I hope Mr. F. E. Duckham's able letter in your issue of the 22nd will meet with the attention it deserves. In your article of the 15th Portland cement concrete seems to have been condemned unheard. I have had a long experience with Portland cement, having supplied it to some of the largest works, both at home and abroad, and when properly used have never known it to fail. What I as a manufacturer have to contend with is—(1) The ignorance of the user; (2) that no two specifications for Portland cement are alike. What wonder therefore, when the user knows not what he wants, if the article is at times unjustly condemned?

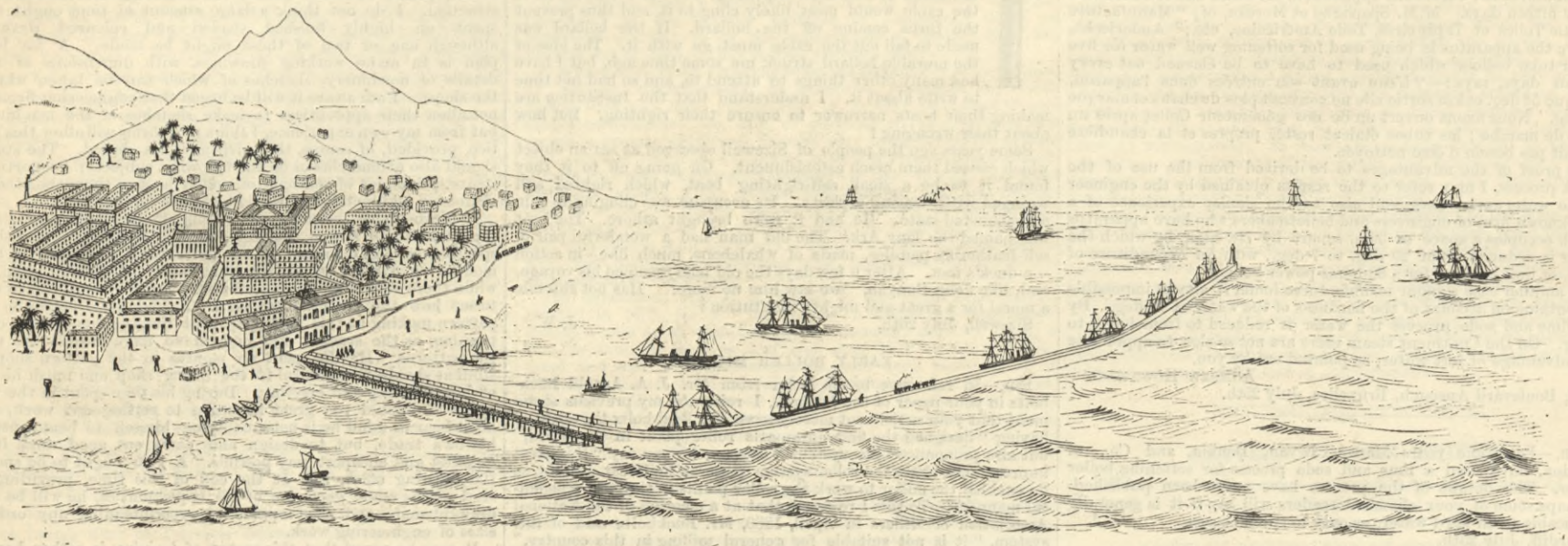
July 27th. A PORTLAND CEMENT MANUFACTURER.

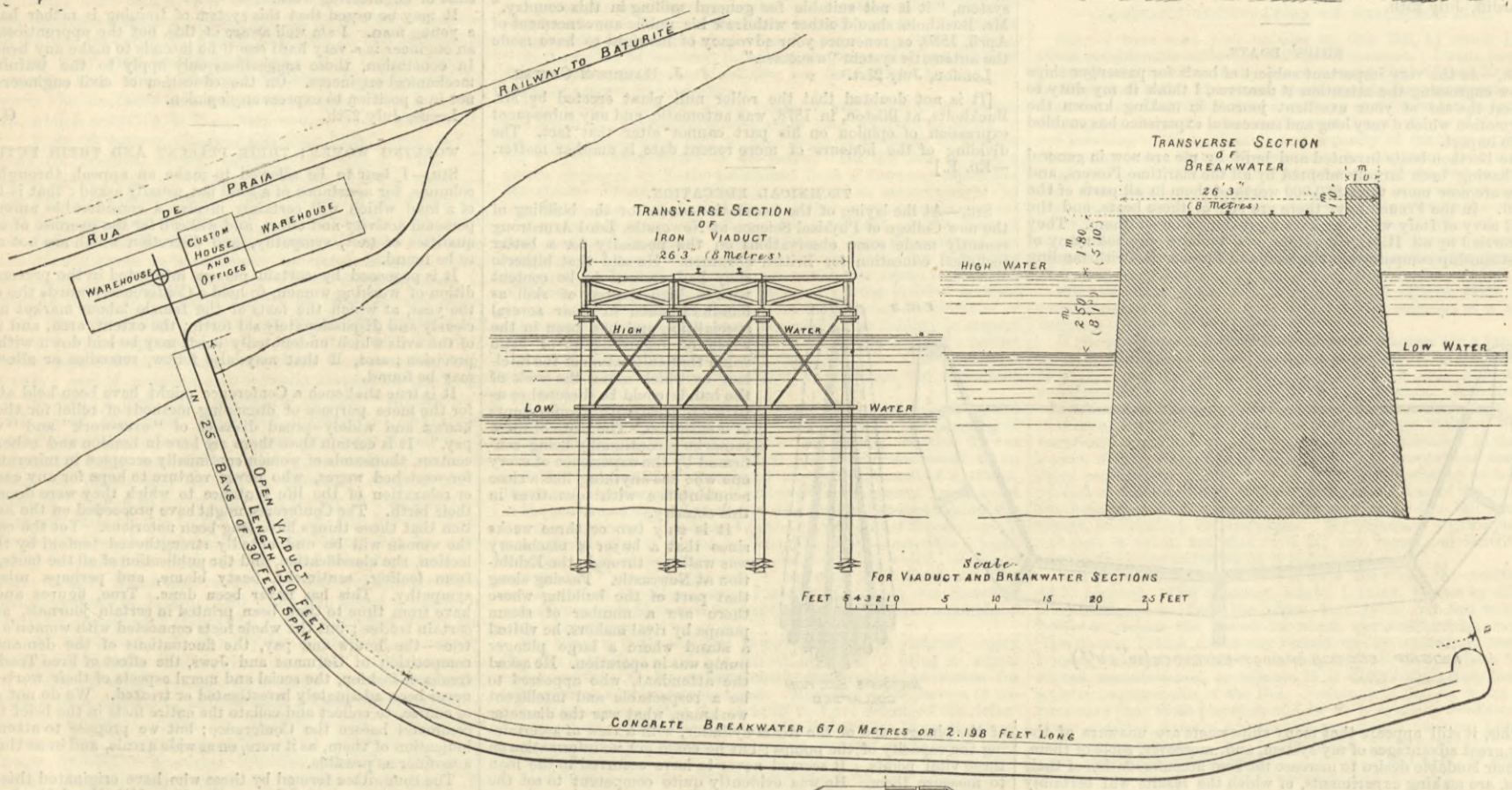
JUNIOR ENGINEERING SOCIETY.—Mr. William Anderson, M. Inst. C.E., has consented to become president of this Society for the seventh session, which he will inaugurate by the delivery of an address in October next. On Wednesday, 20th inst., a party of members and their friends paid a visit to the Royal Mint by permission of the Deputy-Master, the Hon. C. W. Fremantle, C.B. A large number availed themselves of the opportunity thus afforded for visiting this interesting establishment. The next excusion of this society takes place in September when the Beckton Gasworks is to be visited.

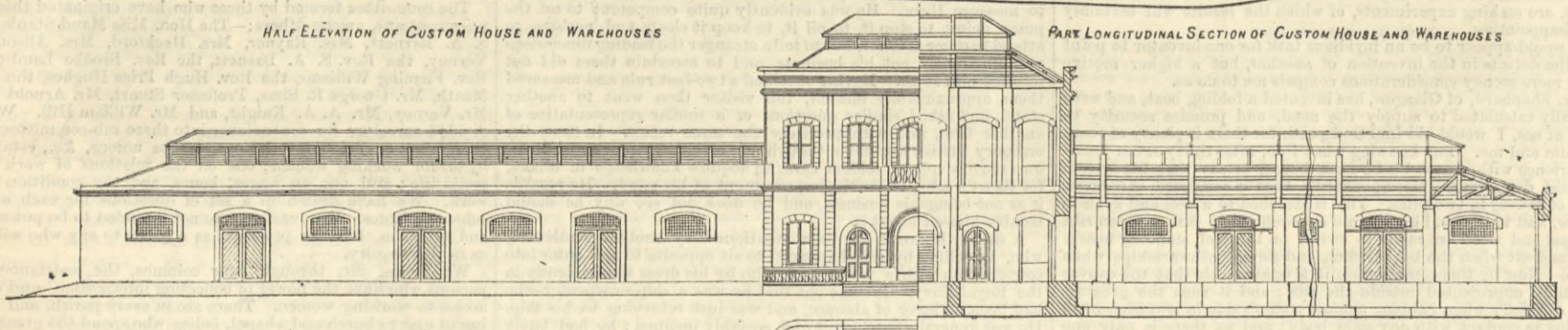
NEW HARBOUR WORKS, CEARÁ, BRAZIL.

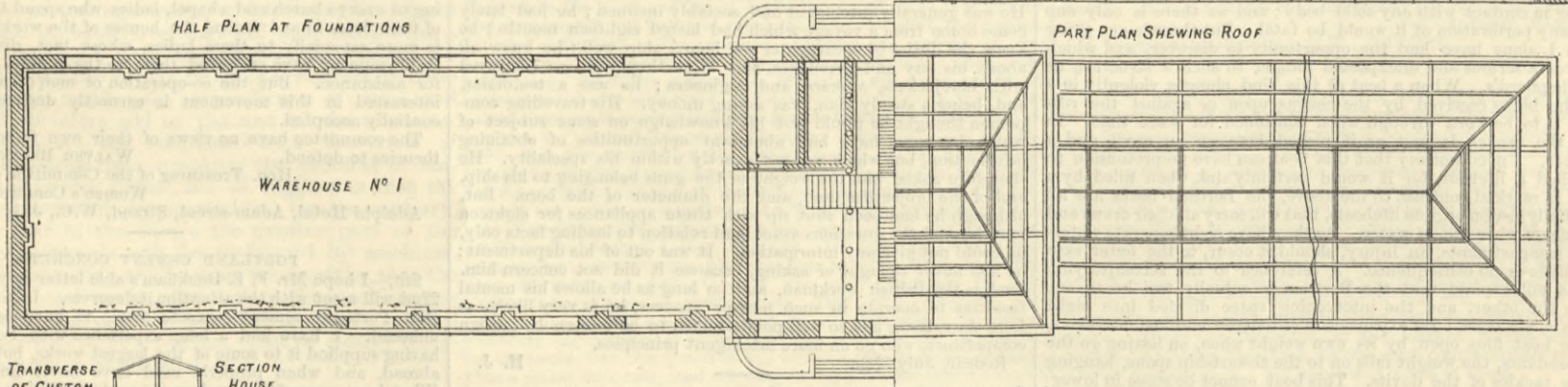
MR. R. E. WILSON, M. INST. C.E., WESTMINSTER, ENGINEER.

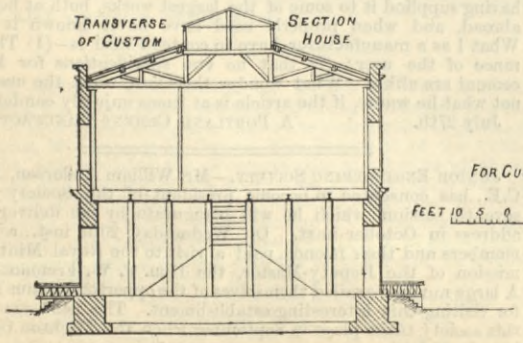
(*For description see page* 90.)

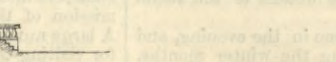


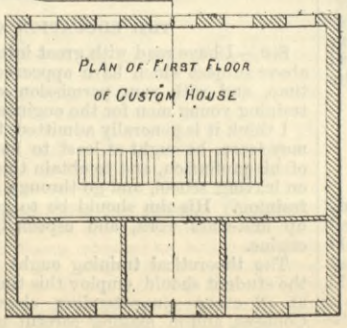


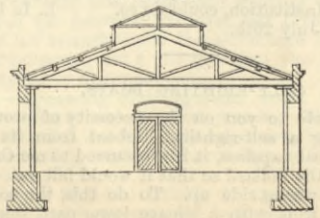






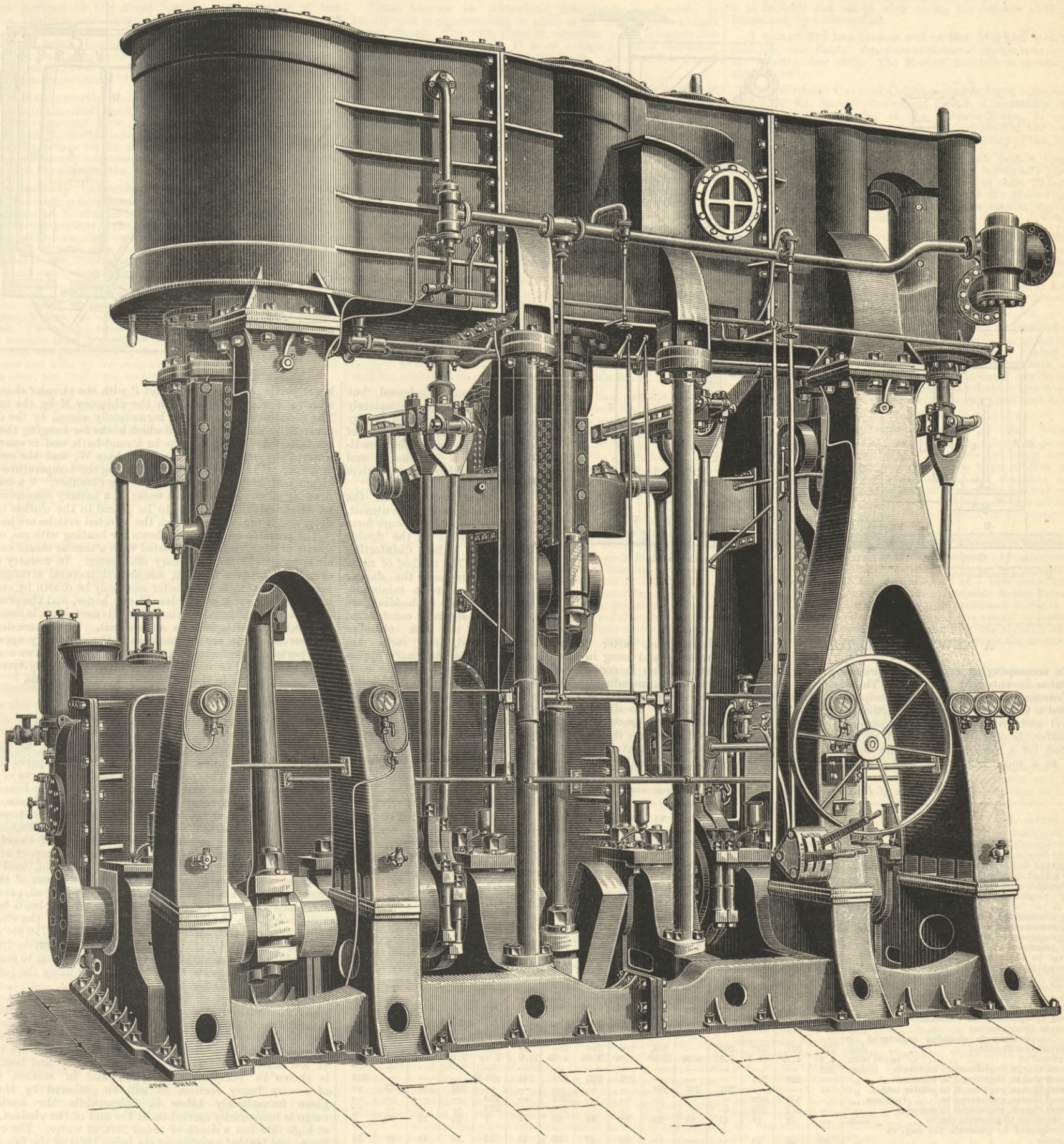






TRIPLE EXPANSION ENGINES, S.S. WORCESTER AND OXFORD.

THE CENTRAL MARINE ENGINEERING COMPANY, WEST HARTLEPOOL, ENGINEERS



TRIPLE EXPANSION ENGINES OF THE S.S. WORCESTER AND S.S. OXFORD.

Above we are enabled to give illustrations taken from some excellent photographs of the triple expansion engines of the Worcester and the Oxford, two large cargo carrying steamers, built by Messrs. Wm. Gray and Co. for the Great Western Steamship Company, of Bristol. The engines are by the Central Marine Engineering Company, of West Hartlepool, and are the twelfth and thirteenth sets turned out from the new engine works of this company. They were specially designed for continuous Atlantic service, and are, in consequence, exceptionally heavy in all details, and massive in general structure. The bed-plate is in two pieces, securely bolted together. It passes beneath the condenser, and its joint is so arranged that the condenser casting serves as a rigid stiffener to the two pieces, obviating all tendency to weakness at the joint. The under side of the bed-plate is levelled and planed up, as is the case with all the engines manufactured by this company, so as to permit of its being supported by and bolted to the ship's engine seating, immediately beneath the main bearings, in line with the principal reciprocating stresses. This is considered by the builders a particularly important feature in their engines, in view of the fact that fractured bed-plates are by no means uncommon, and that the life of crank-shafts is greatly extended by the avoidance of all spring or yielding in the bed-plate. The plan also facilitates the erection of the engines on the iron erecting tables in the shops at the central engine works, which tables were fully described in The Engineer, vol. lxi. p. 299. The cylinders are supported by cast iron columns at the back, which also carry the main guides, and in front there are two massive forked columns in line with the forward and after engines respectively, whilst the middle engine has two polished wrought iron columns. This arrangement gives abundant stiffness combined with great openness and accessibility to the working parts, and moreover it lends a handsome appearance to the whole structure. The cylinders and valves are all in one line over the crank shaft, the first and second cylinders having piston valves of an improved solid adjustable type now manufactured by the Central Company, and the low-pressure cylinder a triple-ported slide valve. The valve gear is a fine example of double bar link motion, every joint being adjustable for wear and every rod adjustable for length. The reversing is performed by a small engine with an oscillating cylinder, snugly placed at the back of the engines, and driving direct on to a worm shaft actuating an "all-round" gear. The worm shaft extends to the front of the engines, where it is fitted with a large hand wheel for use when steam is down. The reversing engine is started, stopped and reversed by the movement of a hand lever in front of the engines, the reversal of the main engines being thus effected in about five seconds. The crank shaft is of steel, and is made in three similar and interchangeable parts. It is borne on six long main bearings, the crank pin bearings being also of more than usual length. The connecting rods are 12in. more than four cranks in length, and are fitted with heavy brasses of gun-metal. The pumps are of the ordinary type, driven by levers from the low-pressure engine. The thrust is on the horseshoe principle, with bearing surfaces of white metal. The block has a base 7ft. in length. The thrust seat built in the ship extends over nine frames, is well bracketted, and forms a substantial and secure foundation for the reception of the thrust forces. The tail-end shaft is of steel lined with brass, and has a bearing on the lignum vitæ 60in. in length. The propeller is of cast iron, loose bladed, made on Mr. Mudd's system of differentiated pitch. The dimensions of the cylinders are 24¾in., 41in., and 66in., by 45in. stroke, and steam is supplied by two double-ended boilers 12ft. 6in. diameter by 17ft. long, with twelve furnaces, which are made to Board of Trade and Lloyds' approval for a working pressure of 150 lb. per square inch.

The Worcester and Oxford are vessels of 6400 tons displacement, and the latter vessel has just made her first trip across the Atlantic, with a full load of over 4000 tons, in 12½ days from Bristol to New York. The machinery was built under the personal superintendence of Mr. R. J. Cross, the superintendent engineer to the Great Western Steamship Company, and designed by Mr. Thomas Mudd, the manager to the Central Marine Engineering Company.

The American *Army and Navy Journal* says :—"Preparations are now under way for the purpose of manufacturing heavy steel guns at Watervliet arsenal. There are to be ten 8in. and three 20in. guns made, and a specimen of the material to be used has already been received. North-west of the barracks the large building known as shed K is being converted into a machine shop for boring, rifling, and turning the heavy guns. For the lathes and machinery, the building, as staked out, will be about 550ft. long and 415ft. wide. The main building fronts the river, and will be prepared for finishing field, siege, and sea-coast guns. The plans for the alterations have all been made and approved by the authorities at Washington. One of the largest lathes in the world, weighing 175 tons, will be used in the works, and has been shipped over the Fitchburgh Railroad from the South Boston Ironworks. A crane, having a capacity of 50 tons, will also be used in handling the guns. In the event of the next Congress appropriating sufficient money for a gun factory at Watervliet, the entire equipment of the guns will then be manufactured there. The alterations are to be completed by November 1st."

THURSFIELD'S AËRO-STEAM DISINFECTOR.

MR. W. E. THURSFIELD, VIENNA, ENGINEER.

FIG. 1.

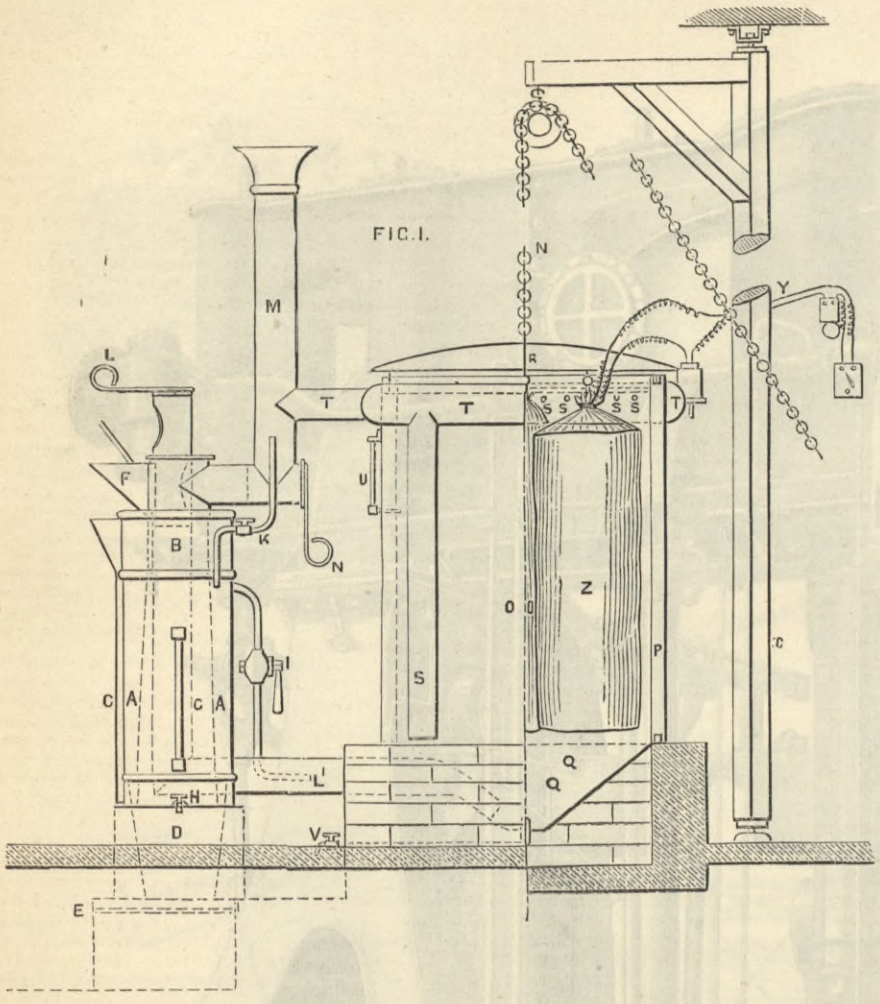
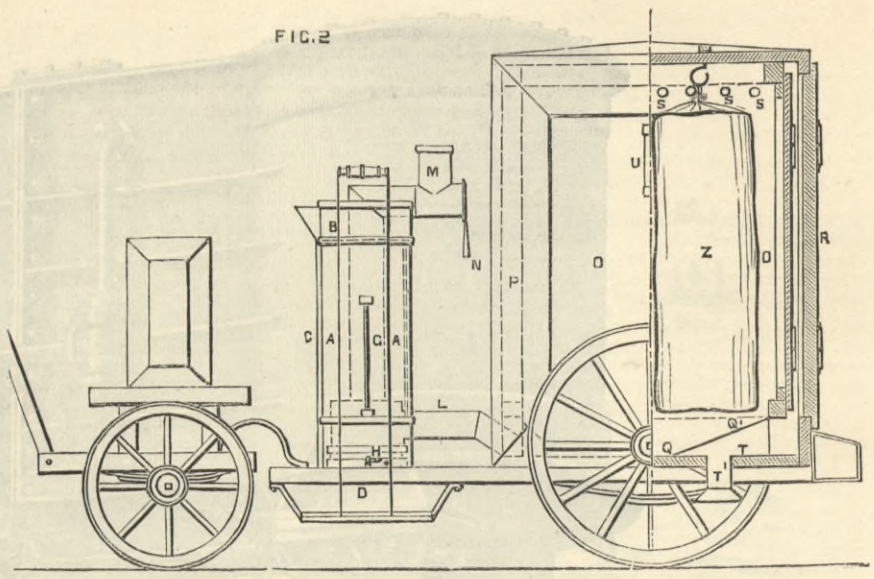


FIG. 2.



A NEW DISINFECTOR.

THE accompanying engravings represent a new disinfecting apparatus invented by Mr. W. E. Thursfield, M. Inst. C.E., of Victorgasse, Vienna. The principle on which its action is based is that the complete destruction of all germs in wearing apparel and bedding, without any material injury whatever to the latter, is only to be obtained by subjecting the articles infected, for a period proportionate to their structural resistance, to a moist heat of at least 212 deg. Fah. Recent experiences in Berlin have shown that, for security's sake, a temperature of 220 deg. is better. To ensure the thorough penetration of this temperature in every fibre, a heat of from 260 deg. to 270 deg. must be maintained in the disinfecting chamber itself. To obtain this by means of ordinary or superheated steam involves the employment of boilers working under a pressure of 2½ to 3 atmospheres, of disinfecting chambers capable of resisting an equal tension, and of skilled labour in attending to the same; in other words, a large initial outlay and correspondingly heavy working expenses in fuel and wages.

The disinfecting apparatus, illustrated in a portable and stationary form, of the dimensions adopted by the sanitary authorities of Vienna, Budapest, Prague, Lemberg, Teplitz, &c., and by the Imperial and Royal Theresianum Institute, and sanctioned for use in barracks, military hospitals, &c., by the Austrian Ministry of War, and for ambulance hospitals by the Red Cross, acts by means of a mixture of steam and hot air in such proportion that the steam, after expending its mechanical energy in inducting the hot air into the disinfecting chamber, is, by contact with the clothes or bedding of a lower temperature, not only condensed, but by condensation completely neutralises the risk of injury through any chance excess of hot air. The boiler being practically open is inexplosive, and requires neither safety valves nor skilled attendance.

The heat generated in the furnace is utilised to the utmost, and the escaping vapours form a steam jacket in the double casing of the disinfecting chamber. The method of manipulation reduces the danger of contagion to a minimum, as the clothes or bedding are placed in specially constructed sacks in the sick chamber itself, and, after being tightly closed, the sacks are removed and hung in the disinfector. The stationary apparatus, which is constructed to disinfect four complete suits of clothes, including underlinen, or one complete set of bedding, including mattress, is specially adapted for hospitals, barracks, gaols, &c. Its dimensions can easily be increased, but the size shown has proved itself, from an economical point of view, the best, as, where the quantity of articles to be disinfected varies, several apparatus can be erected at a less cost than one large one, and one or more be heated as the quantity of infected articles be small or large. In the accompanying drawing A is the boiler, which is filled by pouring water into the reservoir B until the same, entering the boiler at its lowest part through the tube C, rises to the desired height in the water gauge G. C acts also in the place of a safety-valve. D is the fire space, E a movable grate, and F the coal hopper. The fuel consists of charcoal or coke. The boiler is emptied by the cock H. I is a steampipe connecting the steam space with the hot air tube L^1. K is an auxiliary pipe to admit the steam into the chimney during stoppage for emptying and recharging the disinfecting chamber in continuous working. The admission of air is regulated by the handle L and the draught in the chimney M by the handle N. O is the disinfecting chamber enclosed by the space P, which acts at the same time as a steam jacket, and as a channel for the downward passage of the vapours escaping from the chamber through the outlets S. The lower portion of the disinfecting chamber Q is funnel-shaped for the better mixture and distribution of the steam and hot air, and to collect any condensation water. Q^1 is a sieve to catch any fallen article. The vertical tubes S, which serve at the same time to strengthen the chamber, connect the lower portion of the steam jacket P with the circular channel T, which is again connected with the chimney M by the tube T'. The disinfection chamber is hermetically closed by the double cover R, to the lower plate of which hooks for hanging the sacks are fastened. The cover fits in a sand-bath, and is raised and lowered by means of the pulley chain W, and the swinging crane X. U is a thermometer indicating the temperature of the steam and hot-air in the disinfecting chamber. V a cock for drawing off any condensation water, Y a battery connected with an electrical thermometer to be placed in the clothes or bedding, and Z the sacks in which the infected articles are hung.

The portable apparatus as shown for heating with gas, or even spirits of wine, can also be heated with a similar steam and hot-air apparatus as the stationary disinfector. In country towns, or villages, or even in cities, whose architectural arrangements permit, the portable disinfector can easily be drawn by one man into the courtyard, or garden of any house, and the process of disinfection conducted on the spot. Its usefulness in campaigns for ambulance hospitals is self-evident. The letters denoting the several parts are the same as in the stationary apparatus. The portable disinfector is constructed to disinfect two complete suits of clothes, or one mattress. The extremely favourable results are shown in the accompanying table of trials.

Table of Results with Wm. E. Thursfield's Steam and Hot-air Disinfectors.

Series of trials.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.
	Portable apparatus.								Stationary apparatus.						
Contents of boiler, in gallons	3·85	4·18	—	4·18	4·18	4·18	5·7	5·7	10·0	10·0	10·0	10·0	10·0	10·0	10·0
Water added during the process	—	1·54	—	—	—	—	1·4	0·6	4·3	—	—	7·4	1·4	—	—
Temperature of water degs Fah.	—	—	—	72	57	54	43	132	54	46	176	43	43	43	104
Firing commenced with spirits of wine at hours min.	—	2.12	9.10	4.30	—	10.0	—	—	—	—	—	—	—	—	—
Firing commenced with gas at ,,	1.30	—	—	—	3.0	—	—	—	—	—	—	—	—	—	—
Firing commenced with cokes at ,,	—	—	—	—	—	—	—	1.10	—	8.15	1.13	1.43	2.54	—	—
Firing commenced with charcoal at ,,	—	—	—	—	—	—	10.12	—	2.15	—	—	—	—	8.43	10.16
Steam generated at ,,	—	2.34	9.28	4.41	3.15	10.18	10.35	1.34	2.38	8.53	1.20	2.3	3.19	9.3	10.23
212 deg. in chamber registered by external thermometer at ,,	2.30	2.40	9.34	—	—	—	10.50	1.52	2.45	9.3	1.28	2.18	3.37	9.12	10.31
212 deg. in clothes registered by electrical thermometer at ,,	—	—	--	5·25	4.18	12.12	—	—	—	—	1.55	—	—	—	—
221 deg. in clothes registered by electrical thermometer at ,,	—	—	—	—	—	—	11.51	2.34	—	—	—	3.50	4.26	10.4	12.03
Highest temperature in chamber registered by external thermometer deg.	—	270	250	—	324	255	302	275	293	320	284	284	302	284	275
Mean temperature in chamber registered by external thermometer deg.	241	257	239	266	—	253	266	266	284	284	266	266	284	266	266
Trial closed at hours min.	4.45	4.10	11.4	5.45	4.30	12.30	11.51	2.35	4.30	11.0	2.10	3.50	4.35	10.10	12.03
Maximal therm. registered in mattress deg.	262	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Maximal therm. registered in overcoat ,,	—	239	226	—	—	—	223	223	253	244	226	—	—	—	223
Maximal therm. registered in winter coat ,,	—	—	—	232	223	214	—	—	—	—	—	230	232	223	—
Maximal therm registered in ,, trousers ,,	—	243	239	—	—	—	—	—	262	—	253	—	—	—	—
Maximal therm. registered in summer ,, ,,	—	246	252	—	—	—	—	—	280	—	264	—	—	—	—
Time required to generate steam min.	—	22	18	11	15	18	23	24	23	38	7	20	25	20	7
Time required to generate 212 deg. in chamber ,,	60	28	24	—	—	—	38	42	30	48	15	35	43	29	15
Time required to generate 212 deg. in clothes ,,	—	—	—	55	78	132	—	—	—	—	42	—	—	—	—
Time required to generate 221 deg. in clothes ,,	—	—	—	—	—	—	99	85	—	—	—	127	92	81	107
Total duration of process ,,	135	118	114	75	90	150	99	85	135	105	57	127	101	87	107
Water evaporated, in gallons	—	—	—	1·65	1·90	2·75	4·3	3·3	6·93	—	—	9·24	—	3·63	4·84
Consumption of spirits of wine, in pints	—	—	—	3·0	—	9·6	—	—	—	—	—	—	—	—	—
Consumption of gas, in cubic feet	—	—	—	—	70	—	—	—	—	—	—	—	—	—	—
Consumption of cokes, in cbs.	—	—	—	—	—	—	—	6	—	—	8·8	16·5	—	—	—
Consumption of charcoal, in cbs.	—	—	—	—	—	—	8·8	—	16·5	—	—	—	—	14·3	13·8

N.B.—In every case, even in the trials V. and X., in which the temperature in the disinfecting chamber rose above 320 deg. Fah., the clothes, owing to the complete saturation of the hot air with live steam, remained absolutely unimpaired.

The column "water evaporated" shows that the quantity of live steam passing through the disinfecting chamber averages 13 cubic feet per minute with gas or spirits, and 22 cubic feet with charcoal or cokes in the portable, and 33 cubic feet in the stationary apparatus. Trials VI., VII., and VIII. took place in the open air.

According to trial XII., from 28 to 30 complete suits of clothes can be disinfected at an expenditure of about 75 cbs. of coke per diem.

THE CEARA HARBOUR WORKS.

THE works, illustrated by the engravings on p. 88, are now being constructed under a concession from the Imperial Government of Brazil. The province of Ceará has an area of about 50,000 square miles, and is one of the richest in Brazil. Its produce comprises sugar, coffee, cocoa, cotton, tobacco, spices, fruit, cabinet and dye woods, india-rubber, &c. Its population at the last census, taken in 1877, amounted to 952,624 inhabitants, that of the capital, the city and port of Ceará, being about 40,000. Although Ceará is the principal seaport at which lines of English, French, American, Brazilian, and other steamers regularly call, prior to the commencement of the harbour improvements it was almost an open roadstead, passengers and goods having to be conveyed by lighters and boats between vessels and the shore. The official statistics of the trade and shipping of the port show that an income of £35,750 per annum will be collected by the Ceará Harbour Corporation from the dues which they are authorised by their concession to charge on all imports and exports, and on the vessels using the port, and from the rent of the bonded warehouses.

The drawings given here show the nature of the works, which are of a simple character. The depth of water along the principal quay, which is being constructed of solid concrete, and is connected with the shore by an iron and steel viaduct over 750ft. in length—which is already completed—will be 19ft. at low water and 25ft. at high. This quay and breakwater is shown in perspective, in plan, and in section, and is of a very heavy section, as will be gathered by the scale given immediately below it. Meanwhile the landing of cargo is temporarily carried on at the end of the viaduct, which at high tide has a depth of about 20ft. of water. The custom-house and bonded warehouses are being built of the fine granite obtained at the Monguba quarries, which adjoin the Baturité Railway, about sixteen miles from the port. A new incline has also been constructed from the railway down to the port; the line has been laid along the viaduct, and will be extended over the quays as soon as they are completed. The concrete, of which a large quantity is being used, is mixed by Carey and Latham's patent mixers, and the contractors have supplied the very large and complete plant for carrying out the operations.

The engineer to the corporation is Mr. R. E. Wilson, M. Inst. C.E., Westminster, and his resident at Ceará is Mr. R. T. H. Saunders, M. Inst. C.E. The contractors for the work are Messrs. Punchard, McTaggart, and Co., their representative at Ceará being Mr. George Wilson, M. Inst. C.E.

VISIT OF MINING AND MECHANICAL ENGINEERS TO NEWCASTLE-UPON-TYNE.—The following preliminary programme has been issued:—August 3rd (Wednesday)—10 a.m., reception of visitors by the President of the Institute in the Wood Memorial Hall, where all letters for strangers should be addressed; adjournment to the Newcastle-upon-Tyne Royal Mining, Enginering, and Industrial Exhibition, to which the visitors will be admitted, through the kindness of the Executive Council, during the four days of the visit on payment of 2s. 6d.; 8 p.m., conversazione and reception of invited guests by the President, in the Gallery of Fine Arts and Buildings of the Exhibition. August 4th (Thursday)—Excursion to the different collieries in the neighbourhood of Newcastle; details of the objects most worthy of attention at the various collieries will be given in the more extended programme. August 5th (Friday)—Excursion down the river, visiting some engineering shipbuilding, and chemical works on the Tyne, the Albert Edward Dock, and the river Tyne improvement works. August 6th (Saturday)—Visit to engineering establishments in the vicinity of Newcastle; 2 p.m., annual general meeting of the Institute in the Theatre of the Exhibition; address by the President, Sir Lowthian Bell, Bart., F.R.S.

RAILWAY MATTERS.

AN accident occurred on Monday morning on the Western of France Railway near Verriers, a passenger train coming into collision with a goods train. Two passengers were killed and several injured.

THE porters at the most largely used station of the London, Chatham, and Dover Railway—namely, the Ludgate-hill barn—are still the least disciplined and least creditable lot of porters in South London stations. Their behaviour on the arrival of a train remains as disreputably indifferent to the requirements of passengers as ever, and is infinitely inferior to that of the South-Western porters at Waterloo.

THE Handsworth and Perry Bar Railway extension, which was commenced nearly three years ago, will be completed in about two months' time. The line connects the Stour Valley, at Soho and Monument-lane, with the Walsall and Burton route at Perry Bar, close to the present station. There are to be two stations, the larger and more important in the Soho-road, Handsworth, and the other in the Wellington-road.

THE railway between Corinth and Ægium, on the Corinthian Gulf, is now completed. MM. Tricoupis and Theotokis, the Minister of Marine, and others went by train on Sunday and inspected this portion of the line. It will be opened to the public shortly. The remaining section between Ægium and Patras will, it is stated, be finished in about three months, and then, if a line of steamers is established between Patras and Brindisi, London can be reached within four days from Athens.

A SERIOUS landslip occurred on Wednesday near the Dorking station of the London and Brighton Company's main Portsmouth line, in a deep cutting, leading into Betchworth Tunnel. The 4.25 up train from Horsham ran safely through, but a few seconds later a quantity of earth fell in. The traffic was suspended, the passengers by the up express having to leave the carriages and walk up the embankment into the park. Until the line is clear, the traffic will be forwarded by another route.

THE record of train accidents in the United States in May includes 35 collisions, 43 derailments, and five other accidents, a total of 83 accidents, in which 31 persons were killed and 73 injured. These accidents are classified by the *Railroad Gazette* as follows:—Collisions: Rear, 18; butting, 17; total, 35. Derailments: Broken bridge, 3; broken wheel, 1; broken axle, 4; misplaced switch, 2; landslide, 2; accidental obstruction, 5; miscellaneous, 7; unexplained, 19; total, 43. Other accidents, 5. Total number of accidents, 83. The causes of collisions, where given, were as follows:—Trains breaking in two, 4; misplaced switch, 1; failure to put out signal, 3; miscellaneous, 4; unexplained, 23; total, 35.

IN reporting on a collision which occurred on the 15th May, at Limerick terminal station, on the Great Southern and Western Railway of Ireland, Major-General C. S. Hutchinson says:—"In the course of the inquiry I found that the tender engines of this company are not fitted with the vacuum brake connection in front. It seems to me a great pity that so small an economy should have been exercised when the expense of fitting the brake appliances was originally incurred. The absence of brake connections at the front of engines prevents the use of the continuous brakes in those cases (which frequently arise) where engines have to run tender first, or where two engines are attached to a train, and the driver of the leading engine can consequently exercise no control over the train brakes."

ON the proposal of M. de Hérédia, Minister of Public Works, the French Ministerial Council resolved last Saturday that the formation of a metropolitan railway system should be the subject of a new investigation to be immediately proceeded with. A commission composed of engineers will be appointed in the course of the week by the Minister of Public Works, who will take the advice of the higher Council of the Ponts et Chaussées and of the technical committee of the railways. In compliance with the declaration made on Friday to the Chamber by M. Rouvier, in reply to M. Camille Dreyfus, the Chamber on reassembling will be put in possession of the new scheme to be framed by the Minister of Public Works. A meeting will be held to-morrow, under the presidency of M. Lockroy, to protest against the rejection of the metropolitan scheme.

THE International Railway Congress Commission of Brussels announces that the congress will meet at Milan, on September 17th next, and that the sittings will continue until September 25th inclusive. In addition to Italy and Belgium, France, Russia, the Netherlands, Austria-Hungary, Denmark, Sweden and Norway, Portugal, Turkey, Roumania, Bulgaria, Servia, Egypt, and Brazil will all be represented at the congress by official delegates or functionaries of State railways. The companies taking part in the congress represent together in round figures 120,000 kilometres of railway lines, and 140 separate administrative departments. The members, some 300 in number, attending the Milan congress will be officially received as the guests of the Italian Government, by whom instructions have already been given to the Milan authorities that will insure a cordial welcome to the attending delegates. The last international congress—which was at the same time the first—was convened in Brussels by the Belgian Government in 1885, at the time of the celebration of the jubilee of the Belgian railways.

IN a report on the collision that occurred on the 10th June, at Broad-street station, on the North London Railway, when a London and North-Western train from the Mansion House ran against the stop-buffers at the end of the platform at Broad-street, and fifteen passengers were returned as having been shaken and bruised, Col. F. H. Rich says:—"This slight collision was caused by the screw brake on the London and North-Western engine not acting. The screw shaft that works the gearing and puts the brake on and off had become disconnected, owing to the pin, by which the screw is fixed to the gearing, having dropped out. The screw brake had been used at the Mansion House and acted well, before the train left that station. It was not required again until the train reached Broad-street, as the steam and vacuum brakes had been used for all the intermediate stoppages. When the engine-driver, on arriving at Broad-street, found that the screw brake would not act, he applied the steam and vacuum brakes, but it was too late, and he had not sufficient power to stop the train. When the train was brought to a stand at Broad-street station buffers, the washer, which was just above the pin on the screw shaft, was found on the brake lever, immediately under the place from which it had dropped."

THE Julien Electric Company has recently been running experimental cars, actuated by storage batteries, over the Fourth-Avenue surface road in New York City. They have several times run a car over the whole length of the line, from the station at Thirty-second-street down to the City Hall, up to Eighty-ninth-street, and then back to Thirty-second-street. The *Railroad Gazette* says, that in a recent experiment they ran with a speed at certain times of over twelve miles an hour, and the run from the station to the City Hall was made in nineteen minutes, as against thirty-two minutes for the horse cars. Subsequently the car was again run over the route for Mr. Cornelius Vanderbilt and some of the officers of the Fourth Avenue-road. It was sent through the tunnel, from Thirty-second-street to the Grand Central Depôt, at a speed of fifteen miles an hour, and was then worked through the switches and curves about the depôt. The experiment, so far as the operation of the car goes, seems to have been very encouraging, as the starts and stops were made with precision and ease, and the car ran steadily at any speed tried. The president of the company says that the cars can be run at a cost not to exceed 4·10 dols. a day each, running ninety miles, with full loads.

NOTES AND MEMORANDA.

IN London 2724 births and 1977 deaths were registered last week. Nearly 2000 dead bodies put into the ground in one week in the London cemeteries! The unsanitary effect of this is not easily comprehended.

TALC, known in American commerce as *agalite*, is largely used in paper-making in place of kaolin, and gives a much purer effluent. The high glaze of American paper is largely due to the use of this mineral. It is of a highly fibrous character, insoluble in water, and greasy to the touch. In colour it is almost pure white. Its sp. gr. varies from 2·22 to 2·562.

IN 1849 the average rate of transmission of a certain number of telegraph messages addressed to the *Times* was seventeen words per minute. The present speed of the telegraph between London and Dublin, where the Wheatstone automatic instrument is employed, amounts to 462 words a minute. Thus what was regarded as miraculous fifty years ago has multiplied a hundredfold in the course of the half century.

THE following mode of preparing lead carbonate has been described by W. Kubel (*Dingl. polyt. J.*, 262, 143). Lead oxide is readily converted into the soluble hydroxide on treatment with a moderately concentrated solution of magnesium acetate. The solution thus obtained has an alkaline reaction, and yields lead carbonate when treated with carbonic anhydride. The white precipitate is collected, washed, and dried, and the solution of magnesium acetate concentrated and used for another operation.

REFERRING to the successful use of volcanic pumice in the construction of the vaulting of the corridors of the amphitheatre at Catania, run in solidly with Pozzolana cement, Mr. S. Smirke, R.A., remarks that these ancient corridors and the dome of the Pantheon at Rome, executed in the same manner, have stood the sieges, earthquakes, and all other causes of damage and decay, for nearly two thousand years, and he thinks it worthy of inquiry whether a safe, permanent, perhaps even economical, vaulting might not be similarly executed with coke.

MR. A. L. ROTCH has published the results of the observations made at the Blue Hill Meteorological Observatory, Norfolk County, Massachusetts, U.S., in the year 1886. The mean temperature for the year was 45·6 deg. The absolute maximum in the shade was 91·0 deg. in July, and the minimum—15·0 deg. in January, giving a yearly range of 106 deg. The greatest daily range was 38·2 deg. on December 25th, and the least 1·7 deg. in February. The total rainfall and melted snow was 46·99in., measured on 132 days; the greatest monthly fall being 8·29in. in February, and the least 1·52in. in June.

MR. C. S. Wilkinson, the New South Wales Government Geologist, reporting upon the seams of coal pierced in the diamond-drill bore at Holt-Sutherland, near Sydney, says that in this bore a depth of 2307ft. from the surface, or 2175ft. below sea-level, has been attained. This is the deepest diamond-drill bore in Australia. The diameter of the bore to a depth of 500ft. is 3¼in., and below that depth it is 3in. The strata passed through consist of Hawkesbury sandstones, 653ft. 6in.; shales, sandstone, and conglomerates—the upper 314ft. consisting chiefly of chocolate-coloured shales—1573ft. 3in.; upper seam of coal 4ft. 2in.; shales, sandstone, and conglomerate, 65ft.; lower seam of coal, 5ft. 3in.; black shaly sandstone 5ft. 11in.

ELECTRICITY in the house has some important bearings on hygiene. To one of these, *Nature* says, M. Sambuc has recently called attention in the liberation of hydrogen, where strong batteries are used, in which zinc is dissolved by sulphuric acid. Besides the danger of shattering of the vessels, the hydrogen spreading in the air may form an explosive mixture; and it may have a cooling effect through its great conductivity for heat. It also deadens the voice and alters its timbre. Further, if, as may be, the hydrogen is charged with sulphur, arsenic, phosphorus, carbon, or silicium, there are other and greater dangers. A chemist is known to have died from breathing a little arsenietted hydrogen. These facts are not cited against the use of the electric light, but to induce proper care in those who use it.

THE twenty-sixth volume of the magnetical and meteorological observations made at the Government Observatory, Bombay, containing the results for the year 1885, has just been published, under the superintendence of Mr. C. Chambers, F.R.S. The mean barometric pressure for the year was 29·826in., the difference of the greatest and least mean daily pressure amounting to 0·581in. The mean annual temperature was 79·2 deg., and the greatest daily mean was 87·3 deg. on June 6th. The absolute maximum was 91·8 deg. in June—being slightly lower than the maximum in the shade at Greenwich on the 4th inst.—and the minimum 62·1 deg. in February, giving a range of 29·7 deg. The rainfall, measured by a gauge 4½ft. above the ground, was 67·91in.; rain fell on 113 days, and mostly occurred between June and September; the greatest fall was 10·29in. on August 15th.

A SIMPLE form of water battery has been described by H. A. Rowland—*Amer. J. Sci.*—as follows:—"Strips of zinc and copper, each 2in. wide, are soldered together so as to make a combined strip rather less than 4in. wide. This is then cut into pieces about a quarter of inch wide, each composed of half zinc and half copper. A thick plate of glass, a foot square, is heated and coated with shellac, and to this are stuck the strips of copper and zinc which have been bent into the shape of the letter U, with the branches a quarter of an inch apart. The soldered portion is fixed in the shellac, and the two branches stand up in the air, so that the zinc of one piece comes within one-sixteenth of an inch of the copper of the next one. A row 10in. long will thus contain 30 elements. The rows being placed one-eighth of an inch apart, a space 10in. square will contain 800 elements. The plate is carefully warmed, and a mixture of beeswax and resin is poured on to a depth of half an inch. The back of the plate is fitted into a wooden frame with a ring screwed in the centre, so that the whole can be suspended with the elements below. When required for use, the tips of the elements are dipped into a pan of water, and the battery again hung up. The space between the elements will hold a drop of water that will not evaporate for an hour. The battery is thus in operation in a minute, and is perfectly insulated by the glass and cement."

A PAPER on the effects of change of temperature in twisting or untwisting wires which have suffered permanent torsion was recently read before the Physical Society by Mr. Herbert Tomlinson, B.A. The author's attention was redirected to the subject by the note read by Mr. Bosanque on the 14th May. Some eight years ago he made experiments on such wires and noted the effects due to changes produced in the thermal expansibility of the metals by permanent elongation or compression. Thus, if a perfect square be drawn on the surface of a wire, and the wire subjected to permanent torsion, the square becomes a rhombus, the longer diagonal of which suffers permanent extension and the shorter diagonal permanent compression. If permanent extension causes an increase in thermal expansibility, and compression a decrease, than a rise of temperature will cause the wire to twist more, and *vice versa*. With annealed iron wires which have suffered permanent torsion remarkable effects take place at about red heat. On heating such a wire it untwists slightly until a bright red heat is attained, when a sudden twist takes place. On cooling, a sudden untwist occurs at about the same temperature. These effects have been previously observed by Professor Barrett, who believes them to be connected with the sudden changes in the magnetic properties of iron and to take place at the same temperature. This latter conclusion was found to be erroneous, for the author exhibited experiments showing that the magnetic change takes place at a temperature decidedly lower than that at which the jerks above referred to occur.

MISCELLANEA.

POROUS earthenware for building purposes is being exhibited by the International Terra-cotta Lumber Company in the American Exhibition.

A LARGE copper rolling mill, to employ 600 workpeople, is to be built and set to work during the summer at Duisburg, Rheinland, by a Berlin firm.

A GREAT fire has broken out at the Markoff petroleum fountain, near Baku. Fears are entertained that it may spread to the neighbouring wells. The Markoff fountain is spouting over 400 tons daily.

THE Witham General Commissioners have accepted the tender of Mr. Samuel Sherwin, of Boston, Lincolnshire, for the enlargement and lowering of the Hobhole Sluice, in order to secure the full benefit of the depression acquired at low water by the new outfall channel to Clayhole, in the estuary of the Wash.

THE machinery committee of next year's Glasgow International Exhibition propose having an overhead rope-driven crane in the machinery courts, with a lift of some 20 tons, and bearing on rails. This crane will be used for unloading and placing exhibits, and will be allowed to remain during the Exhibition in the central court as an exhibit.

THE report of the proceedings of the Ceylon Chamber of Commerce contains a sub-committee report on the question of a graving dock for Colombo. This committee recommend that the Home Government should be asked to make the docks on condition that the colony provide a northern breakwater for the harbour. The report shows where the money for this is to come from, and is considered a very able one.

THE Clyde Shipping Company have expressed their determination to bring men from Scotland to discharge their vessels in Limerick in consequence of the local labourers having struck against the use of the steam winch, as interfering with manual labour. The Limerick labourers threaten to expel any Scotchman who may come to Limerick to interfere with them. The Waterford Labourers' Society has promised hearty support, and sent delegates to Limerick to confer with the men.

MR. BROTHERTON, superintendent of the American smelter, at Leadville, Col., has patented a plan for generating steam for motive-power at the smelters by using hot slag. By this method the slag is dumped into large shallow vessels, which are afterward run under boilers, and the heat used in generating steam. An experimental test of the method resulted in maintaining 75 lb. pressure on a vertical boiler for seven days. If the plan proves practical, it will result in a saving to the smelter of 1500 dols. a month.

ON the re-assembling of the French Chambers in October a project for the further improvement and enlargement of the Port of Havre will be presented. This project consists in the creation to the north of the roadstead of a new outer harbour. For large vessels the port is now only accessible during three hours at high tide. In addition to this, the continued increase in the alluvial bank at the estuary of the Seine has caused apprehensions for the future of Havre. In consequence of the recently executed embankments of the Lower Seine, the deposits at the mouth of the river have greatly increased.

A DINNER in commemoration of the jubilee of electric telegraphy was given on Wednesday evening in the Holborn Restaurant. The Postmaster-General—Mr. H. C. Raikes, M.P.—presided, and was supported by a large number of scientific and other gentlemen. Mr. Raikes, giving "The Progress of Telegraphy," said that, by the persevering efforts of many successive scientific workers, the laws which governed the action of that marvellous force commonly called the electric current had in 1837 become sufficiently known to admit of its being employed for practical purposes. On July 25th, 1837, Messrs. Cooke and Wheatstone succeeded in conveying a message from Euston to Camden Town.

ON Wednesday M. de Hérédia and M. Dautresme, French Ministers of Commerce and Public Works, inaugurated the Tancarville Canal, which is to place Havre in communication by water with the main waterways of the interior of France. This new canal, leading from Havre to Tancarville, crosses the plain of Graville, passes Harfleur, skirts the hills of Gonfreville, Corcher, Rogerville, Oudalle, and Sandouville, and reaches Tancarville across the pasture land of the Communes of St. Vigor la Cerlangue and Tancarville. It enters the Seine at 96 kilos. below Rouen, its total length being 25 kilos. It is expected to have the effect of reducing the price of freights by at least 2f. per ton between Havre and Paris.

A CONSIDERABLE amount of dredging is at present in progress in the harbour at Whitby, with the object of enabling vessels to get up the river as far as the extreme end of the town, at any state of the tide. Whitby has been, from time immemorial, a fishing station, but the fish trade has remained to a considerable extent undeveloped for want of proper facilities, especially in the way of easy access for the boats to the quays at any time of the tide. The North-Eastern Railway Company, which derives an important part of its revenue from the fish trade, has wisely decided to contribute a considerable sum of money towards the general improvement of Whitby harbour, and it is further assisting by undertaking to do a certain amount of dredging with its own appliances. The building of a new fish quay is in contemplation, and also the erection of sheds for the packing and forwarding of the fish as soon as brought in.

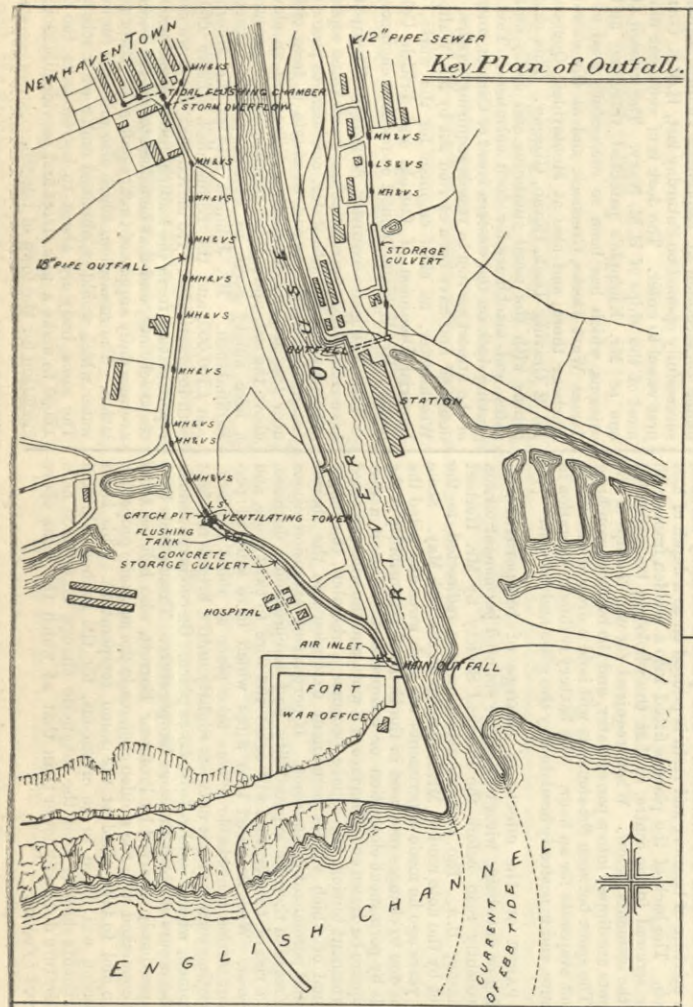
THE new graving dock which has been for some time under construction at Esquimalt, Victoria, British Columbia, was successfully opened on Saturday last, H.M.S. Cormorant being the first vessel to enter. The dock is of sufficient dimensions to dock most of the ships of H.M. Navy. The caisson at the entrance is one of Mr. Kinipple's patented travelling and folding bridge caissons, which has been so successfully used at the Garvel and James Watt Docks, Greenock, and at the entrance to the West Harbour there, and also at Montevideo, Quebec, Aberdeen, and No. 2 Graving Dock, Govan, Glasgow. This class of caisson dispenses with the usual cumbrous and costly swing bridges, dock gates, and machinery for dock entrances. This dock is the only graving dock on the western coast of Canada, and no doubt will be of the utmost service to vessels requiring repairs. The works were designed and have been carried out by Mr. Walter R. Kinipple, of Westminster, as chief engineer for the works, on behalf of the Imperial Dominion of Canada and British Columbian Governments; Mr. William Bennett as resident engineer.

THE Lurgan—county Armagh—Town Commissioners have considered the relative merits of three separate schemes for supplying Lurgan with water, one being to procure the water from Lough Neagh, the second to obtain it from either of two lakes near the Mourne Mountains, Kilkeel, at an elevation of 1600ft. above the sea, and a third scheme, one to procure the water from a lake ninety acres in extent, situate between Dromore and Ballinahinch. Mr. Johnson said as the Mourne scheme would cost £100,000, and the Ballinahinch scheme £60,000, he thought both impracticable. He moved that the town surveyor prepare a report setting forth the leading features and probable cost of the three schemes, and that he calculates on the basis of providing an average daily supply of twenty gallons of water per head of population. The resolution, which also provided for an analysis of the water which would be obtained under each scheme, was adopted. The same body are about to borrow from the Board of Works £6000 to make a new street and provide additional market accommodation for the town of Lurgan.

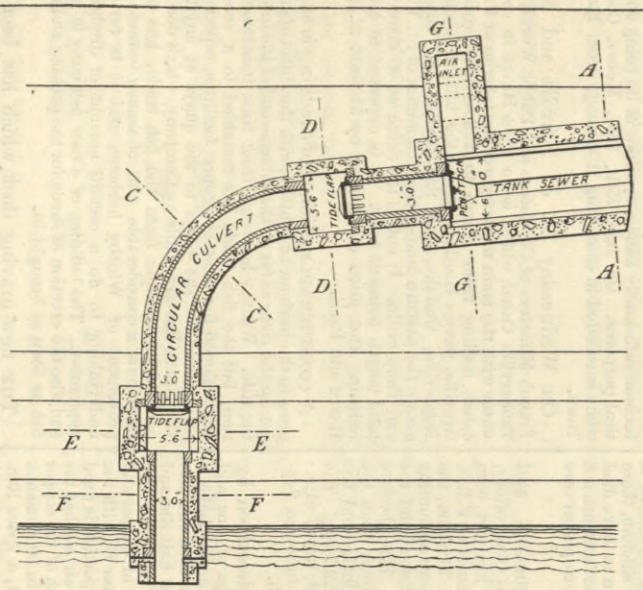
THE DRAINAGE WORKS OF NEWHAVEN.

MR. W. H. RADFORD, ASSOC. M. INST. C.E., ENGINEER.

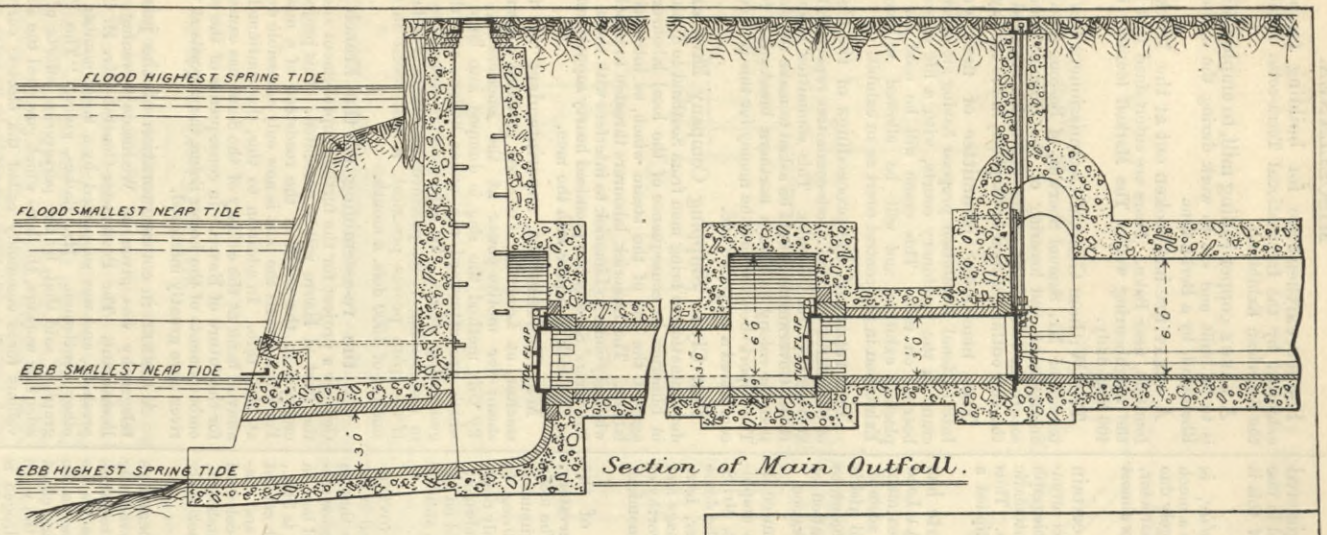
(*For description see page 96.*)



Key Plan of Outfall.

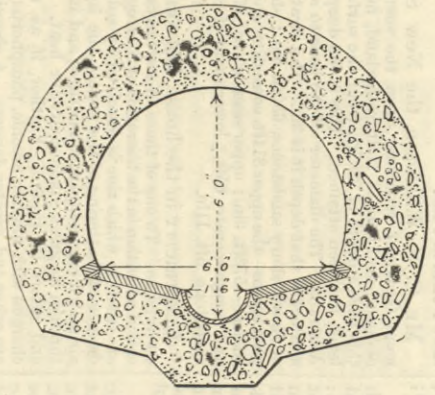


Plan of Main Outfall.

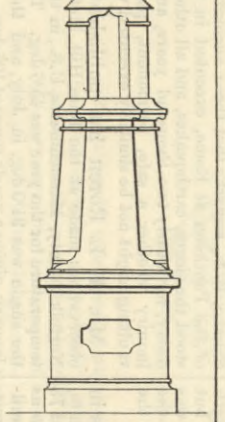


Section of Main Outfall.

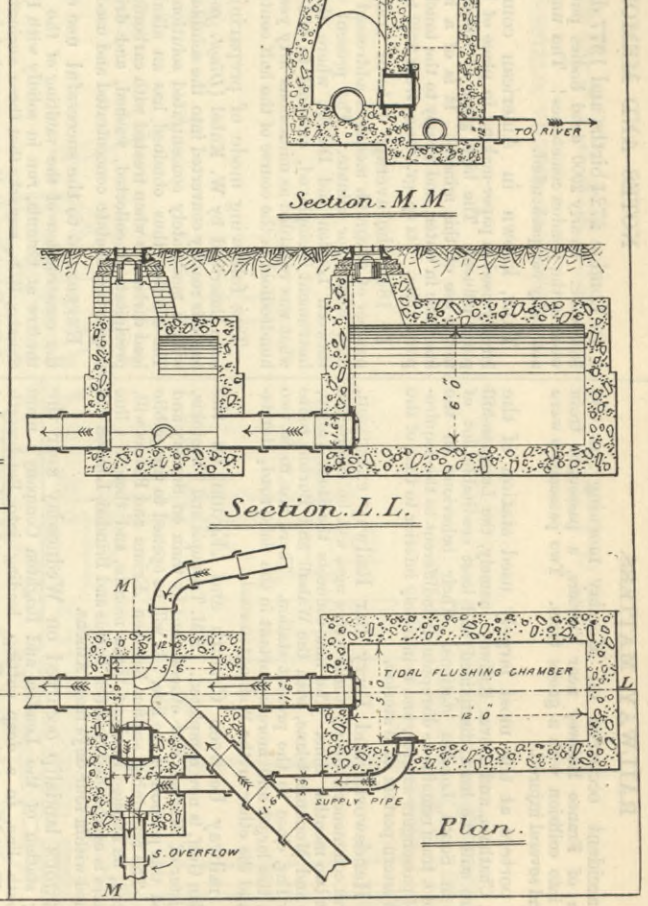
Section G.G.



Section A.A.



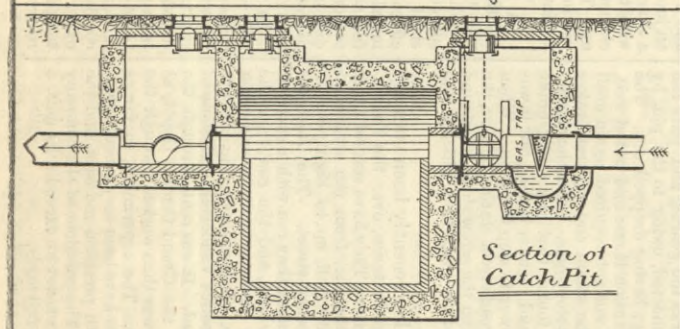
Ventilation Tower.



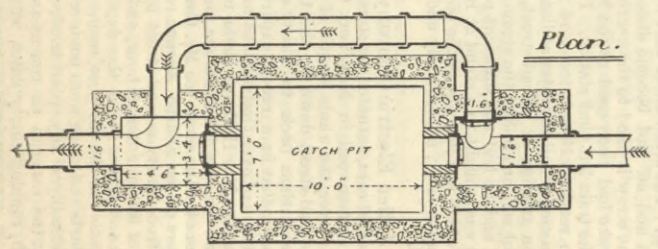
Tidal Flushing Chamber & Storm Overflow.

Section M.M

Section I.I.

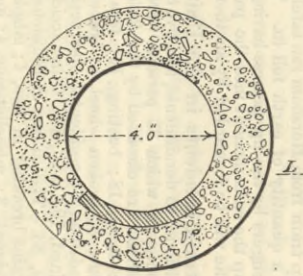


Section of Catch Pit



Plan.

Section of Storage Culvert East of River.



Section. H.H

Plan.

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TO CORRESPONDENTS.

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R. A. C. (Calgary).—*Sixteen shillings will balance your subscription for a year.*

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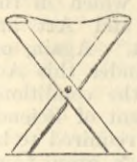
WHITWORTH SCHOLAR (Demerara).—(1) *The total number of units of heat in a pound of steam will be practically the same after the steam has passed the reducing valve, the loss caused by friction being negligible. Therefore the efficiency of the steam will not be reduced in so far as that efficiency depends on the total quantity of heat which it contains, and not on its sensible temperature.* (2) *There may be a great loss of efficiency caused by using the steam for pumping in too large a cylinder, due to cylinder condensation—a subject which has been discussed over and over again in our pages.* (3) *Is already answered by the reply to No.* 2. (4) *The fly-wheel pump will be the more economical.*

STRESSES IN THE LEGS OF A CROSS-LEGGED STOOL.

(To the Editor of The Engineer.)

SIR,—Although the following question relates to stresses in an elementary form of structure, I am unable to satisfy myself concerning them. Although bent upon holiday idleness, the engineering bent provides a puzzle, and to satisfy the importunity of the recurrent thought each time I seat myself on my portable seat, I beg to be allowed to shunt it on to your readers.



What *are* the stresses in this stool? The legs are ash, 2ft. long, and only 1¼in. by ¼in., and the hole for the screw pin where they cross is about ¼in. I weigh 140 lb., and my calculations show that the stool should break with about 90 lb. I will not send my calculations, for fear they have some of the laxity bred of idleness, but I should much like to see some by somebody not quite so much

Swanage, July 24th. PUZZLED.

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MEETINGS NEXT WEEK.

INSTITUTION OF MECHANICAL ENGINEERS.—Edinburgh meeting, 1887. The summer meeting of this Institution will be held in Edinburgh, and will commence on Tuesday, August 2nd. The following papers are announced:—"On the Structure and Progress of the Forth Bridge," by Mr. E. Malcolm Wood, of London; "Notes on the Machinery Employed at the Forth Bridge Works," by Mr. William Arrol, of Glasgow; "On the Paraffine Oil Industry in Scotland," by Mr. St. John V. Day, hon. local secretary; "Description of the Electric Light on the Isle of May," by Mr. David A. Stevenson, of Edinburgh; "Description of the New Tay Viaduct," by Mr. Fletcher F. S. Kelsey, resident engineer; "On Electromagnetic Machine Tools," by Mr. Frederick John Rowan, of Glasgow; "On the Dredging of the Lower Estuary of the Clyde," by Mr. Charles A. Stevenson, of Edinburgh; "On the Position and Prospects of Electricity as Applied to Engineering," by Mr. William Geipel, of Edinburgh. The meeting commences on August 2nd and ends on Friday, August 5th. On Tuesday, the 2nd, the programme includes: Reception in University Hall, reading of papers, excursions to engineering works and Forth Bridge, and Institution dinner. Wednesday: Papers, excursions to iron and engineering works, *conversazione*. Thursday: Visit to Dundee and Tay Bridge Works. Friday: Excursions to waterworks, paper mills, lighthouse, and Newcastle Exhibition. Numerous engineering works open for visitation.

BIRTH.

July 26th, at 3, Lisgar-terrace, West Kensington, the wife of GEO. WALLER WILLCOCKS, M. Inst. C.E., of a son.

THE ENGINEER.

JULY 29, 1887.

THE NAVAL REVIEW.

WITH all that took place at the great Naval Review held at Spithead on Saturday, the world has been made more or less familiar by the daily press. It would be waste of time did we attempt to tell the story over again. We have failed, however, to find in the columns of our contemporaries certain deductions which admit of being drawn from the spectacle. No doubt they did not suggest themselves to the non-professional mind. We propose to fill the gap, and direct attention to points connected with the construction of warships, which have not, as we think, received the attention they deserve. Let it not be supposed, however, that we are going to fight over again the battle of ships and guns, or to discuss the relative merits of various types of armour. Nor shall we say anything of stability, or ramming, or steering powers. The questions we propose to discuss have indeed little or nothing to do with any of these things. They have as a rule been entirely ignored. To see the modern warship anchored at Spithead sufficed to force these questions on the attention of any thoughtful man, who, knowing something of naval warfare and the conditions under which it will be carried on, was at the same time unwedded to any particular system of construction or method of fighting.

Let us consider what is the purpose for which such a ship as, let us say, the Inflexible has been constructed. This vessel has a displacement of nearly 12,000 tons, her main engines indicate between seven and eight thousand horse-power, and she carries ten guns, four of them very nearly the heaviest afloat. She is besides fully fitted with torpedo gear. The whole object and purpose of this vessel is to carry her 80-ton guns and torpedoes from place to place as they may be required. She has considerable speed, first, because she may at any time be wanted in a hurry in some special place; secondly, that if an enemy tries to run away she may be able to catch her; and lastly, that if she has herself to run away, being attacked by an overwhelming force, she may be able to make the attempt with some prospect of success. The be-all and end-all of her existence is, however, to carry four mighty guns, and to enable them to be discharged with as much effect as possible against an enemy. Regarded from this point of view, it will be seen that everything becomes subordinate to the guns, and, of course, the torpedoes. Now it is impossible, we think, to look at such a ship without feeling that everything is not subordinate to the guns, but that, on the contrary, the guns are subordinate to many things. Let us for the moment leave torpedoes on one side, and consider what would be the best way to make the guns efficient. At the outset it appears that it is a policy of doubtful wisdom to put all four of such extremely expensive eggs in one basket, and that four ships, each carrying one 80-ton gun would be better than one ship carrying four guns of this weight. This point, however, we shall not urge; but, retaining our four guns, does it not appear that these weapons, if to be carried in turrets, ought to be so carried that the ship will present the least possible mark to the enemy, and that the structure of the ship above the water-line should be as simple and straighforward as possible? In one word, Ericsson's Monitor above water supplies the *beau ideal* of what a war ship carrying heavy guns ought to be. We say "above water" advisedly, because there were many and grave defects in the underwater portion of the Monitor type, as elaborated in the United States, which should not be copied. The perfect war ship, then, would be a vessel with her upper deck not raised many feet above the water-line, and nothing projecting above that deck save the two turrets carrying the guns and the funnel. If it be conceded that the object of the life of a war ship is to fight, and that fighting involves the carrying of heavy guns from place to place, then it will be admitted that our definition of the perfect war ship is sound. Of course if our proposition is disputed on the ground that in a war ship everything is not subordinate to guns, a large question for discussion may be opened. Let us suppose for the moment that the soundness of our position is granted, and see how far the modern turret ship complies with it. It was only necessary to pass down the lines at Spithead to see that such ships as the Devastation, Inflexible, Ajax, &c., do not comply with it at all. We have in them first the low deck and the turrets, but above these rises a huge structure, weighing a great many tons, and employed as a promenade deck, if we may so use the words. In addition, there are dozens of great ventilators, needed to take foul air out of the ship and pass air into her, to say nothing of supplying her furnaces. Of boats we need not speak; They may, perhaps, be regarded as necessary evils. It is quite impossible for those who have not been on board a modern turret-ship to fully realise what a mass of "top hamper," as a sailor would say, she carries, but a very fair idea of it could be got by those who kept their eyes open at the review. May we ask, what would become of all this top hamper in a naval engagement? It has often been stated that "deck houses," to use an euphuism, would all be blown to bits during the first few minutes, and that their loss would entail no trouble. This we venture to doubt. That the hurricane deck, &c., would be smashed up by quick-firing shell guns in a very short time is quite true; but can any one assert that the consequences might not be disastrous? We may take it for granted that no lives would be lost, for the crew would be withdrawn below when the ship went into action; but is it not possible that a turret might easily be rendered useless by a mass of heavy ironwork falling on and jamming it? But this is not all. If the great ventilators are essential to the working of the ship, what will occur when these ventilators are crushed up and practically ruined? The funnels are to a certain extent protected by armour-plating near the base, but above they are easily destroyed. What would be the result of this destruction? The furnaces depend for their draught, it may be urged, on fans —not on a chimney. Quite so; but all the fans in existence could not help a ship if her funnel was choked below with fragments of itself dropped from above. Naval architects do all that lies in their power to make a ship impregnable as far as the hull is concerned; and they then build up on the top of this hull a mighty structure of decks and houses and ventilators and funnels, and we know not what, and think that all is well. This view we cannot take. We believe that in this much-neglected superstructure lies an important element of danger, and that the truth has not been recognised before, simply because attention has been diverted altogether to other aspects of the war ship question.

We have no doubt but that it will be urged that these deck structures are essential; that they cannot be done without, that they are needed to provide accommodation for the crew, and as means of navigating the ships. This is quite possible; but, so much the worse. It may be pointed out, however, that by saving the weight of these things the ship might be made to float a little higher in the water, and so provide a little more accommodation for the crew below. It does seem strange that in a ship of 12,000 tons it is impossible to find room for 450 men without resorting to deck houses, and the unprejudiced mind begins to think that if naval architects consulted with naval men a little more it might be possible to arrive at a compromise which would end in reducing the intolerable amount of top hamper now being carried, and would secure means of ventilation without the necessity for the vast windsails which now disfigure our men-of-war, especially the fast ships. So much for one lesson taught, we think, by the review. Now for another.

Those who were fortunate, or shall we say unfortunate, enough to see the review from the great Indian trooper Tamar saw that she was steadily followed from Southampton Docks by a craft which, looked on from the great height of the Tamar's taffrail, more resembled in hue and shape, but certainly not in speed, a huge slug than anything else. This was the submarine torpedo boat, the Nordenfelt, which has already been pretty fully described and illustrated in our pages. The Tamar got out of dock late, as she had to give way to the Orontes and the Himalaya, and she did not waste time in steaming to Portsmouth. She is a fast ship too, and returning to Southampton in the evening she very easily and handsomely beat the Orontes. But on the run down to Portsmouth the Nordenfelt just kept the position with regard to the troopship that she liked best. She was not nearly submerged; yet the target she presented was extremely small. Coming bows on 200 yards or so in the wake of the Tamar, little could be seen but an upheaved mass of water. Unlike torpedo boats, which, when going at speed, lift their bows out of the sea, the Nordenfelt keeps on an even keel, and raises in front of her a curious wave, which is rifle-proof and probably proof even against machine guns, because the solid mass of water deflects bullets upwards at such an angle that they clear the hull. The Nordenfelt appeared to be the very incarnation of destructive power. There was not one of the magnificent and costly men-of-war reviewed by her Majesty that could do anything to avert destruction by the Nordenfeldt, if that destruction were contemplated, save take to her screws as fast as she could. At a distance of a mile the boat, when *à fleur d'eau*—that is to say, with only her little conning-tower out of the water—is invisible; when within a couple of hundred yards we do not believe she would be detected, save by chance, if there was a little sea on; at night, the chances of her being found by torpedo guard-boats would be extremely small. She could thus run quite close up to a ship without availing herself fully of her submarine powers, and her chances of getting away unhurt, after discharging her torpedoes, would be very good. But she could approach within a mile of an ironclad at anchor; take her bearings accurately and then go down, and proceed under water until she had run the requisite distance—she could, if in any doubt, come nearly to the top for a moment to permit the steersman to see where he was precisely, and then go down without being detected, or, if detected, injured—and immediately afterwards deliver a blow which would send a great ironclad to the bottom. The Nordenfelt has rendered, we think, naval operations against forts and harbours nearly impossible. No commander dare lie near a harbour from which a submarine boat could be despatched to blow up his ship. The one chance remaining is that ships may be rendered torpedo proof, and how that is to be done remains to be seen.

During the review the Nordenfelt lay near the Tamar. In the evening she weighed her anchor and steamed back to Southampton, where, we understand, Government

trials will be carried out with her in a short time. Events follow each other with rapidity in the nineteenth century. We have already seen the British Navy entirely reconstructed on principles which were not dreamed of in 1856. It is possible that a very few years will suffice to see it remodelled once more, and our readers may rest assured that if this be the case the influence of the Nordenfelt will be manifested in that remodelling.

THE RUSSIAN IRON TRADE.

It was not unforeseen that, at some day or other, as the means of facile transport increased in our colonial dependencies and in the later settled districts of foreign countries, the wave of protective measures within them would extend. Until such means became available—indeed for the very construction of those means—the iron trade of Great Britain has been allowed a free hand. But our weapons have been turned against ourselves. The railways for which we have for many years past supplied the most necessary material have spread, until they have brought the iron-producing districts of foreign countries, and of our Colonies, formerly isolated from their great manufacturing centres, into comparatively close proximity with them, and those whose communications we have thus fostered are now prepared to emancipate themselves from the formerly enforced connection, and to forbid practically all chance of our competing with the local production which has now become possible.

Canada but very lately felt that the time had arrived at which it might be possible for her to walk alone as to her future needs for railway material. We witnessed the outcome to such a feeling in the very heavy duties she imposed against imports of that character from the Mother Country. Her railway system has so spread, that districts abounding in iron have been opened to her industry, and she has determined to stimulate that industry by a course which is repugnant to those thick-and-thin Free Traders who can recognise no wisdom in dealing with exigencies in any way beyond the scope of their own hard-and-fast principles. Whether Canada, and other countries following her example, will or will not be able in the end to supply themselves at an equivalent rate to that they have hitherto had to pay for supplies furnished to them from Great Britain, is a question into which we do not propose to enter; but that such a result is looked for and thought practicable by foreigners, is evidenced by the measures of a similar nature to those of Canada which the Russian Government has just seen fit to take. Indeed, the Government of the Czar has gone far beyond the example set by our own great Western dependency. The restrictions placed upon the import of iron manufactures by the latter seem to be but tentative only when compared with the sweeping character of Russian procedure. Before considering the possible results of this, it will be as well to briefly review the figures which illustrate its intent.

A despatch of Sir R. B. D. Morier informs us that it has been determined to increase the duty on bar iron arriving by land in Russia by 100 per cent., while on that arriving by sea the increase is to be equal to 66 per cent. The duty on metallic and mineral ores is increased by 75 per cent., and that on iron and steel manufactured goods is augmented at rates varying from 17 per cent. on tools to 43 per cent. on locomotives. These impositions are of evil augury enough to our iron manufactures export trade; but bad as is the outlook they create, worse remains behind. The same despatch further informs us that the Mining Department propose to restrict the importation of foreign cast iron into Russia to a total of 360,000,000 lb. during the present year, and to prohibit its importation altogether at the expiration of seven years. The explanation of the intended gradual entire cessation of such imports is to be found in the fact that year by year the Russian railway system has been pushing on towards the full development of the Oural and other mining regions. The present progress of that development it is in contemplation to illustrate by an exhibition about to be held at Ekaterinsburg. The Oural chain has long been famed for its mineral and metallic wealth. The Russian Government has been extending by rapid strides the means for the full development of that wealth, and we now see the approaching realisation of its endeavour in the protective steps it has lately seen fit to make public notification of.

However sound the Free Trade principles so largely adopted by many of our countrymen may appear to be to them, it is useless to deny that the instances we have given above, besides many others that might be quoted, amply show how fully they are disregarded and contemned by not alone our own brethren in race and speech, but by foreigners. With that aspect of the case it is not, however, our province to deal. But what touches us closely is the serious result to our own iron trade which is to be apprehended from these fresh measures. We cannot attempt to controvert the fact that already our home iron trade—and especially that of Scotland—has suffered severely from the foreign competition to which it has of late years been exposed. Equally futile and injurious must it prove to shut our eyes to the further and proximate blow to which that trade must be exposed by the new prohibition which Russia has directed against it. That Scotch and English ironmasters and their workmen can by their skill and by the superior excellency of their machinery compete successfully with Russian production we fully believe. But the competition becomes unequal when the relative cost of extracting ore from deeply worked mines and newly-opened sources of yield is contrasted. Labour is cheap in Russia, and as yet the confusing elements of combination and strikes is unknown there. Without this fresh difficulty to meet, therefore, we should have had to have worked hard to successfully compete with the productions of the newly developed mineral and metalliferous districts of Russia. But with such impositions as we have named joined to our other disabilities, the contest must, we fear, be given up. If those who hold fast to the principles of Free Trade as they receive exposition in this country are right in their views, then, and in that case only, can we expect to see the stringent and prohibitive rules now promulgated relaxed. But if, contrary to the expectation of such advocates, it should eventually happen that both Canada and Russia have found their account in their action, then it must be apprehended that a large and most important branch of trade will have been finally lopped from off our parent stem, and nothing will remain to sustain it in prosperity but the perhaps justifiable hope that British enterprise may be able to open new fields for it in other quarters of the globe.

THE SANITARY REGISTRATION OF BUILDINGS—THE SOCIETY OF CIVIL AND MECHANICAL ENGINEERS.

The drawing up of Bills for the sanitary registration of houses seems to have become the fashion. On the 15th inst. we had occasion to point out the defects of the Bill fathered by Mr. Mark H. Judge; it is our duty in the present issue to say a few words about the amendment Bill which has arisen out of it, and which comes before us under the imprimatur of the Civil and Mechanical Engineers' Society. This Society was requested to give its adhesion to Mr. Judge's Bill, but did not see its way to do so. On the contrary, the Committee appointed to consider the Sanitary Registration of Buildings Bill felt itself forced to propose so many amendments, that they found it more simple to draw up a new one of their own. The broad points of divergence in the Bill thus drafted from the older one are several. In the first place, the Committee considered that as the Bill was one for registration, and as the registering body was to have no control over the licentiates in sanitary practice who were to report on the buildings, the Local Government Board was scarcely adapted to the purpose of a registering machine, and that the Registrar of Births, Deaths and Marriages should be substituted. The Committee also considered that boarding-houses, restaurants, and all places where food is either stored, produced, or distributed, should be included in the Bill. In this the committee was guided by sound, common sense. It was also felt that some definition should be made as to who should incur the expense required by the Act, and that the owner should properly bear his burden; but somehow no clause has been inserted to that effect, so that it is quite possible for a proprietor of a building coming under this Bill to have his house certified, and then to refuse to pay to the licentiate in sanitary practice the fees which are beautifully arranged to scale in a most elaborate schedule, but which the licentiate has not the power to recover. This is a serious omission, but one that would probably be rectified should the Bill ever be laid before the House. Another very important feature of this Bill is that the list of persons entitled to call themselves licentiates in sanitary practice, without examination, has been considerably curtailed, so that only members of the Institution of Civil Engineers, and of the Royal Institute of British Architects, are now included; but this is not sufficient, the list should be done away with altogether. There are numerous eminent members of both these societies whose knowledge of sanitary science is best represented by the cipher 0, and however severe the penalty for falsely reporting on a building may be, still the dangers and complications that might arise are so great that it would be preferable to have no privileged classes at all, but to subject all licentiates in sanitary practice to a severe examination. Besides, if the penalties are supposed to be a sufficient safeguard against non-experts practising as licentiates, there would be no need of examinations at all, which is manifestly absurd. We now come to the question of examinations, and here we find that the Committee of the Civil and Mechanical Engineers' Society have made a very serious error. The examining body is to be appointed by no less technical a personage than the Registrar-General. Now this is altogether wrong. The Registrar-General may be, and probably is, a gentleman of the very highest scientific attainments, but what guarantee is there that he or his successors will know anything of sanitary science? What legal guarantee is there that he may not appoint his own relations to the post of examiners, his sons-in-law, his cousins, his brothers and his nephews? None whatever. It is true that he is limited in his choice, but the clause is very ambiguously worded. It runs as follows:—"9. Any person may present himself to be examined in sanitary science, and, on applying to the Registrar-General on payment of a fee of £3 3s. he shall be examined within three months of his application by an examining body appointed by the Registrar-General, and consisting of at least five members chosen, for England, Scotland and Wales, one member from the Institution of Civil Engineers, one member from the Institution of Surveyors, one member from the Royal Institute of British Architects, one member from the Royal College of Physicians, and one member from the Royal College of Surgeons, and such other members, being not more than three in all, as the said body of five examiners may at their own option themselves elect. For Ireland the examining body shall be chosen, one member from the Institute of Civil Engineers of Ireland, one member from the Institute of Surveyors, one member from the Royal Institute of Architects of Ireland, one member from the Royal College of Physicians, and one member from the Royal College of Surgeons, and such other members, being not more than three in all, as the said body of five examiners may at their own option themselves elect. The Registrar-General shall appoint an official to undertake the office of clerk to each board of examiners, and he shall make public notice of the time and place where and when each examination shall be held at least thirty days before the holding of such examination. The Registrar-General shall decide from time to time what fees or remuneration the examiners shall receive for their services, and he shall defray all the expenses necessary for the due carrying out of this Act. The said examining body shall, under their hands and seal, grant certificates of competency to such persons as they consider to be fit to become licentiates in sanitary practice, but such certificates shall not in themselves qualify the holders to practise as licentiates in sanitary practice."

Now, all this is much too vague. We are not told how many examiners the Registrar-General may appoint beyond the minimum of five. We are not told how these gentlemen are going to be remunerated, presumably out of the fees; nor are we informed whether the clerk will give his services for nothing. If not, we should like to know where his salary is coming from. We think the Civil and Mechanical Engineers' Society might well have taken into consideration that there already exists in this country a very efficient and an exceedingly economical machinery for examinations for the State, and that is the Civil Service Commission. There can be little doubt that the Civil Service Commission would not object in the least to any increase of revenue; and if the Local Government Board were to instruct the examiners of the Civil Service Commission in what subjects licentiates in sanitary practice should be examined, the whole question would be very simply settled, as the Civil Service Commission would be able to command the best examiners that could be procured, and their selection would be above suspicion.

We have pointed out some of the merits and defects of this amendment Bill, which, however, we think a very great improvement on the original. But even this, as any one can see, will want the hand of a Parliamentary expert to make it of any serviceable value. As it is, it is a very meritorious, and a very ingenious attempt to grapple with difficulties before which our legislators have always shrunk, sometimes contemptuously, sometimes with fear and trembling. But the time is fast approaching when this sort of masterly inactivity will have to be relinquished, and when the increasing complexity of life will necessitate legislative interference of a very drastic character. It is to be hoped that when that time arrives the admirable suggestions of the Civil and Mechanical Engineers' Society will receive due attention. But we sincerely trust that the country will not merely content itself with the sanitary registration of hotels and food centres, but will insist on the perfect sanitation of every habitable dwelling. We shall then require some more powerful functionary than this licentiate in sanitary practice, of whom we are now hearing so much. We shall require duly qualified sanitary surveyors, who will have the reporting and discovery of unsanitary dwellings, and we shall require technically trained sanitary engineers, duly assisted by registered plumbers, to make the alterations that may be necessary in old houses, and carry out the sanitation of new ones.

TECHNICAL INSTRUCTION.

Many of our readers are no doubt aware that a Bill is now before Parliament "To Facilitate the Provision of Technical Instruction." This Bill is backed by Sir William Hart-Dyke, Sir Henry Holland, and Mr. Jackson, At first sight it may appear harmless, and even laudable. When, however, we add that if it becomes law there will be a sensible increase in taxation, we venture to think that the ratepayers will hold that it demands careful scrutiny. Any local authority, as defined by this Act, may pass a resolution that it is expedient to provide for supplementing by technical instruction the elementary education supplied in its district, and for that purpose to put in force the provisions of the Act. It might be assumed that this means that the present Board Schools are to be supplemented by schools in which handicraft trades shall be taught. If the matter ended here we should have little to say against the scheme, but it does not end here. South Kensington appears on the scene. In the second page of the Bill, "Two or more local authorities may with the sanction of the Department of Science and Art enter into any agreement that may be necessary in carrying into effect any resolution under this Act; and any such agreement may provide for the appointment of a joint body of managers in the proportion of the contributions to be paid by the respective authorities, and for any other matters which in the opinion of the Department of Science and Art are necessary for carrying out the agreement." Again, on page 3 we find, "Every school provided under this Act shall be conducted in accordance with the conditions specified in the manual of the Department of Science and Art in force for the time being, and required to be fulfilled by such school in order to obtain a grant from the Department." Here we see that the proposed schools are really to be extensions of South Kensington to the provinces, a thing to be regarded with dread.

Those who are in favour of the Bill have not been silent, and although some persons want one thing and some another, the main object is the same in all. The whole scheme is based on the theory that foreigners beat us in commercial competition, because they are better instructed technically than we are. There is not one word of truth in this theory. From first to last it is based on a fallacy. Not one syllable of evidence worth consideration has ever been adduced to prove it, if we except a single department of trade, namely, the art of design. We cheerfully admit that in designing certain articles, such as wall papers, clocks, glass and earthenware, France was at one time ahead of this country; but even when we have conceded this, it does not follow that France was better than England because her children were better taught art. But if to facilitate argument, we concede all that can be urged on this question of designs, the advocates of technical education as a weapon to fight foreigners, have not gained a single point. In the iron trade, for example, how can the spread of technical education aid us? It is not too much to say that every great advance in the process of making iron and steel has originated in Great Britain. Cort, Bessemer, Thomas, and Gilchrist, have but to be named to be recognised as Englishman; even Siemens was virtually an Englishman. What has technical education done for the cotton manufacture? Simply nothing. The whole theory that technical education gives better workmen than we have to France, Germany, or Italy, is baseless. The workmen of the countries we have named are in no sense or way better than our own workmen. Competition is felt, and heavily

felt in this country, because the foreigner has adopted prohibitive tariffs in order to secure the employment of populations that would otherwise be idle. The men of France, and Germany, and America are compelled by these tariffs to develope their own resources and utilise their capital at home. They do not want us to work for them, and the probability is that if their prohibitive tariffs were swept away to-morrow, the countries we have named would be unable to buy goods from us because they would have no manufactures to give in exchange. It is in such facts as these that we must seek for the cause of the tremendous competition which we have now to fight. If all the young men and women in Great Britain could satisfy South Kensington to-morrow that they possessed an adequate technical education, the cause of trade in Great Britain would not be thereby furthered in the smallest degree. Ever since 1851 people have preached the doctrine that outside the pale of technical education there is no salvation for Great Britain. They have seldom troubled themselves to bring forward a single proof in favour of this contention. It is time that men who really do understand what trade is should speak out plainly and tell the world how hollow a sham the technical education craze is.

We have yet to learn what technical education, as contemplated by Sir William Hart-Dyke, means. It may be that he contemplates an extension of School Board work; for example, boys attending the school may be taught carpentering, shoe-making, &c. It is quite clear that the degree of efficiency that can be attained in any trade under the conditions of School Board pupilage will be of the smallest. What *can* a boy learn of these things before he is fifteen? At the most, the least possible smattering. The juvenile carpenter may perhaps construct a better rabbit hutch, thanks to what he has learned at the School Board school, than he could have made if he had not been taught. Theory steps in and says that the boy from the School Board will find favour in the eye of the master carpenter who is subsequently going to teach him his trade. Practice says that the trades union will take a very different view of the matter. Young boys can learn nothing worth learning, under the proposed Act, in the way of trades; and even if they could, the trades unions would interfere to render what they had learned of no account. It is said that the apprenticeship system is dying out, and that its place must be taken by State education. This is another phase of grandmotherly legislation. There is every reason to fear that South Kensington by no means intends to confine its labours to young lads or boys, and it would be rash to assume that there will be any other than a remote connection between the Board School and the technical school. If this surmise is founded on fact, we shall have a number of more or less costly buildings springing up over the country, in which trades will be taught to young men, not to boys, say between the ages of fifteen and twenty-one. In point of fact, they will serve a species of apprenticeship to South Kensington. Can any sane man believe that the trades unions would permit their members to work with men so taught, who would directly compete with them in the labour-market, already heavily overcrowded? The result would be a life of misery for the South Kensington pupil. The whole scheme is so wild, is based on such apparently total ignorance of the conditions under which the supply of handicraftsmen is kept up, that we cannot think that it deserves serious consideration. We are then driven to an alternative scheme, which is that South Kensington does not contemplate the manufacture of smiths and tailors and carpenters; but that in the proposed schools technical education as heretofore understood at South Kensington will be imparted. In other words, the pupil will be taught, if not "all the 'ologies," a fair proportion of them. This tuition will be imparted, say, between the ages of fifteen and twenty-one. What is to become of the pupil subsequently? He will have learned, in the proper marketable sense of the term, no trade and no profession. Let it be clearly understood, that the scheme is intended to bring technical education within the reach of the poor; it is to be paid for by the taxpayer. Wherever there is a school established, there will be a local rate levied to support it. "The expenses incurred by a Local Authority for the purposes of the Act shall be defrayed out of the local rate." There is no room for doubt on this point at least. How is the pupil to be supported during the time he is at school? He cannot earn a living. Are we to suppose that the rates will be augmented sufficiently to provide meals and clothing?

It may, of course, be argued that we are attaching altogether too much importance to the Bill; that, in other words, it contemplates nothing so extensive or far-reaching as we have indicated. All that is contemplated is, say, the establishment of a night school, where two or three times a-week boys will learn something that may be of use to them in the colonies, let us say. This may be so. If it is, the fact has hitherto been carefully concealed. There is certainly nothing in the Bill to indicate that it contemplates the carrying out of a scheme which would be at once cheap and useless. It is clear, besides, that any such insignificant affair could have no effect in fitting Great Britain to fight foreign competitors in the markets of the world. The best clause in the whole Bill is the third, which provides that before a school can be established in any district, a poll shall be taken under the Ballot Act. All members competent to vote for a member of Parliament shall be entitled to vote, and unless there is a majority in favour of the school, it shall not be established, and a new poll shall not be taken before the expiration of twelve months. Unless something more can be advanced in favour of the Bill than has yet been brought forward, Clause 3 will render the Act, should it pass, a dead letter. In this we find consolation.

RAILWAY DIVIDENDS.

THE dividends of many of the chief railways have been announced for the past half-year, enough to enable some idea to be formed of the results of railway working for that period. Dealing only with the ordinary stocks, we find that the Lancashire and Yorkshire Railway is to pay at the rate of 3¾ per cent., as against 3 per cent. for the corresponding period. The North-Eastern is to pay 4¾ as against 4½ per cent. per annum a year ago; the London and South-Western pays at the rate of 3¾, against 3½; the Metropolitan, 5 per cent., against 4 per cent. per annum; and the Manchester and Sheffield 10s. per cent., against *nil*. The London and Brighton, the Great Eastern, and one or two others also add slightly to the sum paid a year ago. We have still to wait for the announcement of three or four of the great companies, but sufficient have been enumerated to show that the general result is a slight increase of the dividend, though it must be acknowledged that the result in one or two instances is not so large an addition as had been hoped for. But there is another feature, and that is the amount carried forward to the credit of the current half-year, and that amount is more, though not so invariably increased as are the dividends. It is worthy of notice that the railway companies are increasing the sums thus carried forward, and that unwisely. There are two features which need alteration: the earnings of the half-year should be divided as fully as possible, and the dividends should be paid at an earlier date than is now generally done. One of the greatest of our railway companies pays its dividend two days after its annual meeting, whilst others retain them for a week, and even a fortnight later, so that the dividend up to the end of June—announced in July—is not paid until the end of August. Returning, however, to the question of the dividends, it must be acknowledged that the slight increase in the amount is a satisfactory indication of some improvement in the extent of the trade of the country; and it is one which will further beneficially affect trade, for the dividends are distributed amongst hundreds of thousands of investors, who speedily put the receipts into circulation. It may be hoped that in the current half-year there will be a further improvement. So far as it has gone, the receipts of the North-Eastern, the Lancashire and Yorkshire, London, Brighton and South Coast, London and South-Western, Manchester and Sheffield, and one or two others, show satisfactory increases which, it may be hoped, will become more general as the year passes on. But the cheapness of iron, steel, and coal will further prove in favour of the railways for the remainder of the year, and there ought to be reduced working-expenses from these causes, as well as larger receipts. It will be extremely satisfactory to find the increased dividends of the first half-year maintained in the second; and, so far as indications are visible yet, this is promised.

ADVANCED PRICES FOR CONTINENTAL GIRDERS IN ENGLAND.

THE importation of Continental rolled iron joists into this country is leading to a new departure in the trade of the constructive engineer. Instead of supplying for building purposes rivetted plate girders in the numbers previously current, a trade is now springing up in the building of combination girders out of Continental rolled ironwork. The change is one which should be well noted. There is important news this week which may tend to give the rivetted girder more chance than it has recently had against its new competitor. Prices of Belgian rolled joists brought into London have just been advanced nearly 10s. per ton, and a further advance of 8s. per ton is spoken of as likely. The cause of the rise is the increased demand at the works, and the determination on the part of the Continental makers to, if possible, effect a change in the want of profits which has characterised the business of the past twelve months or more. During the past year the largest dividend which was made by the Continental companies was only 1¼ per cent. The 10s. advance leaves the price of Belgian joists, 12in. by 6in., if obtained promptly from stock in London, at about £6 12s. 6d. per ton; but if obtained from Belgian works—involving a delay of five or six weeks—at about £5 12s. 6d. These figures cover delivery to consumers in mid-England. It is peculiarly gratifying that steel rolled joists of North of England manufacture are steadily making headway, and architects are specifying them for buildings. Prices of these now range from £6 15s. to £7 15s. per ton, for from 8in. to 16in. depths, also delivered into the Midlands. An important future awaits the English steel joist business.

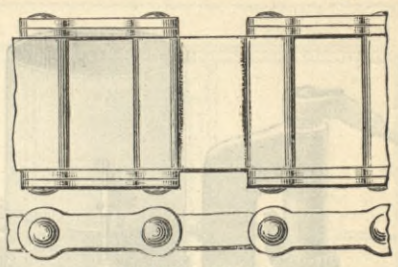
ELECTRIC TRAM-CAR PROPULSION.

FOR some time experiments with a view to electric tram-car propulsion have been carried on at Southwick, near Brighton, by the Electric Traction Syndicate, which has for the purpose had the use of the tramway between Southwick and Hove, and the premises at Southwick for the purpose. For a considerable time very little progress was made; but, within the last few months, tangible results have been arrived at, and at the present time the Syndicate has at work an electro-motive and an electrically propelled car.

The tram-car, which may be seen running between the places mentioned—sometimes at from twelve miles to fifteen miles per hour—is one of the smaller size without roof seats, and is capable of carrying about twenty passengers in all. It is a one-horse car, and weighs, according to figures given us, approximately 1 ton. It is driven by an Immisch series-wound motor, supplied with current by eighty secondary cells, weighing each about 40 lb., or approaching 1·5 tons with their fixings. Passengers may be assumed to reach 1·5 tons. The motor weighs 5·5 cwt., or 0·275 ton; and the gearing, with the brackets, bearers, and strengthening pieces, probably bring this up to about 0·75 ton, making for the whole weight, 4·75 tons. The total weight, however, is given as 5·25 tons, the difference between this and 4·75 tons being due to the accumulators, which are given as weighing 1·75 tons, although they are also said to weigh about 40 lb. each—probably a mistake for 49 lb. The motor and other gear and attachments, which we have assumed at 0·75 ton, is given roughly as 1 ton.

Experiments were first made with a larger motor running at 350 revolutions per minute, but the necessary torque at this low speed required a machine of much greater weight than that now used, which runs at 1000 revolutions per minute with the car running at eight miles per hour. The weight of the attachments was also increased. The Immisch motor is specially designed to give a powerful torque for work of this kind, and no motor which will not do this can be of any use for the purpose, considering the heavy resistance of tramcars on some roads, and the occasional necessity for starting on an incline, a contingency, however, which the careful driver avoids by refusing to stop on an up-gradient.

The car is driven by means of straight link-chain gearing. On the motor spindle is a small chain wheel about 6in. in diameter. This is connected by a steel straight-link chain of the kind shown in the above sketch to a wheel about 20in. in diameter on an intermediate shaft. On this secondary shaft is a small wheel about 7in. diameter, connected to one about 21in. diameter on the driving axle by a chain similar to the above, but of about double the strength. These chains are of steel, and tempered, and are similar to those in use on the Newry and Bessbrook electric tramway, where they have been in use, we are informed, during about a year without any trouble whatever. The road wheels are 30in. diameter and the wheel base 5ft. The secondary batteries used are of the Tatham type, and it is said



DRIVING CHAIN.

that the car can be worked about twenty-five miles with one charge.

On Tuesday the car was shown at work to a number of those interested in the subject. The road is for the greater part straight, but there are some very sharp curves upon it, one being of only 30ft. radius, and it was noticed that the Ampèremeter showed double the current on this curve that was shown immediately before on the straight. A large portion of the road is level, but there are two rather long gradients, stated to be of about 1 in 30, and a short one of about 1 in 20. The road is not in a good condition in one respect, namely, that it is covered with coarse sand and grit, and the grooves are, to a large extent, filled up, so that the resistance even on the level is probably as much as 40 lb. per ton, and more in some parts. The car gear worked well, and was perfectly under control. The motor is not covered in at all, and yet gives no trouble by sparking. The heating on the runs made of nearly two miles, sometimes reaching a speed of twelve to fourteen miles, was barely perceptible, and no doubt keeping the machine uncovered is an advantage in this respect. A small quantity of vaseline is occasionally rubbed on the commutator. The absence of sparking at the commutator is to a great extent due to the Immisch arrangement of brush spring which prevents the brushes from dancing upon the commutator without pressing heavily upon them.

The results attained are very encouraging and very favourably commented upon by Major-General Hutchinson, who inspected and tested the car for the Board of Trade. Some of the leading tramway companies intend, we are informed, to adopt it. The success so far obtained opens up the possibility of extensive applications, but whether by currents conveyed to the car by rail or otherwise, or by accumulators, it would perhaps be difficult to say for considerable time. The Southwick experiments show that there seems to be no difficulty that cannot be surmounted as far as concerns the electro-motor and the driving gearing, the one addition in the gearing now required being an arrangement by which the speed of the car may be varied whilst that of the motor remains unaltered.

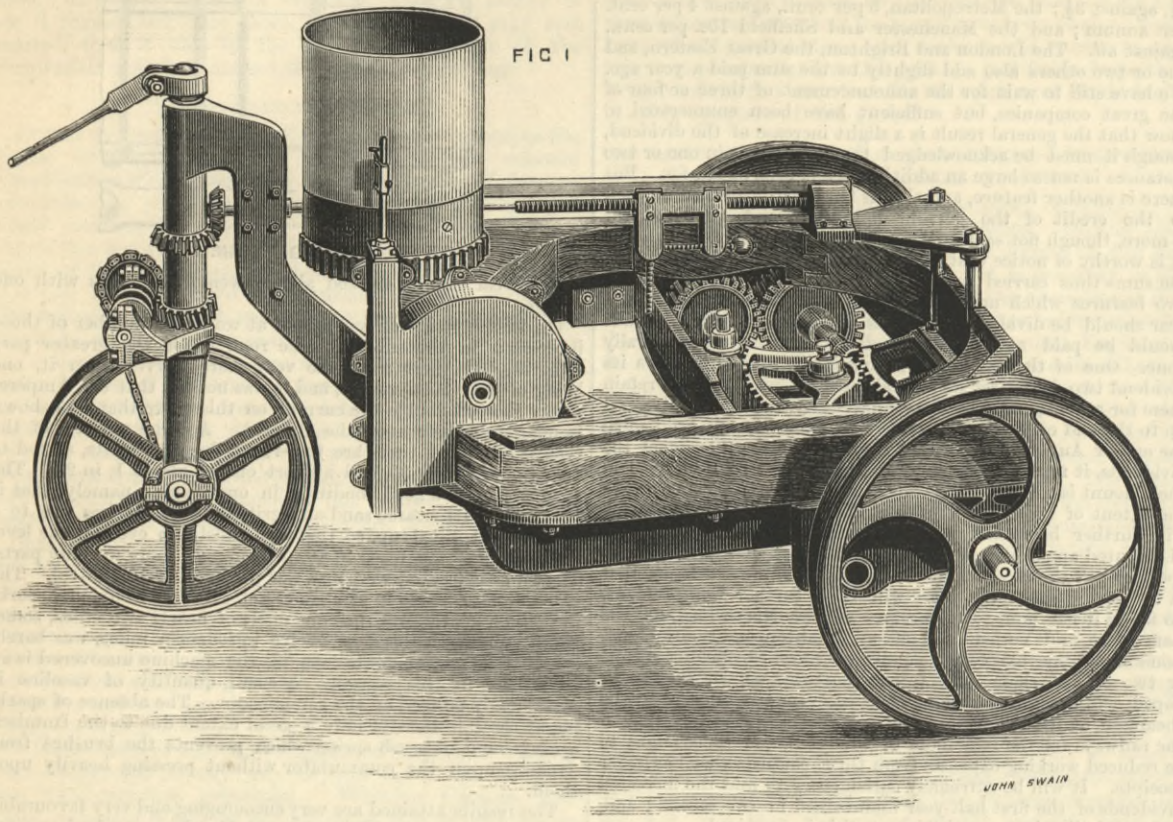
The electro-motive consists of an angle iron frame supporting three platforms, on which accumulators are lodged in sliding cradles. The springs and axle-boxes are designed upon the wagon pattern to carry about 3 tons per wheel. The motors, which are two of the Immisch type, series wound, have a speed of 650 revolutions per minute and armatures 9in. in diameter, and gear direct by pinions at each end of the armature spindle into internal toothed wheels fixed on the inner surface of the driving wheels, which are 3ft. in diameter. The proportion is 10 teeth in the pinion to 67 teeth of the wheel. The motors are suspended from the axles, which are of steel, and have a tension bar from the centre of the fields to the end—framing bar to act as a fulcrum. The motors independently can exert a maximum power, it is stated, of 15-horse power, and together, 30-horse power; but this is much more than is necessary to draw a bogie car and 60 people in it at a mean speed of eight miles per hour over the road, the inclines and curves of which have already been noticed. There are 192 A-size Tatham cells in all on the platforms, divided into two groups, placed at each end of the car, but separated by a well in which the driver stands to attend to the motor whilst running. The motors can be made to run either in series parallel or independently as required, being controlled by a special form of locking switch designed by Messrs. Immisch and Co. By this switch also the discharge of the accumulators in half series or parallel can be controlled, resistance being automatically introduced in starting. The present design of electro-motive is surmounted by a canopy which in practice would be superseded by sitting space for fourteen people, making a passenger load with the bogie car of seventy-four seats. The gross weight of the electro-motive is about 12 tons, the accumulators each weighing 56 lb., and being capable, as we are informed, of a discharge of 70 ampères, having a capacity of about 200 ampère hours. The mean working discharge for draught of 20 tons, that is, electro-motive and bogie car together, at eight miles per hour, is about 40 to 55 ampères per cell, and the electro-motive under these conditions will, it is estimated, run twenty-five to thirty miles in distance without requiring to be recharged. In the present design the accumulators are not intended to be withdrawn, as it is thought that the cells adopted may be charged so quickly that during the trip of one electro-motive the charging of the second, or spare one, may be effected. In ordinary practice, thirty miles represent about half-a-day's work. It may be questioned, however, whether any tramway company will employ enough electro-motives to enable them to stand half their time, but no doubt development will be made in this matter as the actual use of electro-motives increases practical knowledge.

THE autumn meeting of the Iron and Steel Institute takes place in Manchester on the 14th, 15th, and 16th of September next.

THE new steel paddle-wheel steamer Halcyon, belonging to the General Steam Navigation Company, made a directors' trial trip on Wednesday from Fresh Wharf to below the Blythe Sand, taking a full steam run over the measured mile on going and returning, and proving herself capable of performing the 17 knot speed assigned by the builders, Messrs. Scott, of Kircaldy. The vessel is of special design, to meet the requirements of comfort and shelter for 600 passengers, the saloon accommodation being carried out to the full extent of the dimensions of the vessel, and made by framing an integral part of the hull. In this way there is obtained abaft a fine cabin, and above it an even finer dining-room, capable of seating 120 passengers, whilst an enormous upper deck space over all is also provided. Similar, but less extensive and less elegantly furnished accommodation is given forward to second-class passengers—a gateway parting the two fares amidships. The vessel if 215ft. long by 26ft. beam, and 6ft. draft of water. Her engines develope 1300-horse power. She is by far the handsomest and most luxurious of any passenger vessel on any of the Thames services, and steers with great precision and handiness. She may be expected, it is stated, to perform the passage from Ramsgate to London Bridge in five and a-quarter hours.

SURVEYING AND LEVELLING APPARATUS.

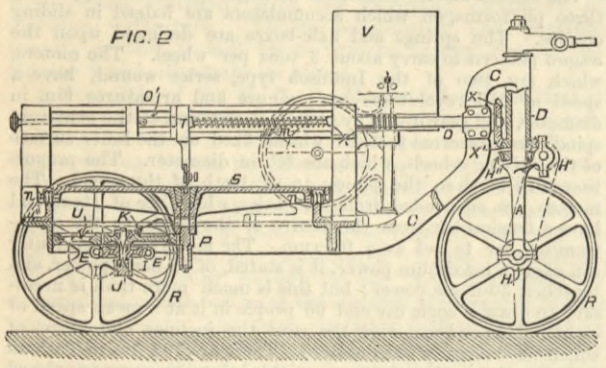
FIG 1



THE AUTOGRAPHOMETRE.

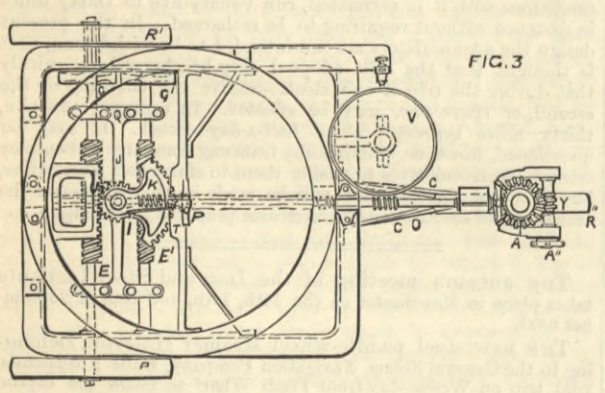
THE new apparatus we are about to describe, says *Le Génie Civil*, to which M. Florian de Villepigne has given the name of autographometre, purposes to survey automatically, by drawing on a known scale, the topography and levels of a given course. As regards topographical survey, the apparatus gives the lengths of the straight parts of the road and the angles of the turnings, and as regards levelling, it traces a distinct outline of the road followed. Very simple in appearance, this apparatus—

FIG. 2



Figs. 1 and 2—is enclosed in a rectangular case resting on three wheels, and drawn by a man or horse over the road to be surveyed. The apparatus is supported on three wheels. The leading wheel R^{II}, which is the guiding wheel, moves in every direction by means of a fork, the axle of which turns freely in a socket fixed to the frame. Of the two trailing wheels, the one R fits round the axle E, the others round a cogged socket on the axle. The axle E is screwed, as is also a splindle E^1, which receives a cog wheel G^1 of the same diameter as the wheel G, which works into it. A heliocentric wheel I gears into the screw of the axle E and of the spindle E^1. Upon the axle of this wheel I is mounted a double-toothed cycloidal sector K, which gears on one side into a pinion, and on the other into a double-toothed rack. On the axle of the pinion P is mounted a horizontal circular plate S, supported by a series of rollers *n*. The axle of the fork of the driving wheel R^{II}

FIG. 3



carries a small bevel pinion X, working into the teeth of a similar pinion X mounted on a small horizontal screwed shaft with pencil carrier T. The bevel pinion X gears with a wheel H^{II}, gearing with a screw *y*, upon the axle of which is mounted a wheel H^1. This, by means of a chain, is coupled to the wheel H on to the axle of the front driving wheel R^{II}. A sheet of paper is placed on the plate S, and on this the pencil T makes its tracing.

It is apparent that if the apparatus be drawn in a straight line, the three wheels R, R^1, R^{II}, which are of the same diameter, would have equal and balancing effects, passing over the same paths; the pencil traces upon the plate a straight line, beginning from the centre and running towards the circumference. But if at a certain moment, for example, a turning be made to the right, the right wheel slackens its movement; the left wheel, on the contrary, is quickened, the spindle E^1 turns more rapidly than the axle E, drags the wheel I and its axle to the left, and consequently the double cycloidal sector K, which causes the pinion P to turn, and naturally the right plate also, to the left, making it describe the angle made by the carriage. The pencil traces an arc of a circle of the same measure as this angle, and continues its movement.

A levelling survey is obtained by the following process:—A hollow vertical cylinder V is fixed on the carriage, around which a sheet of paper is rolled. The base of this cylinder carries a heliocentric wheel, which gears into the screw on the shaft O. The wheel V thus receives a uniform rotary motion when the apparatus is in movement. To the left of this cylinder an iron box—see perspective view, Fig. 1, and detail, Fig. 4—is fixed to the frame C. In the centre an axle is fixed, upon which a hollow wheel t^1 turns. A part of this hollow box, which is partitioned off, and a closed compartment formed *m*—Fig. 4. A vertical pencil carrier *r* moves in a perpendicular line. Two steel bends *n p* rolled in contrary directions over the wheel, and fixed to it and to the pencil carrier, render these two dependent on each other, so that the partial rotary movement of the box is transformed into a vertical movement of the pencil carrier. The box *i* is filled with mercury. The case, which is a part of the wheel *t*, constitutes a float, the centre of gravity of which is constantly found on the vertical line passing through the centre of the cylinder. The result is that when the carriage, and consequently the box *i*, quit the horizontal plane and run on the incline, the mercury changes its level, and causes a partial rotation of the box *t*, which imparts a movement to the pencil in a vertical direction, the pencil tracing upon the cylinder V an outline of the road passed over.

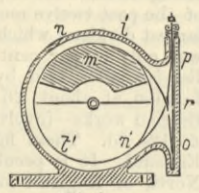


FIG. 4

This new apparatus, in order to work perfectly, requires to be constructed with the greatest precision, and is likely in some cases to be of very great service.

NEWHAVEN DRAINAGE.

WE illustrate details of the drainage works now in course of construction at the Port of Newhaven. The engineer to the works is Mr. W. H. Radford, Assoc. M.I.C.E., Nottingham, and his scheme was chosen in an open competition in February, 1886. There are 3360 yards of pipe sewers in the town on the west side of the river, and these convey the sewage to a storage culvert, where it is retained until half ebb of the tide, when the penstock at the bottom end of the culvert is raised, and the sewage enters the mouth of the tidal river. The penstock is closed again before low water, and no sewage is allowed to enter the river in the flood tide. The outfall sewer has a clear fall into the storage culvert, so that no sewage accumulates in the sewers, and noxious gases are effectually prevented from entering the town. The heavy tidal current in the river during the ebb takes the sewage far out to sea, and in the flood tide the currents set up the English Channel, so that no part of the sewage reaches the coast or enters the river again. The storage culvert is 6ft. 6in. diameter, and 900ft. long, with a capacity of 166,000 gallons. Very large volumes of water have been encountered during the construction of this culvert. Fine cement concrete is used largely, as the materials are found on the spot. There are two tidal flaps at the outfall, in case one gets blocked. No ventilation openings were allowed by the War Department near their fort hospital; consequently a large air inlet is provided near the outfall, and a ventilation tower, with exhaust wind ventilator at the top end of the culvert. Storm overflows are provided for excessive rainfalls. A catch-pit is provided to retain heavy suspended matter before it enters the storage culvert. One feature of the scheme is the utilisation of tidal water for washing the sewers out from end to end. Most of the sewers are below the level of high tide, and therefore the flood fills a number of flushing chambers at convenient places; the water is retained by a flap, and at low tide a man raises the penstock and flushes the sewers. There is an ample number of manholes and ventilators combined, and lamp-shafts and ventilators combined; gas traps on a new principle are fixed to prevent the gases from the low quarters ascending to the high parts of the town; each length of sewer therefore ventilates itself. Hassel's patent pipes are used where water is encountered. Some of the present sewers are and the present outfall is retained on the east side of the river; but a storage culvert, 300ft. long and 4ft. diameter, has been inserted to prevent the sewage backing up the sewers of the town. New flushing and ventilating arrangements are provided for the old sewers. The drainage arrangements of Newhaven were previously in a notoriously bad condition; and as it is one of our chief passenger ports for the Continent, it is important that the town should be drained in accordance with the latest modern principles. Mr. Hayward, of Eastbourne, is the contractor for the works.

THE INSTITUTION OF NAVAL ARCHITECTS.

THAT very vigorous society, the North-East Coast Institution of Engineers and Shipbuilders, invited the Institution of Naval Architects to hold a summer meeting in Newcastle and Sunderland, and upon the acceptation, made in the most complete manner all the necessary arrangements to carry out a very interesting programme. This programme itself is an illustration of the thorough manner in which the Northern Institute does anything it sets about.

The meeting was opened on Tuesday in the hall of the Literary and Philosophical Society, Newcastle-on-Tyne. The president, Mr. W. T. Doxford, and the council of the North-East Coast Institution of Engineers and Shipbuilders attended to welcome the naval architects, and the Mayor and Sheriff of Newcastle also attended in their robes of office with a like view. Many of the most distinguished members of the Institution attended, under the presidency of the Earl of Ravensworth, the company including Lord Armstrong, Sir B. C. Brown, Sir I. Lowthian Bell, Mr. B. Martell, of Lloyd's, Mr. W. Parker, of Lloyd's, Mr. James Laing, Mr. J. C. Stevenson, M.P., and others. After speeches from Mr. Doxford and the Mayor of Newcastle welcoming the members to the North, Lord Ravensworth, as president, returned thanks.

Lord Armstrong opened the regular business of the conference by reading a paper by himself and Mr. J. Vavasseur on the application of hydraulic pressure to gunnery. The paper gave a description of the old type of wooden gun-carriage, running in and out on small low wheels, and with a recoil controlled more or less by the friction produced by making the axles of these wheels abnormally large, or substituting a chock of wood for the rear wheels, the final check being effected by a rope breeching. Iron for wooden carriages was substituted about 1864, and this and the invention of slides for the carriage to run on were great strides in advance; but a new mounting was required, and the increasing weight of guns made other than hand power needful. The steam engine seemed most convenient, and water under pressure the most practical mode of applying its power. The conditions needed for a new mechanical brake were described and the compressor brake described by Mr. George Rendel in 1874 was referred to. This compressor was in almost universal use until superseded by the hydraulic brake, the compressor brake being in the end inadequate to the work required of it. Next a hydraulic "buffer" was employed. Dividing gun-carriages into two classes—the first of carriages for guns from 4in. to 9·2in. in calibre, or 1¼ to 23 tons in weight, and the second for all guns of a larger calibre than 9·2in. —the writers next described the application of hydraulic power to gun-carriages. The Vavasseur mounting was described and illustrated by diagrams, and its distinctive features shown at great length. Comparing a 9·2in. hydraulic-worked mounting with that arranged for hand power, it is said that the hydraulic-worked turret for two guns, with the carriages, slides, engines, and all accessories, weighs 85 tons, and is protected by some 80 tons of armour per gun. The hand-worked gun has a weight of machinery of 26 tons, protected by some 80 tons of armour per gun. The number of men required in the turret to work the manual labour is sixteen, for the hydraulic only five. These statements, the writers concluded, bore out the object of the paper, which was to show the great advantages which have resulted from the application of hydraulic power to naval gunnery, and to describe some of the mechanical adaptations for rendering it available.

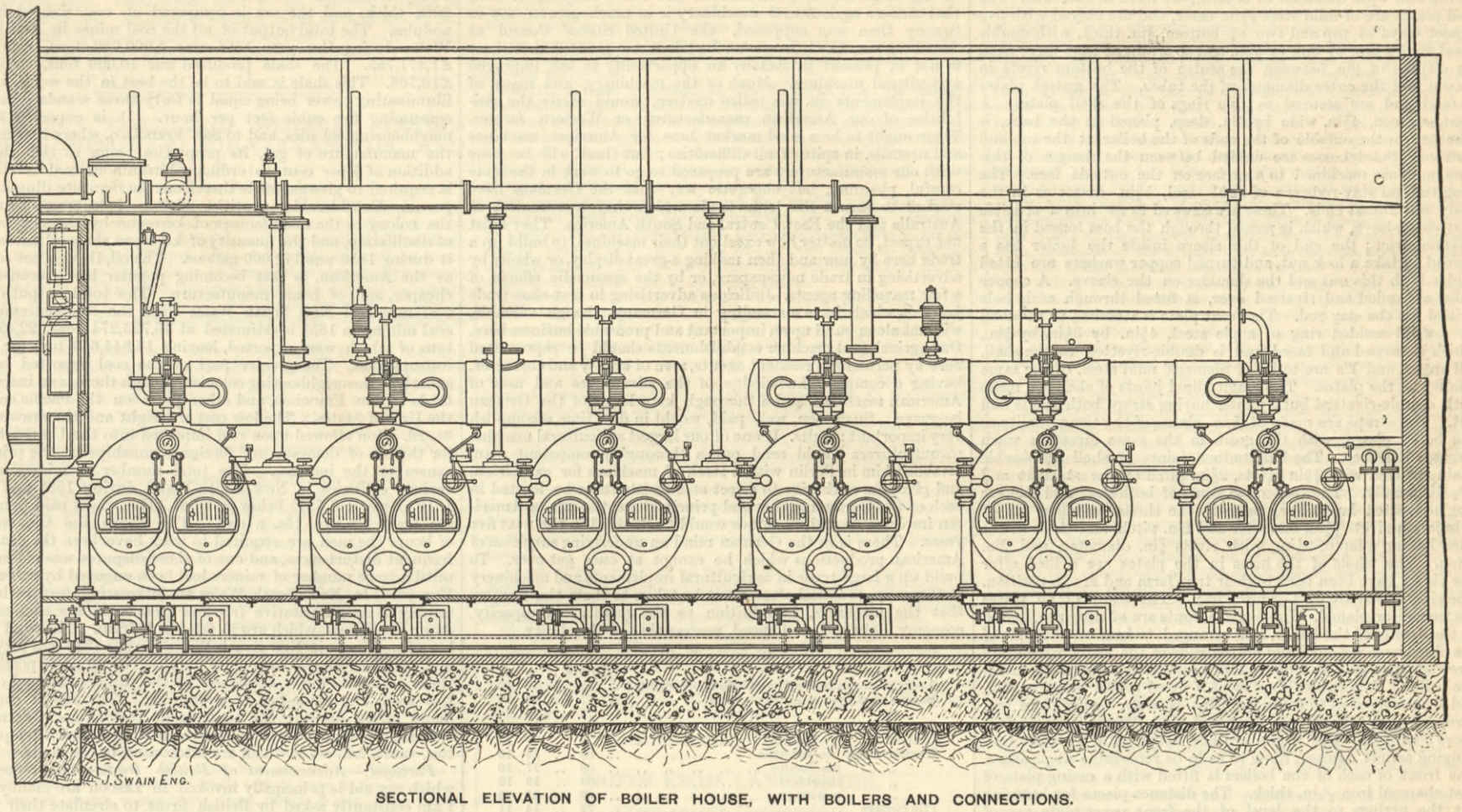
Mr. F. C. Marshall next read a paper on "Recent Developments in Marine Engineering." In the last six years great strides had been made in economising fuel, especially by the introduction of the triple expansion engines, while recent developments as regards power of engines and speed of vessels are remarkable, as shown by the engines employed in the Atlantic liners, in which the power indicated was about 5000-horse power, and now in the Etruria and Umbria is over 14,000. The new vessels placed on the Dover and Calais route and the Isle of Man line were driven at a speed hitherto unprecedented. In war vessels as great improvements were shown. In 1881 the fastest cruiser afloat had a speed of 18½ knots, now there were several having a speed of 19 knots, and one, the Dogali, has attained a speed of 19·75 knots, but she is not likely to retain the supremacy long. The greatest power put into one vessel previous to 1881 was about 8000 horses. In 1881 and 1882 the Italia and Lepanto were being built, having a power of 18,000, while the Italian Government have now the Sardegna with a power of 22,800. The system of the adoption of forced draught was sketched, and the author of the paper credited to Mr. G. W. Rendel its first application to other than torpedo vessels. The advantages of the system of forced draught were pointed out at length, some of them being the reduced size and weight of boilers, the maintenance of uniform pressure of steam, and better control over the operations connected with the generation and maintenance of steam. Interesting tables were given of the increase in the weight of the engines built in recent years by the firm with which the writer is connected. The author contended that, taking a broad view of the position, the near future would show further progress on all points connected with marine engineering, and although the requirements of the mercantile marine are different from those of war vessels, yet in many respects they have much in common, and it may be expected that in such matters as economy of fuel, the mercantile marine will take the lead, and the designers of war vessels will profit by the experience thus gained. So in matters connected with the production of power. On a minimum weight, war vessels will always be to the fore, and will give experiences which the wise will apply and make the most of.

After some remarks by Mr. Parker, Sir I. Lowthian Bell, and Mr. Alexander G. Kirk, the discussion was adjourned until after the reading of Mr. Messent's paper on Thursday morning. The members, at the termination of the Tuesday meeting, were conveyed in brakes to the Elswick Works, where they were shown over the ordnance and shipbuilding departments, and were entertained at luncheon by Lord Armstrong.

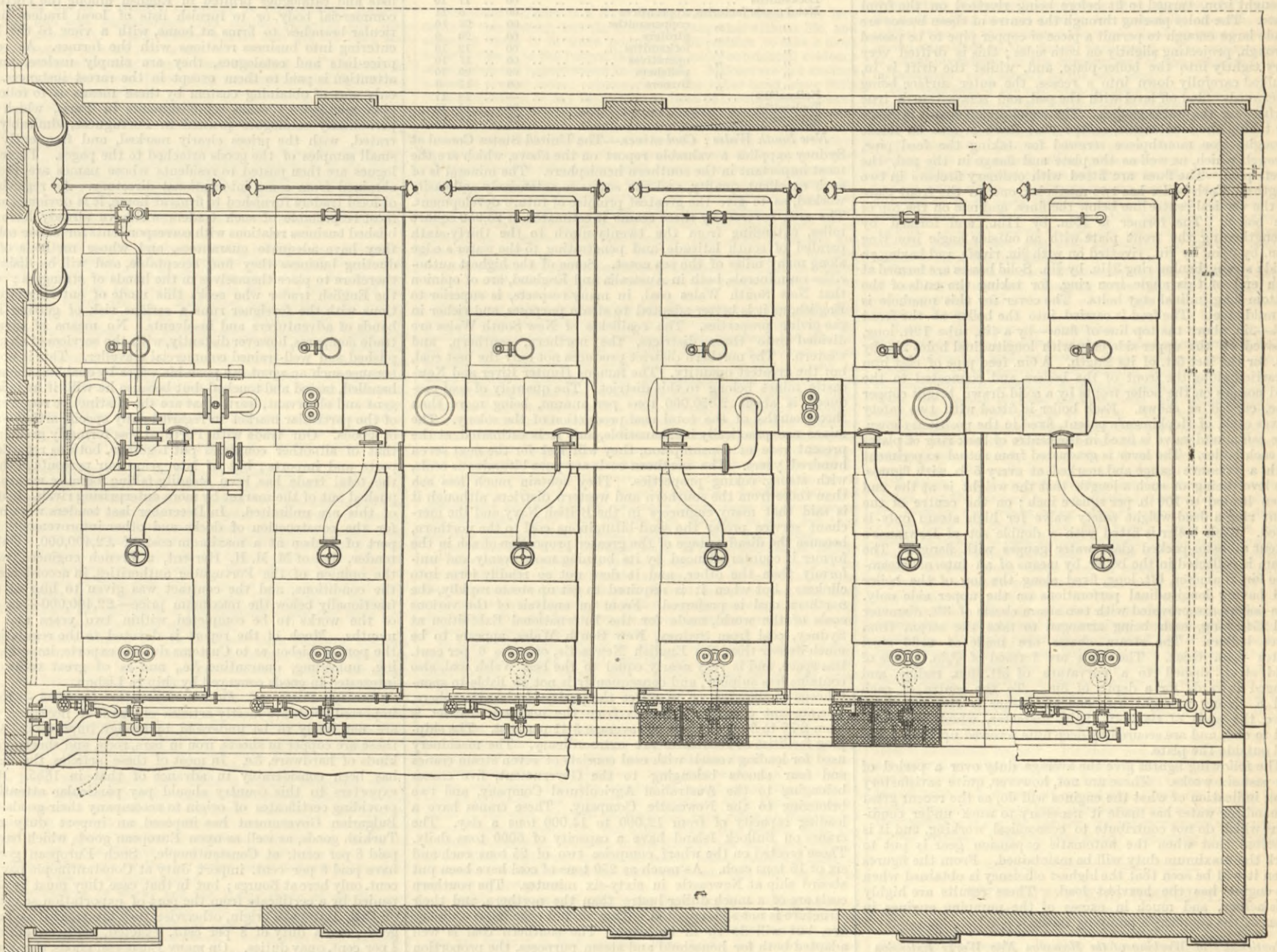
The Institute on Wednesday visited Sunderland. Mr. W. H. White, Naval Constructor to the Admiralty, read a paper on "Some Recent Experiments with Basic Steel." He said that on the completion of the experiments Mr. Barnaby sent in a special report, showing that basic steel very readily welded, and was much less susceptible to blue heat than other makes. The experience gained was limited, but so far it was entirely satisfactory. Summing up the results, Mr. White said there was no reason for doubting the possibility of producing basic steel for ship work without departing from Admiralty limits of strength and ductility. Mr. B. Martell, chief surveyor of Lloyd's Register, read a paper on "The Present Position of Basic Steel as a Material for Shipbuilding." He detailed the result of experiments, and expressed a belief that at no distant date basic steel of uniform ductility and average tensile strength to Siemens-Martin steel would be produced. Lloyd's register would, however, require exhaustive tests of basic steel to be used in ships for classification in the Register. The members of the Institute afterwards visited the anchor and chain testing works of the River Wear Commissioners, from which they proceeded to inspect the new pier works at Roker.

SOUTHWARK AND VAUXHALL WATERWORKS, HAMPTON.

MR. J. W. RESTLER, M. INST. C.E., ENGINEER.



SECTIONAL ELEVATION OF BOILER HOUSE, WITH BOILERS AND CONNECTIONS.



PLAN OF BOILER HOUSE, BOILERS, AND CONNECTIONS.

COMPOUND PUMPING ENGINES—SOUTHWARK AND VAUXHALL WATER COMPANY.

IN the description of these engines, published in our last impression, reference was made to an automatic cut-off, some details for which were given at Fig. 21. p. 68. The engines were designed in the first instance with piston valves, but this was subsequently altered and ordinary exhaust valves at each end of the steam chest used instead, having at their backs a Meyer cut-off valve variable in the usual manner by means of right and left-hand screws. This variation will ultimately, it is intended, be made automatically by altering the travel of the expansion valves. This will be done by shifting the block in the link, Fig. 21, by a connection with a piston actuated by the variation of the pressure in the rising main.

In the engravings above, we illustrate the plan and sectional elevation of the boiler-houses, with the boilers and their connections. The boiler-house on the left side joins the engine-house, as shown by the steam pipe and by the plan we published last week. The boilers are six in number, of the Lancashire type, 7ft. 6in. diameter inside the smallest ring of plates, and 28ft. long, each having two Fox's corrugated flues of 3ft. internal diameter, with a clear waterway between each tube of 3in., and between the tubes and the shell. They are worked at a pressure of 100 lb. per square inch. The shell plates are $\frac{9}{16}$in. thick, 3ft. 3in. wide. The two flues to each boiler, 3ft. inside diameter, reduce to 2ft. 5¼in. diameter at the last plate at back end. The furnaces are made of mild steel $\frac{5}{8}$in. thick, the furnace rings being formed each of two plates, 2ft. 9in. and 7ft., and 2ft. 9in. and 7ft. 6in. respectively in each boiler, the flues

beyond this being formed of two rings of plates 4ft. 4in. in length each, two rings of 3ft. 7in. each, and a taper length of tube $\frac{7}{16}$in. thick, reducing the diameter from 3ft. to 2ft. 5¼in., to connect to end of boiler. Galloway's tubes, 10½in. diameter at top and 5½in. diameter at bottom, are fixed in each flue. The end plates are of mild steel $\frac{11}{16}$in. thick, and are stayed with five gusset stays at top and two at bottom, ½in. thick, with double steel angles 3in. by 3in. by ½in., and so arranged that there shall be a space of 9in. between the centre of the bottom rivets in gusset and the outer diameter of the tubes. The gusset plates extend and are secured to two rings of the shell plates. A channel iron, 4½in. wide by 3in. deep, planed on the back, is rivetted on the outside of the ends of the boiler at the top and bottom. Solid bosses are welded between the flanges of this iron, and are machined to a surface on the outside face. The longitudinal stay-rods are of mild steel, 1¾in. diameter in the body and 2in. at ends. These are screwed to fit into a crucible cast steel sleeve, which is passed through the boss forged in the channel iron; the end of this sleeve inside the boiler has a thread to take a lock nut, and turned copper washers are fitted under both this nut and the shoulder on the sleeve. A copper tube, expanded and rivetted over, is fitted through each hole drilled for the stay-rod. The front plate is attached to the shell by a solid welded ring of angle steel, 4½in. by 3½in. by ⅝in., which is turned and faced, and is double-rivetted to the shell. All angles and T's are to be of Siemens' mild steel, of the same quality as the plates. The longitudinal joints of shell are made with double-rivetted butt joints, having straps both inside and out. The straps are made of $\frac{7}{16}$in. plates, of the same quality as the boiler plates, with the grain in the same direction when rivetted together. The longitudinal joints of shell are double chain rivetted with $\frac{13}{16}$in rivets, 2⅝in. pitch on the straight and $2\frac{1}{16}$ diagonally. The transverse joints of both shell and flue are single-rivetted lap joints, those in the shells having a lap of 2¼in., with rivets $\frac{13}{16}$in. diameter and 2in. pitch, and those in the flues having a lap of 2¼in., with rivets ¾in. diameter, and 2in. pitch. The whole of the holes in the plates are drilled after the plates have been bent to their true form and are in position. The rivets used are of Lowmoor iron. The edges of all plates are turned or planed. The furnace fronts are of cast iron, bolted to the fronts of the boiler, but arranged to bear on the ends of the flues, and not to hang on the ends of the studs, which are screwed through the front plates and fitted with nuts inside the boiler. A polished brass band is fitted round each flue end, and so arranged as to cover the joint between casing plate and furnace front. The fronts are fitted with Martin's patent fire-doors complete. The fronts are also fitted with wrought iron hanging ashpit damper, hung so as to be removable at pleasure. The front of each of the boilers is fitted with a casing plate of best charcoal iron $\frac{3}{16}$in. thick. The distance pieces for bringing out the fittings to the level of the front cover-plate are of wrought iron, turned to fit before being rivetted on the front plate. The holes passing through the centre of these bosses are made large enough to permit a piece of copper pipe to be passed through, projecting slightly on both sides; this is drifted very very tightly into the boiler-plate, and, whilst the drift is in, caulked carefully down into a recess, the outer surface being afterwards filed off level with the pad, and scraped to a true surface for the water gauges. The same arrangement is made for taking the feed nozzle, except that there is also an inside wrought iron mouthpiece screwed for taking the feed pipe, through which, as well as the plate and flange in the pad, the rivets pass. The flues are fitted with ordinary firebars in two lengths. Each boiler has two manholes, one on the front plate on the vertical centre line below the flues, and one on the top of the boiler. The former is 15in. by 11in., and formed by strengthening the front plate with an outside angle iron ring 3¼in. by 3¼in. by ¾in., rivetted on with ⅝in. rivets, and having an inside strengthening ring 3¼in. by ¾in. Solid bosses are formed at each end of this angle iron ring, for taking the ends of the bottom longitudinal stay bolts. The cover for this manhole is of mild steel. The feed is carried into the boiler at the front end—3in. above the top line of flues—by a 4in. tube 12ft. long, grooved on the upper side only with longitudinal holes 2in. by ½in. for the last 5ft. of its length. A 6in. feed pipe of cast iron is carried along the front of the boilers and connected to the feed nozzles on the boiler fronts by a solid drawn bright copper pipe, curved as shown. Each boiler is fitted with two safety valves each, of Hopkinson's patent, fixed in the positions shown. The compound valve is fixed in the centre of back ring of plates on each boiler. The lever is graduated from actual experiment with a pressure gauge and marked at every 5 lb. with figures, the lever being of such a length that the weight is at the end when loaded to 100 lb. per square inch; on the centre of the front ring a dead-weight safety valve for high steam only is fitted. Each boiler is fitted with a double set of Dewrance's patent asbestos-packed glass water gauges with flanges. The steam is collected in the boiler by means of an internal steam-pipe 9in. diameter, 6ft. long, fixed along the top of the boiler and having longitudinal perforations on the upper side only. The boilers are provided with two steam chests of 3ft. diameter and 25ft. long, each being arranged to take the steam from three boilers. The steam chests are made of mild steel plates $\frac{7}{16}$in. thick. The ends are formed of $\frac{9}{16}$in. plates of mild steel, dished to a curvature of 5ft. 6in. radius, and flanged inwards for a depth of 3in. To the centre of each end a strong wrought iron flanged washer is rivetted to receive the ends of tie bolts, 2½in. diameter, which run from end to end, and are secured by deep nuts screwed up both inside and outside the plate.

The following figures give the average duty over a period of the past six weeks. These are not, however, quite satisfactory as an indication of what the engines will do, as the recent great demand for water has made it necessary to work under conditions which do not contribute to economical working, and it is expected that when the automatic expansion gear is put to work the maximum duty will be maintained. From the figures given it will be seen that the highest efficiency is obtained when the engine has the heaviest load. These results are highly satisfactory, and much in excess of the pumping engines in other of the company's pumping stations.

Particulars of Working of the Hampton New Works Extension Engines.

Weeks ending 1887.	Average quantity per day.	Revolutions per minute. Max.	Min.	Av.	Average head of water.	Average duty per cwt. of coal.
June 18 ..	9,642,783	18·85	10·33	12·80	248·47	98,598,454
,, 25 ..	10,474,397	16·95	9·91	10·85	271·92	110,456,434
July 2 ..	11,486,575	15·31	7·30	11·90	275·80	105,750,992
,, 9 ..	11,888,815	14·31	10·20	12·32	284·46	109,395,777
,, 16 ..	11,985,096	14·76	10·38	12·42	284·78	117,160,188
,, 23 ..	11,989,267	15·63	10·60	12·43	287·46	121,414,409
	Average	duty	for	six	weeks	110,462,709

ABSTRACTS OF CONSULAR AND DIPLOMATIC REPORTS.

Germany, field for agricultural machines in.—An article having been recently published on the above subject, showing that modern agricultural machinery is in much greater use in Saxony than was supposed, the United States' Consul at Annaberg remarks it must not be taken for granted that there is not at present in Saxony an opportunity to sell improved agricultural machines. Much of the machinery, and many of the implements in use called modern, would excite the risibilities of our American manufacturer or Western farmer. There ought to be a good market here for American machines and utensils, in spite of all difficulties; but there will be none until our manufacturers are prepared to go to work in the same careful, plodding, but energetic way that the Germans have worked to secure the large trade which they now control in Australia and the East, Central and South America. They must not expect, no matter how excellent their machines, to build up a trade here by now and then making a great display, or wholly by advertising in trade newspapers, or by the spasmodic efforts of a few travelling agents. Judicious advertising in first-class trade journals which have a standing in Germany, though valuable, will not alone build up an important and profitable business here. Our agricultural machine establishments should be represented here by permanent resident agents, men of ability and character, having a complete knowledge of the advantages and uses of American machines, and a thorough knowledge of the German language. Such men, well paid, would in due time accomplish very important results. If one of our largest agricultural machine manufacturers would send out a thoroughly competent man, establish him in Berlin with a stock of machines for exhibition, and give him authority to select able assistants to be located in each of the German States and principalities, the sale of American implements and machines would be doubled in the next five years. There is in the German mind an underlying suspicion of American productions which he cannot at once get over. To build up a large trade in agricultural implements and machinery in Germany, practical steps must be taken to show the farmers that the machines, in addition to the qualities of capacity, economy, lightness, and speed, possess that of durability.

Wages in Berlin.

	Hours.	s.	d.
Average wages paid per week to blacksmiths	72	17	10
Brass and copper work operatives	72	23	10
,, ,, workmen	72	17	10
Coppersmiths	72	20	10
Cutlers	78	17	10
Engine works' blacksmiths	69	19	10
,, mechanics	69	17	10
,, moulders	69	19	10
,, workmen	69	15	10
File cutters	72	14	11
Locksmiths	60	17	10
Metal goods factories, apprentices	60	5	11
,, ,, coppersmiths	60	23	10
,, ,, girdlers	60	20	9
,, ,, locksmiths	60	19	10
,, ,, operatives	60	17	10
,, ,, polishers	60	20	10
,, ,, turners	60	17	0
Nailsmiths	—	14	11
Toolsmiths	78	17	10
Labourers	78	14	11

New South Wales: Coal mines.—The United States Consul at Sydney supplies a valuable report on the above, which are the most important in the southern hemisphere. The mineral is of such excellent quality, and the seams so extensively and easily worked, as to give the greatest promise of future development. The area covered by these seams is estimated at 23,950 square miles, extending from the twenty-ninth to the thirty-sixth parallel of south latitude, and penetrating to the water's edge along many miles of the sea coast. Some of the highest authorities on minerals, both in Australia and England, are of opinion that New South Wales coal, in many respects, is superior to English, as it is better adapted to steam purposes, and richer in gas-giving properties. The coalfields of New South Wales are divided into three districts, the northern, southern, and western. The northern district produces not only the best coal, but the greatest quantity. The famous Hunter River and Newcastle mines belong to this district. The quantity of coal produced is about 2,350,000 tons per annum, being more than three-fourths of the total coal production of the colony. The mines are practically inexhaustible, and it is estimated, at the present rate of consumption, they will last for the next seven hundred years. The northern coals are pure bituminous coals, with strong coking properties. They contain much less ash than those from the southern and western districts, although it is said that many engineers in the British Navy and the merchant service prefer the semi-bituminous coal to the northern, because the disadvantage of the greater proportion of ash in the former is counterbalanced by its burning more evenly and uniformly than the other, and it does not so readily form into clinkers; but when it is required to get up steam rapidly, the northern coal is preferred. From an analysis of the various coals of the world, made for the International Exhibition at Sydney, coal from Sydney, New South Wales, appears to be much denser than the English Newcastle, occupies 6 per cent. less space, and is very nearly equal to the best Welsh coal, also contains less sulphur, and consequently is not so liable to spontaneous combustion or to affect the purity of the atmosphere. The amount of ash in the coals from the northern district is from 2·70 to 8·82, or upon an average 5·41 per cent. The shipping facilities at Newcastle are extraordinary. The machinery used for loading vessels with coal consists of seven steam cranes and four shoots belonging to the Government, five cranes belonging to the Australian Agricultural Company, and two belonging to the Newcastle Company. These cranes have a loading capacity of from 12,000 to 14,000 tons a day. The cranes on Bullock Island have a capacity of 6000 tons daily. Those erected on the wharf comprise two of 25 tons each and six of 15 tons each. As much as 250 tons of coal have been put aboard ship at Newcastle in sixty-six minutes. The southern coals are of a much duller lustre than the northern, and their structure is not so laminated. They do not coke in an ordinary fire, but will do so in an oven. The southern coal is well adapted both for household and steam purposes, the proportion of ash varies from 4·41 to 13·52, average 10·02 per cent., and it is predicted that the mines of this district will become in the future as important as those of the north. The western coals are much drier than those of the southern district, and contain considerable valuable matter. The general opinion is that they will never be exported in large quantities, but that they will answer for local purposes equally well as many coals worked in France and Great Britain. The proportion of ash is from 6·88 to 12·91, average 9·87 per cent. At Wallerawang we hear of brown hematite and magnetite. The magnetite runs approximately north-east and north-west, and the magnetic effect is said to be so great as to render the compass useless in the neighbourhood of the lode. The vein is 13ft. wide, the ore compact, and accompanied by silicious gangue. It yields about 41 per cent. of iron, and is free from phosphorus and sulphur. The brown hematite vein has nearly the same direction as the above, and along the line of its outcrop great blocks of ore are scattered at from 12ft. to 50ft. for nearly a mile. At a depth of 40ft. the vein is from 18ft. to 20ft. thick, and the cre is composed of comminuted fibrous nodules. The total output of all the coal mines in New South Wales during the year 1886 was 3,000,000 tons, valued at £1,471,755. The shale produced was 40,000 tons, valued at £16,708. This shale is said to be the best in the world, its gas illuminating power being equal to forty-three standard candles, consuming five cubic feet per hour. It is exported to the neighbouring colonies, and to San Francisco, where it is used in the manufacture of gas, its properties being so rich that an addition of 5 per cent. to ordinary bituminous coal is all that is required to give gas made therefrom the requisite illuminating power. Considerable quantities of this shale are consumed in the colony in the manufacture of kerosene by the slow process of distillation, and the quantity of kerosene shale oil made from it during 1886 was 112,000 gallons. The oil, though not so good as the American, is fast becoming popular here, because it is cheaper, and of home manufacture. The total output of the coal mines of New South Wales since the commencement of coal mining in 1858 is estimated at 35,723,274 tons, 22,428,585 tons of which were exported, leaving 13,844,689 tons for home consumption. The greater part of the coal exported is consumed in the neighbouring colonies, though there is an increasing trade to San Francisco, and other parts on the Pacific coast of the United States. The low cost of freight and the drawback of 3s. 2d. a ton allowed upon coal imported into the United States for the use of domestic and foreign steamships are the principal causes of the increase. The total number of miners at the various collieries in New South Wales during 1886 was 7197, 1510 above, and 5378 below ground. The wages paid to miners are from 10s. to 15s. a day. The wages and the number of hours the men are required to work have been the causes of frequent disturbances, and one of these disputes was not settled until a large number of miners had been engaged by cable from Europe. In New South Wales an interesting feature in coal mining is its comparative freedom from accidents, such as fire-damp explosions, which are so fatal in Britain. The total number of accidents in New South Wales during 1886 was fifty-one, and of these eleven only were fatal. The greater portion of these accidents were occasioned by the fall of coal, and one or two from the explosion of gunpowder. The report contains many tables showing the analyses of various coals, details of working the mines, places where the coal is exported to, quantities, value, &c., all of which are interesting to the trade.

Portugal.—Advancement of British trade.—The objects in which my aid is principally invoked in Lisbon are mainly two. I am constantly asked by British firms to circulate their price-lists and catalogues printed in English among the Portuguese commercial body, or to furnish lists of local traders in particular branches to firms at home, with a view to the better entering into business relations with the former. As regards price-lists and catalogues, they are simply useless, and no attention is paid to them except in the rarest instances. The only way of obtaining custom by these means is to follow the plan adopted by some establishments in Paris, which issue periodically catalogues printed in Portuguese, admirably illustrated, with the prices clearly marked, and frequently with small samples of the goods attached to the pages. These catalogues are then posted to residents whose names are probably obtained from some international directory. As regards lists of local traders furnished to firms at home, it is obvious that the most respectable of such traders will have already have established business relations with correspondents for whose solvency they have adequate guarantees, and whose methods of conducting business they find acceptable, and will be disinclined therefore to place themselves in the hands of strangers; whilst the English trader who seeks this mode of entering into relations with the foreigner runs a serious risk of getting in the hands of adventurers and insolvents. No means of advancing trade compares, however distantly, with the services of an accomplished and well-trained commercial traveller. This is not only because such an agent can push his wares by enabling them to be handled, tasted and touched, but because he will, if he is intelligent and observant, learn what are the distinctive requirements of the particular market in regard to any special article or class of goods. Our trade with Portugal was formerly greater than that of all other countries put together, both as regarded exports and imports; but of late years our percentage share of the total trade has been steadily falling because we are being pushed out of the market by more enterprising rivals. Instances of this are unlimited. In December last tenders were invited for the construction of docks and other improvements in the port of Lisbon at a maximum cost of £2,400,000. Only one tender, that of M. M. H. Hersent, a French engineer, was, in the opinion of the Portuguese authorities, in accordance with the conditions, and the contract was given to him at a sum fractionally below the maximum price—£2,400,000—the whole of the works to be completed within two years and eight months. Much of the report is devoted to the regulations of the port of Lisbon as to Customs duties, exports, imports, loading, unloading, quarantine, &c., and is of great value to all interested in goods conveyed by ship to Lisbon.

Turkey—Trade of Eastern Roumelia in 1886.—English imported goods are mostly articles of the first necessity, which are not likely to be undersold by foreign importers. Among these are copper in sheets, iron in bars, rods, and sheets, various kinds of hardware, &c. In most of these articles the demand has been considerably in advance of that in 1885. British exporters to this country should pay particular attention to providing certificates of origin to accompany their goods. The Bulgarian Government has imposed an import duty on all Turkish goods, as well as upon European goods which have not paid 8 per cent. at Constantinople. Such European goods as have paid 8 per cent. import duty at Constantinople pay ½ per cent. only here at Bourgs; but in that case they must be accompanied by a certificate from the port of exportation as evidence of their European origin, otherwise they are treated as Turkish goods, and a duty of 8 per cent. exacted, with an additional ½ per cent. quay duties. On many European goods, the origin of which cannot be proved to the satisfaction of the Bourgas Custom House authorities, as much as 16 per cent. duty has been paid before they are brought into the market. To avoid payment of these excessive dues the local merchants are beginning to import direct from Europe, and a considerable amount of trade is thus being diverted to Bourgas from Dédé Agatch, through which port by way of Turkish territory there has hitherto been a large trade with Eastern Roumelia. Local merchants complain that it is extremely difficult, and frequently impossible, to obtain a certificate of origin for European goods that have been several months at Constantinople, during which time they may have changed hands two or three times. Again, iron, mostly of British origin, is imported in large quantities into Constantinople and there worked into tools of various

kinds, window bars, &c., which upon being re-exported pay an export duty of 5 per cent. Such goods on arriving here are treated as of Turkish origin, and a duty of 8 per cent. exacted, so that the same metal has paid a duty of 21 per cent. before it can be sold here. Such duties have a very depressing effect on the import trade. Austria is making rapid strides, and at her present rate will soon compete with England in the value of her imports, which are already much superior in volume.

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

(*From our own Correspondent.*)

'CHANGE in Wolverhampton yesterday, and in Birmingham to-day—Thursday—preserved, as regards sheets, the stronger tone which has recently become conspicuous. Too much reliance, however, cannot be placed upon these favourable indications, since experience teaches the trade to be prepared at almost any moment for a reaction. At present the orders upon the markets for sheets exceed the supply, and makers are so well placed that some of them have deemed it advisable to put up prices to an almost prohibitive level.

Some sheet makers now quote prices up 7s. 6d. per ton, and being in a position independent of the market, they decline to accept business at under £6 5s., and occasionally even £6 7s. 6d., for galvanising doubles, and £7 2s. 6d. to £7 5s. for lattens. Galvanising singles are becoming stronger, and some firms quote them at a figure almost equal to doubles. Purchases, however, can yet be made at £6 2s. 6d. Merchant singles are procurable at £5 15s. to £6.

All orders for best thin sheets for Russia now under execution are being got out of hand as rapidly as possible, with a view to their being sent away from this country before the imposition of the revised import tariffs. No fears are entertained that trade will be yet prejudiced by the new Canadian imposts.

Galvanised corrugated sheet makers are in receipt of a good number of inquiries, and it is not improbable that the plant which is now lying idle at some of the works will be set going. The increased inquiries are coming from South America. The advance of 10s. per ton declared by the Association is firmly demanded, prices being £10 5s. to £10 10s. per ton for 24 w.g. delivered Liverpool, and 2s. 6d. extra when deliveries of large lots have to be made in London. There is a falling off in the business with merchants, who decline to pay the advance.

Orders for marked bars are being received with slightly more freedom at some establishments, but they are insufficient to keep the works going full time. Most of the inquiries are from the colonies. The quotation for first qualities is £7, while second branded sorts are £6. Merchant bars are without alteration at £5 10s. In the common bar trade orders have to be secured in the face of sharp competition from South Wales. The Welsh makers are delivering bars in this district at not much more than £4 10s. per ton of a quality surprising to Staffordshire makers. For nut and bolt manufacture and similar purposes the iron answers admirably. Staffordshire hurdle bars are £4 10s., and common smithy bars £4 15s. to £5.

Contrary to what might have been expected, the advances in crude iron have not been followed by any improvement in finished iron prices other than sheets. A little more is being done in hoops, strips, angles, and girder plates, but the prices which can be secured are not favourable. Export hoops are quoted £5 to £5 10s. per ton.

There is a movement on foot for re-starting, as a joint-stock concern, one of the most extensive and oldest-established of the South Staffordshire finished ironworks, which was recently closed in consequence of unprofitable trade. The balance-sheet presented to the creditors has turned out much more satisfactory than had been expected, the deficiency being very small as compared with the extensive business of the concern.

Imported steel continues to meet with a brisk sale. Prices are advancing, the result of the increased demand at the works. Bessemer plating bars from Sheffield are £6 to £6 2s. 6d. per ton; tin bars from Wales, £5; billets, £4 12s. 6d.; and blooms, £4 10s. Ingots from Wales are £4. Mild steel bars suitable for rolling into best thin sheets are £5 2s. 6d. for first qualities and £4 17s. 6d. for Bessemer qualities. An ever-increasing quantity of these bars is being consumed in this district, and the economy of manufacture which results, compared with the old system of best sheet manufacture from Staffordshire puddled iron, is conspicuous. Billets and slabs from the West Coast are £4 12s. 6d. for Bessemer, and £4 15s. for Siemens qualities. Tin bars are 2s. 6d. to 5s. per ton additional. The steel hoop makers report an increased home trade on behalf of large brewing firms, though the bulk of the orders of this description are placed in districts other than Staffordshire.

Local steelmasters note with much satisfaction the manner in which the steelworks in other parts of the kingdom are filling up with orders of every description of metal. We are unable to boast in this district, as are some of the west coast firms, of having rejected more orders in three weeks than would have carried them on to the 30th June next; but as other districts get filled up with work, Staffordshire has a much better chance in the general competition for the orders on the market. The advance of 2s. 6d. per ton in the price of basic steel blooms on the Clyde is of significance to this district, since, after Scotland and the North of England, Staffordshire is the only part of the kingdom where the basic process pure and simple is being carried on.

Pigs are characterised by less briskness than recently, but this gives rise to no concern. Makers, being booked well forward, are not anxious for more business at present, since they are confident that, long before the completion of present deliveries, consumers will again be ready to speculate. Prices of imported Midland pigs are this week hardly so strong. About 35s. for Northamptons, delivered to consumers' works, and 37s. for Derbyshires, with 40s. to 41s. for Lincolnshires, delivered to stations, are the selling rates. Staffordshire pigs are 50s. for hot blast sorts, 40s. nominal for part mines, and 29s. to 30s. for cinder qualities.

The North Staffordshire iron trade is slightly improved, but it has become apparent that the slightest extraneous influence would suffice to cause a renewal of the downward tendency of the market. Competition is very keen, and this cuts down prices. Actual prices are irregular, but nominal quotations may be set down at £4 17s. 6d. to £5 2s. 6d. for crown bars, 10s. extra for best; £6 2s. for bridge plates, and £6 10s. for boiler plate, delivered Liverpool or equal. Pigs are in fair demand.

The extensions of works and the laying down of wholly new plants which are at the present time characteristic of the steel trade the country over, involve the placing of valuable orders for machinery with steelworks' engineers. This district is not receiving very many of the orders; still it is getting a share from such machinery as heavy rolls, wheels, pinions, and the like. Orders are also being received for similar class work by local engineers for certain of the continental iron and steel concerns.

Constructive ironwork engineers are pretty steadily engaged upon combined shipping and home contracts, and a report is current of one large South Staffordshire firm having lately secured a new large foreign bridge contract. Competition for all the orders which appear upon the market is, however, so severe, that engineers complain that profits are at a minimum.

Good inquiries are again coming from India for railway material. The State railways are buying cast iron piping and galvanised fencing wire; and on account of the Bengal Nagpur Railway tenders are invited for a supply of 12,000 tons of steel Vignoles rails, 180,000 steel transverse sleepers, 750 tons of steel fish-plates, and 180 tons of steel fish bolts and nuts. The Madras Railway Company requires steel rails, cast iron pot sleepers, tie-bars, and cotters.

The tankmaking trade is not very brisk at date, and manufacturers have to be content with partial employment. Many of the light tanks which are being turned out are used as packing casks for dry goods to go abroad, and are resold on their arrival in distant markets for water storage purposes.

The production of railway carriage and wagon materials finds plenty of occupation, and manufacturers of coach axles and springs are also fairly busy.

Marked success is attending the Wrought Iron Tubemakers' Association, which includes the German as well as all the English makers; and although it has a tendency to limit merchants' orders, yet the advanced prices obtainable more than compensate for this drawback. The articles are drawn with care, and are the outcome of much experience. Native makers seem particularly well assured of the good faith of their German *confrères*.

Set propositions are now before the English cast iron hollow-ware trade, with a view to the formation of a similar association to prevent ruinous underselling, and negotiations have so far proceeded that it now rests with one or two firms to determine ultimate action. The North Staffordshire pottery makers are also suggesting a similar united trade movement.

Experiments have been officially conducted at Birmingham this week with an improved fire engine manufactured by Messrs. Shand, Mason, and Co., London. Several improvements are claimed for the new engine which weighs, with all its appurtenances, only 30 cwt. Steam was generated to 100 lb. pressure within seven and three-quarter minutes after the fire had been started, and with a 1¼in. jet water was thrown on to the Council House dome, which has an altitude of 150ft.

The directors of the Hampstead Colliery Company have resolved upon an interim payment on account of arrears of preferred shares at the rate of 4 per cent. per annum for the half-year ended June 30th last.

After lasting about fifty weeks, there is some prospect of the Cradley Heath chainmakers' strike being brought to a close. About twelve firms have conceded the advanced rates, but other masters do not yet show any disposition to accede to the operatives' terms.

At an annual meeting at Wolverhampton on Tuesday of the Railway Rolling Stock Company, a dividend was declared at the rate of 6 per cent. on the paid-up portion of the preference shares, and at the rate of 3 per cent. on the ordinary shares.

The Union Rolling Stock Company, at its half-yearly meeting in Birmingham this week, declared dividends of 6 per cent. per annum on preference shares, and 10 per cent. on ordinary shares, with a bonus of 2 per cent. on ordinary shares. It was reported that during the year new business to the extent of £27,000 had been done.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—There is a slow steady business doing in the iron trade of this district, but the market is altogether without life, and although there is in some quarters a disposition to take a more hopeful view as to the future, there is no really substantial evidence of any material improvement in prospect. Makers are not anxious sellers at present rates; consumers, on the other hand, show little or no disposition to buy beyond their hand-to-mouth requirements, and the outlook seems to be that we shall go on much as we are for some time to come. Local and district makers of pig iron are in most cases moderately well sold for the present, as the result of the fair orders booked at the commencement of the month; and although there is only a very small business now coming forward, they do not attempt to push business, and are holding firmly for list rates. Hematites are perhaps not held quite so strongly at the full prices recently quoted, but where prices much under current rates are taken, it is only on occasional transactions of an exceptional character, and the general tone, so far as makers are concerned, is one of firmness. The shipping season has brought out a moderate weight of business in finished iron, but the home trade is still only very indifferent, and the competition of needy sellers keeps prices down.

There was only a dull market at Manchester on Tuesday, and very little inquiry stirring for any description of pig iron. For local brands quotations remained at 38s. 6d. for forge and 39s. 6d. for foundry qualities, less 2½, delivered equal to Manchester, with makers not disposed to give way to any material extent on these figures. Quotations for Lincolnshire iron remained firm without change from last week, 36s. 6d., less 2½, being the minimum for forge and 37s., to 37s. 6d., less 2½, for foundry qualities, delivered into the Manchester district. For Scotch and Middlesbrough iron, makers' prices were also steady at the rates ruling last week, the fluctuations in the current quotations at Glasgow and Middlesbrough having no appreciable effect upon this market. Occasional sales of hematites are made on the basis of 52s. 6d. to 53s., less 2½, for good No. 3 foundry qualities, delivered into the Manchester district, and for ordinary transactions these represent the minimum figures that makers are disposed to take, but they are only obtained with difficulty from buyers in this market.

There has been a fair business doing in hoops and sheets, chiefly for shipment, and prices are rather firmer, if anything, hoops being quoted at £5 5s. and local made sheets at £6 5s. to £6 7s. 6d per. ton delivered into the Manchester district; bars, however, still meet with only a slow demand, and do not average more than £4 17s. 6d. delivered, with needy sellers, in some instances, prepared to cut under this figure to secure orders.

In the metal market there is only a very slow business doing, but makers are firm at 5¼d. per lb. for solid drawn tubes, 6¼d. solid drawn copper tubes, 6¼d. brazed copper tubes, 4¾d. brass wire, 6¾d. copper wire, 4¾d. rolled brass, and 5¼d. brass sheets, delivered into the Manchester district.

If the lessened number of men actually out of employment may be taken as a good indication of the condition of trade, then there must certainly be some improvement in the engineering branches of industry. The returns of the local trades' union organisations show that there are now, independent of the Bolton strike, only about half the number of members on the books in receipt of out-of-work support as compared with the commencement of the year, and this decrease has been going on steadily for several months past. On the other hand, the reports from the leading engineering concerns in the district are still mostly to the effect that employers are in no really better position; some of them may be rather busier, but work can still only be got at excessively low prices.

Another unsuccessful effort has been made to bring about a settlement of the dispute in the Bolton engineering trade. A similar proposal to submit the dispute to arbitration as that which was put forward in May last has been made this week, but has again been rejected by the men, and this obstinate refusal of the men to proceed to arbitration is felt to be the signal for the continuance of the struggle until one side or the other is forced into submission. The strike committee is still well supplied with funds for carrying on the struggle, and the financial statement issued for the tenth week of the dispute shows a balance in hand of £720. In the appeal issued with this statement for continued support, the strike committee, of course, lay all the blame on the employers because they have refused the proposals put forward by the men as a basis of settlement, and from their attitude they are charged with wishing to add insult to injury. The appeal adds that the employers had attempted to fulfil their boast that they could fill the places of the men on strike by Lancashire men alone, but the committee were happy to say that up to the present the efforts in this direction had proved to be a failure. A very bitter tone pervaded the appeal all through, and it is scarcely conceived in the spirit of seeking a settlement, but rather of fomenting increased ill-feeling.

The other day I saw one or two improvements in machine tools at the works of Messrs. T. and R. Lees, Hollinwood, near Oldham, which are worth brief notice. One of these was an improved drilling machine which had just been finished for shipment abroad, in which a very effective mode of double-gear driving has been introduced, the changing from single to double gear being done instantly and dispensing with the old catch arrangement. The bottom cone and fast and loose pulleys revolve on a strong stud, giving a long bearing surface, this dispensing with the usual out end pedestal. The table, which is raised and lowered by rack and pinion, works on a swivel for turning it clear away when large articles require drilling, and the whole machine is very compact in arrangement. A saw bench, with an improved rise-and-fall table, was also noticeable. The table is made to rise or fall by double slides actuated by hand wheel and screw, which enable it to be raised or lowered quickly and truly, and also gives a rigidity to the table when in position. The advantage of this arrangement is, of course, that the user is not troubled with variations of the driving belt, as is the case when the spindle rises and falls. Another noticeable feature is an improved fence with sliding plate to work at any angle, and which can be turned over clean out of the way for cross cutting, the driving gear being also arranged that it is below the level of the table. The saw spindle also carries a cutter block for tongueing, rebating, grooving, &c., and a boring attachment with an adjustable sliding table can in addition be applied to the end of the spindle, so that the bench is available for a variety of wood-cutting operations, and it is altogether a very handy, compact machine.

On Saturday last the members of the Manchester Geological Society made an excursion to Dalesgate, Todmorden, to examine the millstone grit and lower coal measures which are well represented there, Mr. Robert Law, F.G.S., acting as guide. Attention was first drawn to the great anticlinal fault which ranges through Todmorden, and the effect of which is so plainly visible in the physical features of the landscape. Dalesgate is one of the many picturesque valleys carved out of the millstone grit and lower coal measure rocks in the neighbourhood of Todmorden. Its scarped sides expose good sections of the millstone grits, of which the third grit is the oldest one exposed in Dalesgate, and which, owing to faults cutting across the valley, is brought up again and again. The hard silicious sandstone bed, known locally as "Calliard," and much used for road metal, was also seen in fine section; and passing over the second grit, the newer beds of the first grit or rough rock were examined. A good section was also exposed of one of the thin seams of coal which occur in this grit, called the "Sand-rock coal," which rests on a thick bed of fireclay, and has a roof of sandstone rock. The Mountain Mine seams of coal in the lower coal measures were next visited in the upper part of the valley, and after the party had collected a number of well-preserved specimens of fossil plants found in the coal beds which occur in the seams of the Mountain Mine, a very interesting excursion was brought to an end.

The Manchester Ship Canal preference shares have not been received with any favour on the London Stock Exchange; but as this portion of the capital was guaranteed, the financial position of the undertaking has not been so far materially affected, and the capital required to commence the works has been raised within the period stipulated by the Act of Parliament. The commencement of actual operations for the construction of the canal will, it may be presumed, very shortly be the next step.

The condition of the coal trade remains without material change; for all descriptions of fuel the demand is excessively dull, and notwithstanding that pits are not working more than three to four days a week, all classes of round coal are a complete drug in the market. Current quoted prices are nominally without change, but the actual selling prices are very irregular, sellers being willing to accept almost any figure to effect temporary sales to clear away stocks. Contracts for gas coal are now being given out, and in most cases they are being placed on the basis of last year's prices, but here and there the tendency is to give way slightly. Engine classes of fuel are only in moderate demand, and the present very restricted production of slack is generally ample to meet requirements.

There has been a moderate business doing for shipment, but only at very low figures, not averaging more than 6s. 6d. to 6s. 9d. for ordinary steam coal delivered at the high level, Liverpool, or the Garston Docks.

Barrow.—A rumour is current this week about great changes in the ownership and guiding spirit of one of our large shipbuilding and engineering establishments. Some eminent names are mentioned, but I have heard nothing definite, reliable, or official. The shipbuilding trade remains extremely quiet, and very little work is in the hands of local builders, who are consequently only employing a limited number of hands. The few orders which are offering are at extremely low prices, and are keenly competed for. In the engineering department no new work of moment has lately come to hand, but marine shops are beginning to be more busy, although in the general department there is very little doing. In the pig iron trade there is a fairly active state of things, but the demand is not so spirited as it has been, and makers are seeking for orders, being already very fully sold forward. Prices show no change, and last week's rates can be quoted. Stocks of iron have been further reduced by the sale of some very heavy parcels which have been bought for speculative purposes. There is not much more iron in stock at present than will represent a month's production. The steel trade is very briskly employed, and particularly is this the case so far as rails are concerned. The demand for rails is simply extraordinary, and as makers are so well sold forward, they are not booking many new contracts. It would naturally be expected, under these conditions, that prices would advance, but this is not the case. The prices makers have lately been quoting are firmly held, but there is no indication of any advance, and as makers are not for the moment dependent on new orders, they are waiting till they can secure them at fuller prices. There is not much doing in other branches of the steel trade. The mills are kept fairly, but not quite regularly, employed on bars, billets, plates, and angles. Merchant steel is in limited request. Finished iron is very quiet, and there are indications that with the increased uses to which steel is now put hopes of any revival in the finished iron trade cannot be entertained with any degree of sanguinity. Iron ore is firm and in good demand, so far as best descriptions are concerned, for which the quotation is 11s. 6d. per ton, but inferior qualities do not enjoy a good market. Coal and coke steady. Shipping fairly employed.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

IN the lighter industries of cutlery and plated wares there is no change for the better. Further orders for railway material, gun forgings, and machine work have been received. The gun forgings are exclusively for the British Government.

The article in THE ENGINEER of last week headed "Effect of Recent Experiments on our Shot and Armour" has been much talked about here. Your references to Messrs. Hadfield's progress in projectiles caused me to make inquiry as to what the Government are really doing. I am told that the authorities have stopped Woolwich making steel armour-piercing projectiles; but they still are making enormous quantities of steel shrapnel shells, which were originally, and—it is contended here—ought to be made in Sheffield. After a long period Sheffield only gets sample orders for these shrapnel, and very few orders for armour-piercing shells, whilst the French Government have recently placed orders for 12,000 tons with French shell makers, and Russia has also ordered 9000 tons of steel armour-piercing projectiles, which are expected to be in stock by the end of the year. England, on the

other hand, has not 500 tons of armour-piercing projectiles. The question asked here is, Why do not the Government encourage English makers as do France and Russia? These are not articles which can be supplied quickly, and in the event of war we should be nowhere without them.

On Tuesday next the Cutlers' Company hold their annual meeting for the election of Master-Cutler. Their choice will fall upon Mr. James Dixon, a member of the famous silver and electro-plating firm of Messrs. James Dixon and Sons, Cornish-place. Mr. Dixon becomes Master-Cutler-Elect, the present master—Mr. G. F. Lockwood—holding office till the morning of the Cutlers' Feast—the first Thursday in September—when Mr. Dixon is formally installed.

Mr. Alexander Wilson, managing director of Messrs. Charles Cammell and Co., Cyclops Steel and Ironworks, Sheffield, has been appointed a director of the Cleator and Workington Junction Railway, in the room of Mr. J. C. Valentine, ex-M.P. for Cockermouth. Mr. Valentine's resignation is stated to be due to business engagements with the branch establishment of the Moss Bay Iron and Steel Works in America. The Cyclops Company has a large establishment—the Derwent Iron and Steel Works—at Workington, and it is no doubt owing to Mr. Wilson's association with that concern, as well as the generous interest he has taken in the affairs of the town, that he has been called to the important post.

An interesting and unusually frank reply was made in the House of Commons on Thursday night. Interrogated as to the tenders for 3000 tons of 18in. and other steel-faced armour plates for the Trafalgar and the Nile, the Secretary for the Admiralty said "they were dealt with together, and were invited from the two firms who alone in England had plant capable of manufacturing plates of the thickness and weight required." He then went on to say that the tenders received were one from Messrs. Charles Cammell and Co., at prices ranging from £95 5s. to £98 5s. per ton, according to size, and one from John Brown and Co., at £95 and £98. The order was divided between the two firms, so as to ensure delivery at the required times. The terms are considerably higher than the old iron armour, and the Ellis and Wilson plates are, it will be noted, practically the same price.

Steel-making at Woolwich continues to excite interest here. Twelve months ago Mr. C. Stuart Wortley, M.P., noted in the *Times* what seemed to indicate that the manufacturing department at Woolwich were manipulating masses of steel in excess of what they had pledged themselves to limit their operations. He at once wrote to Mr. Woodall, who was then Surveyor-General of the Ordnance in Mr. Gladstone's Government. Mr. Woodall replied that in the *Times* report the steel ingot should have been 8 tons instead of 68 tons in weight. Mr. Woodall added, "You may rest assured that nothing has been done in deviation from the understanding arrived at in 1884, or contrary to the explanations which have from time to time been given to yourself and Mr. Mundella on the subject." The subject has again been re-opened by Mr. Wortley, who has written to Mr. Stanhope enclosing an extract from one from Sir William Leng, dealing with the subject of steel making at Woolwich and the contracts given to Sheffield. Mr. Stanhope states that at the present time contracts for three-fourths of the steel used in the gun factory are given to the trade, and since the date of Sir William Leng's letter—July 20th, 1887—tenders for about £50,000 worth of steel forgings have been sent to Sheffield. Mr. Stanhope adds, "It is manifestly not desirable to abandon entirely the making of steel at Woolwich, since an emergency might arise when the power to do that would be of great importance. But as large orders are given to the trade as can be done consistently with the retention of a certain power of production in our own hands, as a precaution against possible contingencies."

It was announced a few days ago that the Dore and Chinley Railway, which was promoted under local auspices with the assent and assistance of the Midland Company, had been abandoned. I have been informed that this is not the case, and it was freely stated that arrangements were being made this week with every prospect of the financial difficulty being overcome. I now learn, however, on undeniable authority, that the requisite capital has not been obtained, and it was decided on Wednesday not to proceed with the Bill this session. Its abandonment, though only for a year, is a source of local disappointment, as it would give Sheffield an alternative route to Manchester, and open up one of the most delightful parts of Derbyshire. Practically it would give Sheffield a new suburb.

Penistone sustains its evil reputation. Within a short distance of Bullhouse, near Penistone, where the express went over the embankment with terrible results, an express fish train from Grimsby came to grief on the 21st. The train being unusually heavy, there was a pilot engine in front. Suddenly the crank axle of the pilot engine snapped, and the locomotive went down the embankment. Driver Heeley, of Sheffield, stuck to his engine and went down the slope with it. No one was injured, but serious damage was done to the rolling stock and permanent way. It is suspected that the crank axle gave way through a flaw which was not externally visible, precisely as was the case with the Manchester express engine wrecked at Bullhouse a little farther on. The Manchester, Sheffield, and Lincolnshire officials, with great promptitude, had the line cleared under the charge of Mr. Hamilton, their assistant superintendent of the line.

The silver platers invited to emigrate to New York are still waiting confirmation of the offer made to them a fortnight ago. If the terms are adhered to, and something like permanent employment can be given, there will be no lack of Sheffield artisans willing to try the States, for the plated and electro trades are very depressed.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

No improvement was noticeable at the Cleveland iron market held at Middlesbrough on Tuesday last, and indeed the tone was one of dulness and depression. Scarcely any business was transacted, either for prompt or forward delivery, and prices were slightly easier than at the previous market. Most of the merchants held out for last week's rates—namely, 34s. 4½d. per ton for No. 3 g.m.b., and 33s. for forge qualities, but some sellers accepted 1½d. per ton less for small lots. Makers still adhere to 35s. for No. 3, and are not likely to lower their quotations so long as their order books continue fairly well filled. For delivery over the next three months merchants are willing to accept 34s. 6d. to 34s. 9d., but buyers do not come forward.

Stevenson, Jaques, and Co.'s current quotations:—"Acklam hematite," mixed Nos., 45s. per ton; "Acklam Yorkshire" (Cleveland), No. 3, 36s. per ton; "Acklam basic," 36s. per ton; refined iron, 48s. to 63s. per ton—net cash at furnaces.

There is little or no speculation in warrants at present. The price offered is about 34s. 4½d. per ton, but very few holders are willing to sell at that figure.

The quantity of pig iron in Messrs. Connal and Co.'s Middlesbrough store is slowly decreasing. On Monday last there was a stock of 335,531 tons, or 373 tons less than a week previously.

Shipments from Middlesbrough are somewhat slack for the time of year. Up to Saturday last only 50,015 tons had left the port. From the 1st to the 23rd of June 50,639 tons had been shipped. The consignments to Scotland have been much smaller than usual owing to the occurrence of holidays there; but Germany, Belgium, and the United States are taking large quantities.

Finished ironmakers report that specifications are coming to hand more freely, and that inquiries are somewhat more numerous than they were. But owing to the sharp competition for every order little or no profit is made. Prices remain as quoted last week.

The event of the week at Newcastle has been the visit of the Institution of Naval Architects, under the presidency of Lord Ravensworth. The Institution was received by Mr. W. T. Doxford, President of the Council of the North-East Coast Institution of Engineers and Shipbuilders, and by the Mayor and Sheriff of Newcastle. After some appropriate words of welcome from Mr. Doxford and from the Mayor, Mr. B. C. Browne, Lord Ravensworth gave a presidential address, in the course of which he dwelt upon the Newcastle Exhibition, and the great success which had attended that undertaking. He also gave a rough outline description of the Tyneside localities, and the industries connected therewith. He professed himself in favour of the principle of the Board of Admiralty contracting for their requirements to a large extent, rather than being themselves manufacturers. He then alluded to the continued heavy loss of life at sea, but considered that that was not in any way for want of skill in the design and construction of modern ships. The first paper read was an important one, prepared jointly by Lord Armstrong and Mr. Josiah Vavasseur, on "The Application of Hydraulic Power to Naval Gunnery." After discussion this was followed by a paper by Mr. F. C. Marshall on "Recent Developments in Marine Engineering," and then the whole party adjourned to the Elswick Ordnance, Engineering, and Shipbuilding Works.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

BUSINESS has now been fully resumed after the holidays, but the pig iron market has been comparatively quiet this week. Reports from the United States showed that the stocks of Scotch iron are increasing in New York to a larger extent than could have been anticipated. Recent arrivals of pigs there have gone partially into store, and this proves that the demand for immediate consumption is not urgent. Notwithstanding this rather discouraging circumstance, the warrant market has been fairly steady. Comparatively little iron has, however, changed hands. The past week's pig iron shipments were 7767 tons, as compared with 11,120 tons in the corresponding week of 1886. One furnace has been damped down at Eglinton Ironworks, and there are now 82 in blast, against 85 twelve months ago.

The current values of makers' pigs are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 48s. 6d.; No. 3, 43s. 6d.; Coltness, 54s. 6d. and 44s. 6d.; Langloan, 49s. 6d. and 45s. 6d.; Summerlee, 52s. 6d. and 43s.; Calder, 49s. and 42s. 6d.; Carnbroe, 44s. and 40s.; Clyde, 46s. 3d. and 41s. 3d.; Monkland, 43s. and 38s. 9d.; Govan at Broomielaw, 43s. and 38s. 9d.; Shotts at Leith, 48s. 6d. and 45s. 6d.; Carron at Grangemouth, 52s. 6d. and 44s.; Glengarnock at Ardrossan, 49s. and 41s. 6d.; Eglinton, 43s. and 38s. 9d.; Dalmellington, 44s. and 40s. 6d.

The week's arrivals of Cleveland pigs at Grangemouth were 2810 tons against 5845 in the same week of 1886.

Business is quiet in the malleable iron and steel trades, with no new feature to notice.

The coal trade is a little more active this week, although the shipments are still below the average in amount.

The strike among the shale miners continues in a number of districts, the men declining to submit to the reduction in their wages. In certain cases, the men have offered to meet the employers half-way; but the circumstances of the oil companies are so unsatisfactory, owing to the low prices obtained for their products, that they are obliged to insist upon the full reduction.

In several districts the coal miners have adopted the five hours day, with the object of restricting the output of coal and arresting the decline in prices and wages.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

GREAT movements are announced for Cardiff next week, when the Marquis of Bute is to arrive, and amongst the events will be the opening of the Roath Dock Extension. This and the Taff Vale Railway branch will have a marked effect in lessening future blocks. Another suggested undertaking, in which the Marquis may figure, is the weiring of the Taff—still, for Cardiff, an unaccomplished fact.

The drought promises to bring forth a good crop of new schemes. The Corporation of Cardiff sent an inspector up to the Rhondda Valley, and found that the Rhondda River, as well as the Taff, were simply open sewers, and that Cardiff was the catch pit! The upshot of this must be considerable engineering work, and systematic schemes for general sewerage.

The drought, which has crippled most of the steel works, and was beginning to affect the collieries, nearly brought about a serious state of things at Merthyr. A few days longer, and it is thought that a similar condition to that at Swansea would have prevailed. One of the reservoirs, the Noyadd, was empty; the other nearly so. In this emergency the railways had notice to stop receiving supplies, and the works at Cyfarthfa must have fallen into the same condition as those at Dowlais and Tredegar. The rainfall on Sunday and Tuesday has now given a depth of 25ft. in the Noyadd, and 1ft. 4in. in Dolygaer. This will save Cyfarthfa. But the imminence of danger and the losses which have accrued to the majority of steel works by the dry spring and summer, suggest that general action in the formation of reservoirs is imperative. In Tenby they are flushing the drains with sea water, and doubtless Cardiff and Swansea will follow suit.

The industries of Wales are in fair condition, but there is nothing particularly gratifying to record in connection with either—in fact, the grumblers have something to report in relation with each of them. Thus in the matter of coal the last two weeks have indicated a falling-off at Cardiff, and only a bare retention of an average at the other ports. Cardiff, which was expecting to see a total of 200,000 tons foreign weekly coal exports, barely reached 150,000 tons last week. Newport coasting total was only 15,000 tons and Swansea 26,000 tons. A few weeks of this may witness a backward movement in price. So far quotations are retained, and for best steam Cardiff offices still ask confidently 9s. 6d., Newport offices are quoting 7s. 9d. to 8s., Rhondda is offering for 8s. 3d.; small steam is selling generally for 5s., some little best quality at 5s. 6d.; house coal in all quarters is slack, and may be expected to remain so for another month. Patent fuel is going off better, Swansea sent away close upon 5000 tons this week.

In steel rails I cannot record much business doing, prices being too low for many to accept. In steel sleepers Tredegar has been up to the drought busily engaged on a large order, but Tredegar, in common with several large works, has been blocked by the short water supply. Great preparations are being made at Treforest to re-start the steel works, and an early day has been named for the event.

It is gratifying to see that whatever condition the steel works may be in, a steady purchase of foreign ore goes on. Tredegar, Dowlais, and Cyfarthfa are unusually large buyers. The last-named has been busy of late. Crawshay Brothers are making their works the first in utilisation. The last step would have gratified Robert Chambers, who always regretted that Welsh ironmasters covered the land with unsightly tips. The present course is to use up all the ashes and spare lime in making mortar, which is becoming a large industry, engines, railway trucks, &c., being specially devoted to it, the mortar being sent to a wide radius. Cyfarthfa has been busy of late with steel bar, having almost a monopoly of make.

The Swansea Exchange on Tuesday afforded a good deal to interest. Quotations were:—Swansea blast Bessemer iron, £2 8s., f.o.b.; Cwmavon, £2 8s.; Siemens' tin-plate bars, £5 2s. 6d.; Bessemer bars, £4 15s.; blooms, £4 5s., delivered in district; cash, less 2½.

Tin-plates retain their figures, notwithstanding an evident effort to "bear" the market. It has been reported in Swansea and elsewhere that sales at a reduction from last week's figures have been effected both at Birmingham and Liverpool, and cases are cited where some of the neediest locals have sold at a corresponding "fall." This, however, must be understood, there is no warranty for a falling market. Stocks are low, demand good, orders held large, and the effort to bring down prices is simply the action of buyers who wish to prevent a rise, but who in another week will gladly give current prices. The Exchange quotations are—non-coke tins, 13s. to 13s. 3d.; Bessemer, 13s. 3d. to 13s. 6d.; Siemens, with coke coating, 13s. 9d. to 14s. 6d.; charcoal ternes, 28in. by 20in. I.C., 26s. to 27s. per double box; charcoals from 14s. 6d. to 18s. 6d. Block tin is £105, and firm at that.

I was much interested this week at Merthyr Vale Colliery, where a blower has been tapped and brought to the surface, and for more than a week an immense quantity has been pouring out, which, lit at the top of the shaft, gives a glare all over the workings and the valley. The intention is to pass it into the gas retort and utilise it. The "Ocean" colliers have had a notification that wages are to remain as at present. Some grumbling has occurred, but this is unreasonable.

In view of the forthcoming discussion in the House *re* shot firing, I may add to what has been previously stated in this column, that if the shot-firing clause be passed unmodified the labours of the Government Commission may be regarded as thrown away. The evidence of the most scientific experts will show the margin of danger, and it will be easy to define and keep it.

Coalowners are raising the question again, and an important one, of railway rates. Coal is not half the price it used to be, yet railway rates remain, and Wales suffers in paying more than competing districts. This is telling on the London coal trade with Wales, which lately has shown a falling off.

NOTES FROM GERMANY.

(*From our own Correspondent.*)

AGAIN there is some difficulty, under the circumstances, in pronouncing a general opinion on the state of the iron trade of Rheinland-Westphalia, because some branches of it are in a different condition to others, but on the whole it may be said that a better tone prevails. Everywhere there is an endeavour being made to create conventions or sales syndicates, as the only means available in critical times of opposing the disastrous competition which would otherwise ensue; and though all districts have not yet succeeded in concluding such, notably the Siegerland for pig iron, yet when they do exist, as in the Rheinland and Westphalian and Silesia, they have not only steadied, but in some cases given an advancing tendency to prices. There seems every chance of a sheet iron convention or a common sales bureau being concluded. The Silesian iron market is quiet. The foundries have made steady purchases, as they are at present well employed, and the rolling mills have work enough on large rounds and squares, girders, other sectionl irons, boiler plates, and sheets to keep them busy into the autumn, so the syndicate prices of M. 127·50 for bars and 135 to 140 up to 160 p.t. for plates are well maintained. The prospects for steel rails are also good, as tenders were shortly ago given out at Breslau, more railways in Silesia are projected, and the War-office is in the market for rails for military purposes. Forge pig iron is noted at M. 44 and foundry at 48 to 50, and endeavours are being made to fix the former at 47,40 and the latter at 50 to 52 p.t.

The demand for iron ores in the Rhenish-Westphalian districts has increased of late, and the prices of Siegerland sorts are maintained—have advanced, indeed, a little—and if no eventuality intervenes, it is thought they will soon take a rise. On account of high river and sea freights, Spanish ores are dearer. Luxemburg ores cost as follows:—Grey minette, M. 1·80; yellow do., 2·40; red calcareous do., 3·20; red silician, 1·60 p.t. The minette has lately been in great request, especially for Belgium, which has received large parcels. In general the demand for crude iron has increased, but as concerns Spiegel, this is only the case for high qualities, as the lower or 10 to 12 p.c. manganese are still neglected by export buyers. The better demand for forge sorts is justly attributed to the formation of the sales syndicate, which has given an impulse to buyers of wrought iron. Siegerland forge, which came down in all too great a hurry, has regained its former price, and the demand is brisk again. There has of late also been a better demand for foundry sorts visible, and Bessemer and basic have maintained their prices. On the 22nd inst., the crude iron convention raised its selling base price M. 2 p.t. The last quotations were, before the rise, spiegel 10 to 12 p.c, Mn., M. 50 to 50·50; best forge sorts, 41 to 42 up to 43·50; foundry, three sorts, 49 to 55; basic, 41 to 42; Bessemer, 50 to 51; and Luxemburg forge, 26·40, to 27·20 p.t. The rolling mills and forges are all well employed, some exceptionally so, with bars and sectional iron. As a rise in price is pretty certainly looked for on the 1st August, when the syndicate begins its functions in full force, buyers are coming well forward. Iron is so rapidly superseding wood for building purposes that the business in girders is very active with firm prices, which are tending upwards. Plates are also in good request, which has justified the late rise of M. 5 p.t. Sheets, again, in consequence of an improved demand lately and a rise in forge pig, have gone up a little, while all the mills are fully engaged. Prices are expected shortly to improve. Wire rods have maintained their nominal price, otherwise this branch is in the same position as last week. At the last tendering at Breslau, 12,344 tons of steel rails (*a*) and 1223 tons of ditto for points (*b*), were awarded as follows:—7850 tons of rails, *a*, to the Königs and Laura Hütte at M. 116, and for *b* at 135; 4500 tons of rails, *a*, Oberschlesische Eisenbahnbedarf Company at 116·15 free at works' station. Cockerill and Co. offered at 117·85, Bolckow, Vaughan and Co. at 119, both free at Stettin duty paid. At the Rhenish-Westphalian works tendered at prices for *a* rails from M. 107 to 120, and for *b* rails at 117 to 130 p.t. The accepted prices are M. 1 to 1.15 higher than those of a tendering at the beginning of the year at the same place. The iron prices—base—are, merchant bars, M. 112 and occasionally higher; angles, 111 to 115; hoops, up to 115; steel billets, 110 to 122; boiler plates, 5 m.m. and upwards, 150; sheets, 128 to 130; iron wire rods, 110; steel ditto, 108 to 110; drawn in iron or steel, 125 to 128; light rails, 110 p.t. The machine shops are busy, but in consequence of the dearer raw materials the prices may be said to be worse than before. The brass foundries are all now fully engaged, as last month brought a large influx of orders, some of which were from abroad, so that in many cases a higher price was attainable, and a further rise is sure to follow if the crude metals continue to advance.

The Belgian iron market has this week again continued firm, and as the raw material is much sought after, wrought iron prices have been very firmly maintained. In Luxemburg the whole output for the quarter has been contracted for. Foundry pig is scarce, so the prices are easily obtained. The machine shops are not well off for work, and it is considered in Belgium as a national disgrace that the first locomotive for China is to be made in America instead of in the former country. Industrial coal is in good demand.

In France it has become clearer and clearer that measures must be taken to check the everlasting tendency to lowering prices, and concerted arrangements are on foot to bring about an equalisation of production to consumption. In fact a committee of ironmasters has already sent out circulars to this effect. Merchant bars are selling at 132·50f. to 135f., and girders at 122·50f. to 125f. p.t. In the Haute-Marne district Martin furnaces for making mild steel and others for the production of basic steel are about to be erected.

There seems to be no end to the curious accidents which occur now-a-days in connection with modern industry. A smelting works in the Siegerland is obliged to convey its slag over a bridge to a valley on the opposite side of the river Sieg, and in doing so a day or two ago, whilst on the bridge, the wagon full of hot cinder exploded, and the red hot shower very seriously injured a woman and her two daughters who were engaged bleaching clothes in the adjoining meadows below.

AMERICAN NOTES.

(From our own Correspondent.)

NEW YORK, July 16th.

IRON and steel brokers who have just returned from the Interior report a generally depleted condition of stocks throughout the country. In the West the stocks of crude iron are light, on account of the continuation of the coke makers' strike. The decrease in production amounts to 150,000 tons per month, which, if continued long enough, will certainly exercise a marked influence on the iron trade. The reduction in anthracite output is no more than 10,000 tons per month, and in charcoal iron the reduction is only nominal. Several large industrial establishments west of Pennsylvania will probably be compelled to suspend operations, unless the Connellsville region can be started. A force of 500 policemen is in the region, and the workmen are threatened with eviction unless they yield. They propose to continue opposition, and are gathering funds from friendly organisations for that purpose. The steel consuming establishments throughout the West, such as are engaged in making agricultural implements, tools, machinery, carriages and wagons, and boat makers, are all buying liberally from Pennsylvania steel makers, and prices are firm under the steady demand which, to all appearances, will continue throughout the season. American Bessemer is selling at 18 dols. to 19 dols. at furnace; foreign, 20 dols. at tide-water. The rail makers are not booking many heavy orders, and are overrun with small orders for Fall delivery. It it estimated that there are now contracts for nearly 1,000,000 tons of rails on the books of American makers. There are also engagements for between 60,000 and 70,000 tons of bridge iron. The blast furnaces are booking contracts at the rate of 200,000 tons per week. There is an impression among American iron and steel buyers that prices will harden, and those who have heavy engagements are purchasing ahead. Old rails are scarce, and advancing at all points. The American supply is almost exhausted. Trade combinations in iron and steel are exercising a conservative influence.

The most favourable trade indication at present is the assured heavy crop of wheat, corn, and the consequent abundance of breadstuffs in American markets. The cotton crop will fall but little short of 7,000,000 bales; the corn product, 1,600,000,000 bushels; the wheat product, 480,000,000 bushels. All staple products will be abundant, and to all appearances there will be a ready and profitable market. These influences are stimulating demand, and leading the agricultural communities, as well as the mining and timber sections, to enlarge their purchases. The establishments supplying railroad companies with material and appliances are booking extensive orders, and there are inquiries this week for very heavy requirements for freight, coal and lumber cars, besides passenger and baggage cars. The western car works have from three to five months' work under contract, and the managers are covering these requirements in iron and steel lumber and hardware. The result of this is that the manufacturing industries of the States are in an exceptionally favourable condition.

NEW COMPANIES.

THE following companies have just been registered:—

Chatham, Rochester, and District Electric Lighting Company, Limited.

This company was registered on the 15th inst., with a capital of £10,000, in £5 shares, to carry on in Chatham and neighbourhood the business of an electric lighting, motive power and supply, and telephone company. The subscribers are:—

	Shares.
*H. Jasper, Chatham, flour factor	1
*C. T. Smith, Chatham, wholesale draper	1
W. Eveling, Chatham	1
F. Wingin, Chatham, miller	1
G. Church, Chatham, draper	1
J. Taylor, Chatham, outfitter	1
*W. J. Mackey, New Brompton, provision merchant	1

The subscribers denoted by an asterisk are the first directors.

Croydon and District Electric Lighting Company, Limited.

This company was registered on the 18th inst., with a capital of £20,000, in £5 shares, to carry on at Croydon the business of an electric light, heat, and power company. The subscribers are:—

	Shares.
*J. Stent, Thornton Heath	1
J. Klein, M.A., Thornton Heath	1
*D. B. Miller, Thornton Heath	1
T. Pook, Thornton Heath, merchant	1
T. Floyd, C.E., 3, Victoria-mansions, S.W.	1
*R. J. Hinton, Bramley Hill, merchant	1
H. Johnson, 1, St. Swithin's-lane, electrician	1

The number of directors is not to be less than three, nor more than seven; qualification, 20 shares; the first are the subscribers denoted by an asterisk; minimum remuneration, £100 per annum.

L. W. Leeds' Patent Floor-warming Stove Company, Limited.

This company proposes to adopt an agreement for securing and working patents known as the Leeds floor-warming gas stoves, together with the benefit of all provisional or other protections for the same, and also all future improvements or modifications thereof made between L. W. Leeds and the company. It was registered on the 15th inst., with a capital of £75,000, in £1 shares, the following being the first subscribers:—

	Shares.
J. B. Fryer, Buckhurst Hill, secretary	10
A. P. Jones, South Hampstead, clerk	1
C. F. Gardner, 1, Worship-street, manager of a company	1
E. Johnson, 12, Brompton-square, consulting sanitary engineer	20
P. S. Justice, 55 and 56, Chancery-lane, metal merchant	1
L. W. Lewis, 38, Old Jewry, heating and ventilating engineer	1
E. H. Stanley, Leicester House, Gipsy Hill	1

The number of directors shall not be less than three, nor more than seven; and the following shall be the first, viz., Charles Frederick Gardner, Edward Johnson, Philip S. Justice, and Lewis Walker Leeds. As remuneration for his services, each director shall be paid out of the funds of the company the sum of £100 per annum, and such additional sum, after the payment of 10 per cent. dividend to the shareholders, as the shareholders in general meeting may determine.

Myers' Patent Box and Barrel Machinery Company, Limited.

This company proposes to take over the manufactory and business carried on by Messrs. L. Lumley and Co., at the Invicta Works, Bow Common-lane, E. It was registered on the 14th inst., with a capital of £120,000, in £1 shares. The subscribers are:—

	Shares.
G. H. Ingleton, 7, Scarsdale-villas, Kensington, commission agent	1
A. Buckley, 361, Holloway-road, N.	1
H. F. Baker, Braintree, Essex, commercial traveller	1
E. Finckenstadt, Waltham Cross, Herts	1
F. G. Walford, 153a, Shakespeare-road, Herne Hill, clerk	1
W. S. Scrivens, 47, Twyford-street, Caledonian-road, N.	1
J. Spencer, 9, Alconbury-road, Upper Clapton, stationer	1

The number of directors is not to be less than four, nor more than seven; qualification, £500 of share capital; the first are Messrs. J. Crossfield, Warrington; R. H. Randall, Barratt's Brewery and Bottling Company, Limited; A. A. Davis, 11, Queen Victoria-street; M. Lumley, 1, America-square, E.C.; and Charles Peto Bennett, of 27, Lombard-street. The company in general meeting will determine remuneration.

Patent Stopper, Box, and Stamp Company Limited.

This company was registered on the 15th inst., with a capital of £25,000 10s., divided into 839 preference shares of £7 10s. each, and 4677 ordinary shares of £4 each, to take over the business of the Patent Stopper Company, Limited. The subscribers are:—

	Ordinary Shares.
C. Murray Smith, 11, Grafton-street, Bond-street, solicitor	1
Forster Graham, 16, Grosvenor-street, decorator	1
*Hy. Brown, 7, Westminster-chambers, chartered accountant	1
C. H. Brown, 7, Westminster-chambers, chartered accountant	1
*E. H. Brown, Kingsbury Ironworks, Ballspond	1
W. Graham, 39, Upper Baker-street, N.W.	1
*J. Graham, Oxford and Cambridge Club, Pall Mall	1

The number of directors is not to be less than three, nor more than five; qualification, 100 shares; the first are the subscribers denoted by an asterisk; remuneration, £250 per annum.

Perfume Automatic Supply Company, Limited.

This company was registered on the 16th inst., with a capital of £35,000, in £1 shares, to acquire patent rights in connection with any appliance for supplying perfumery, &c., by means of a coin placed therein. The subscribers are:—

	Shares.
J. Yates, 4, Surrey-square, accountant	1
F. W. Melbourne, 95, Boyson-road, Camberwell, secretary to a company	1
T. F. Ward, 28, Shillington-street, Clapham Junction, secretary to a company	1
J. Day, 14, Moreland-street, Finsbury Park	1
A. Forster, 149, Bethnal Green-road, clerk	1
J. R. Smith, 77, Lowfield-road, West Hampstead, glass manufacturer	1
R. Willcox, 172, Blackfriars-road, manufacturer	1

The subscribers appoint the first directors, and act *ad interim;* remuneration, £100 per annum to the chairman, and £50 per annum to each ordinary director.

THE CORROSION OF LEAD PIPES BUILT UP IN WALLS OR LAID UNDERGROUND.[1]

DR. G. VON KNORRE—*Gesundheits-Ingenieur*, 1887, p. 161—states that during the past year he has had many opportunities of examining specimens of lead pipes which have been corroded in walls, owing to the action of the mortar or cement, or in the soil. The behaviour of the lead exposed to the influence of the air, water, lime-water &c., is briefly discussed. In damp air a bright, freshly-cut surface of lead becomes speedily coated with a thin scale of grey oxide, which adheres closely to the metal and prevents further oxidation. At ordinary temperatures, in dry air and in enclosed vessels specially protected from moisture by the presence of sulphuric acid or calcined chloride of calcium, lead undergoes no change; lead, however, in a fine state of subdivision, is speedily converted into protoxide. Water that has been boiled and which is free from oxygen, if air is excluded, does not dissolve lead. Shaken up with lead in the presence of air, water even in two hours takes up about $\frac{1}{10}$ per cent. of the metal. Even a corroded surface is thus attacked, and when the metal is alternately exposed to the influence of air and water the action is more rapid. All waters do not dissolve lead with equal freedom, and the presence of small quantities of carbonic acid and of certain bicarbonates retards the action, while chlorides, nitrates, and decomposing organic substances intensify it. The experiments of Pattison Muir bearing on this subject are specially quoted, as are also the results recently obtained by Lunge and Venator. Besnou had found that lime-water powerfully attacked lead; and the author, who has made a careful investigation of the influence of lime-water on lead, states that if air is excluded, bright lead shavings remain unaltered in the liquid, but that on the admission of air the metal is at once vigorously attacked. If lead is exposed to the action of lime-putty, lime-water, or lime-mortar, air being also present, a pale yellow deposit of oxide of lead becomes visible, even in the course of a day or two; the part of the lead nearest to the surface of the putty, the lime-water, or the mortar being the most freely attacked, because it is there that the air has most ready access. The chemical reaction is a very simple one: the hydrated oxide of lead, formed in the presence of oxygen and moisture, is dissolved in the lime-water and partially precipitated as yellow oxide, free from water—it being a well-known fact that under certain conditions the yellow anhydrous oxide of lead is set free from solutions of oxide of lead in the presence of caustic alkalies, or lime-water, as yellow or red crystals, forming a red powder. Such a precipitate of oxide of lead might be formed upon lead pipe in mortar or cement containing caustic lime, in the presence of air and moisture. Two specimens of corroded lead pipe proved on analysis to contain in the corroded parts 99·05 and 99·37 per cent. of oxide of lead. The mortar in which the latter sample was embedded was extremely alkaline when tested with litmus paper, and contained a considerable quantity of caustic lime. In certain specimens of corroded pipes forwarded to the author from the Berlin Waterworks, the part of the lead attacked was white, and not yellow, and it was proved that when caustic lime is not present the hydrated oxide may be decomposed by the carbonic acid gas contained in the atmosphere, in which case a white basic carbonate of lead takes the place of the yellow oxide. Some analyses are given which show that these corroded pipes had been thus attacked, but that varying amounts of sulphuric acid, nitric acid, and chlorides, were also present. The author states that these latter ingredients appear to him to play an important part in the corrosive action, for, on the analogy of the old plan of manufacturing white lead with small quantities of acetic acid in dung heaps, in which process the acetic acid only acted as a carrier, the first formed acetate of lead being at once converted into carbonate of lead by the carbonic acid evolved, it can readily be seen that nitric acid would play a similar part. Indeed, both the nitrates and chlorides are known to act just as well as carriers as the acetates formerly employed in white-lead making. In impure soils, rich in decaying organic matters, lead would be speedily attacked were it not for the absence of oxygen.

In a discussion on the paper, it was pointed out by Mr. Oesten that though lead may be thus readily attacked, the whole of the necessary conditions are rarely united, as out of 20,000 lead house-connections in the city of Berlin, he had only, after careful search, extending over a period of twelve months, found eight instances of corroded lead-piping.

1 "Proc." Inst. Civ. Engineers.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending 23rd July, 1887:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m.: Museum, 6696; mercantile marine, Indian section, and other collections, 3387. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 6 p.m.: Museum, 1057. Mercantile marine, Indian section, and other collections, free, 2734. Total, 13,874. Average of corresponding week in former years, 16,529. Total from the opening of the Museum, 25,749,285.

GLASGOW INTERNATIONAL EXHIBITION.—At a special meeting of the executive council of this undertaking, held in Glasgow on the 13th inst., the recommendations of the building committee in regard to the contract for the erection of the main buildings of the Exhibition were considered. Altogether seventeen tenders had been sent in, and it was decided to give the contract to Messrs. William Shaw and Son, builders, 44, Wallace-street, Glasgow, their offer being the lowest. The area to be covered by the buildings will be fully 10¼ acres in extent, or 3 acres more than that occupied by the Edinburgh Exhibition. Notwithstanding that the area covered by the buildings has been considerably increased from what was originally intended, the cost of erection will be within the architect's original estimate. The contract figure has not yet been made known, but the cost of the entire buildings has already been stated as limited to £30,000. Some time ago tenders were invited for the work of excavating the bed of the river Kelvin to render it deep enough for the exhibition of all kinds of small craft worked under steam or by hand, and a large number of offers have been received, the lowest of which is that by Messrs. A. and J. Fail, and which has consequently been accepted.

A 28-KNOT HERRESHOFF YACHT.—The Now Then is the name of a new steam yacht built by the Herreshoff Company for Mr. Norman L. Munro, of New York. The Now Then was designed by the famous blind designer, Herreshoff, at Bristol, R.I. She started from Newport the other day, and made the run from Newport to New York in 7 : 06 : 00. Coming through Hell Gate, according to the estimate of her designer, she flew along at the marvellous speed of 28 miles an hour. All the Sound steamers going East were passed. The Now Then is 81ft. long on the water-line, 85ft. over all, 10ft. beam, and draws 3ft. 3in. of water. She has a flush deck of red cedar, with trimmings of red cherry. She has two masts, fore and aft, schooner rigged, a low pilot house, and a brass smokestack. Her bow is extremely long, sharp as a knife, and terminates in a long clipper overhang. Her stern is her most peculiar feature. It runs outward aft from the deck just like the bow of a ram, and the propeller is under the projecting part. This projection is designed to prevent a deep immersion of the stern in running at a high rate of speed, and it works like a charm. The engines are of the triple expansion type, and the boilers can bear a pressure of 250 lb. There is a comfortable cabin aft, and the yacht is fitted for extended cruising. Mr. Munro says the name occurred to him when she was building, and he casually remarked, "Now, then, we shall do something." He is ready to race any steam yacht in America, including the Stiletto, from Newport to Larchmont, and will give any of them 10 miles. He believes that his boat will beat the Stiletto, because she can maintain her great speed for a longer distance. Mr. Herreshoff, her designer, and also the designer of the Stiletto, coincides with Mr. Munro in this view.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Application for Letters Patent.

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

7160A. VELOCIPEDES, W. Wright, Manchester.—*17th May*, 1887. [Received 21st July, 1887. This application having been originally included in No. 7160, dated 17th May, 1887, takes, under Patents Rule 23, that date.]

19th July, 1887.

10,070. CARDING ENGINES, T. B. Kay, Manchester.
10,071. FITTINGS for LAMPS, W. B. Sayers and W. H. Sturge, Birmingham.
10,072. STONE BREAKING MACHINES, S. Mason, Leicester.
10,073. FIRE-EXTINGUISHING APPARATUS, J. B. Hannay, Glasgow.
10,074. EMPTYING STOPPERED BOTTLES, F. A. Walton, Birmingham.
10,075. TUBE-WINDING MACHINERY, J. Heal, Halifax.
10,076. GIG MILLS, W. E. Heys.—(*F. Martinot, France.*)
10,077. FOOTBALLS, W. Sykes, Wakefield.
10,078. BICYCLES, &c. H. Shand, Newcastle.
10,079. EASEL PEGS, J. E. Smith, Winchester.
10,080. TROUSERS STRETCHER, S. H. Smith, Wolverhampton.
10,081. RING SPINNING MACHINES, R. Tatham, Manchester.
10,082. FASTENING SADDLE PANELS, P. A. Martin, Birmingham.
10,083. BROOCHES, C. E. Soloman, Birmingham.
10,084. BARREL BUNG SPOUT, D. Cameron, Bristol.
10,085. DECORATING POTTERY, C. Toft, Newcastle-under-Lyme.
10,086. CUP and BALL JOINTS for GAS, J. Dungey, London.
10,087. GAS-BURNING MACHINES, T. Duncan and D. Mills, Heywood.
10,088. LOOMS, J. Mason, Preston.
10,089. WATERING GARDENS, F. W. M. Bateman, London.
10,090. BUTTON-HOLE SEWING MACHINES, J. K. Macdonald.—(*The Singer Manufacturing Company, United States.*)
10,091. TRANSMITTING SOUNDS, H. J. Allison.—(*S. L. Barriett, United States.*)
10,092. INSULATING ELECTRICAL CONDUCTORS, R. W. Eddison.—(*J. Tatham, United States.*)
10,093. OBTAINING PURE ALUMINA from BAUXIT, &c., C. J. Bayer, London.
10,094. UMBRELLAS, J. Stephenson, London.
10,095. HORSESHOES, H. E. Newstead, London.
10,096. WOODEN BUNGS, J. Helme, Troqueer, Kirkcudbrightshire.
10,097. DENTAL ENGINES, W. P. Thomson.—(*W. A. Knowles, United States.*)
10,098. NUT LOCKS, W. P. Thompson.—(*E. C. Rolls, Canada.*)
10,099. UTILISING WASTE PRODUCTS, M. W. Hydes, Liverpool.
10,100. ADVERTISING DEVICES, T. W. Tetley, Liverpool.
10,101. U-SHAPED METAL PLATES, E. de la Sauce, H. Kloss and L. Cohn, Liverpool.
10,102. SHOE SEWING MACHINE, A. H. Reed.—(*C. Goodyear, jun., United States.*)
10,103. PHOTOGRAPHIC CAMERAS, T. J. Collins, London.
10,104. EMBOSSING LEATHER, J. M. Baker, London.
10,105. PAPER DRIERS, A. A. Simonds, London.
10,106. PICTURE HOOKS, W. M. Brinkerhoff, London.
10,107. CLIPPING HAIR of HORSES, G. F. Redfern.—(*L. A. D. Hadmar, France.*)
10,108. GRAPE WINES, W. Wild, London.
10,109. COLLAPSIBLE VESSELS, W. Cheshire, London.
10,110. AUTOMATIC SUPPLY BOXES, A. C. Savage, London.
10,111. FURNITURE POLISH, C. Schachtel, London.
10,112. UTILISING PRODUCTS of HEAT, R. Haddan.—(*T. T. Prosser and H. Waller, jun., United States.*)
10,113. PRODUCTION upon FIBRES and FABRICS of COLOURS, A. Gilliard, P. Monnet, and J. M. Cartier, London.
10,114. HEADS of RAIN-WATER PIPES, I. C. Wallas, London.
10,115. ELECTRIC SWITCHES, W. E. Hunnex, London.
10,116. AUTOMATIC DELIVERY of GOODS, &c., J. S. Wallace, London.
10,117. WATERPROOF BONNETS and HATS, H. H. Lake.—(*A. B. Floyd, United States.*)
10,118. BOILER TUBES, J. D. Ellis, London.
10,119. REMOVING BILGE WATER from SHIPS, H. H. Lake.—(*A. Cook, United States.*)
10,120. STEAM ENGINE MOTORS, H. H. Lake.—(*E. S. Smith and R. V. Pierce, United States.*)
10,121. UNHAIRING and GREEN SHAVING HIDES and SKINS, J. W. Vaughan, London.
10,122. ATTACHING HEELS to BOOTS, H. H. Lake.—(*C. S. Mersick, United States.*)
10,123. FACILITATING KINDERGARTEN TEACHING, T. Dougherty and G. H. Clarkson, London.
10,124. RETAINERS for UMBRELLA RUNNERS, W. H. Wharton, L. E., and D. P. Ladd, London.
10,125. REAPING MACHINES, N. Browne.—(*R. K. Parkerson, New Zealand.*)
10,126. SIGNALLING, G. A. Scott, London.
10,127. DESULPHURISATION of GASEOUS PRODUCTS, J. J. Hood and A. G. Salamon, London.
10,128. BLAST PIPES, H. Appleby, London.
10,129. RIFLING SMALL-ARMS, W. Lorenz, London.
10,130. PREPARING ZINCOGRAPHIC PRINTING PLATES, H. Schoembs, London.
10,131. METERS for MEASURING ELECTRICITY, G. Forbes, London.
10,132. SPIRAL TUBES, &c., H. L. Doulton and M. Marshall, London.
10,133. AUTOMATIC APPARATUS, C. Ingrey, London.

20th July, 1887.

10,134. SEATS of RAILWAY CARRIAGES, G. and E. Woods, Liverpool.
10,135. RECOVERING TIN, J. A. B. Bennett, King's Heath.
10,136. SOLE for TRAWL HEADS, W. D. Taylor and H. Challiner, Sheffield.
10,137. PROCESS of WATERPROOFING, T. F. Wiley, Bradford.
10,138. JACK-IN-THE-BOX SURPRISE ENVELOPE, J. Young, Leith.
10,139. BOOT SOLE FRAMES, J. Willis, Norwich.
10,140. RAISING of WATER, M. W. Household, Birmingham.
10,141. SPINNING, &c., WOOL, P. Wallace, Halifax.
10,142. HINGES for VENTILATORS, J. Mason, West Hartlepool.
10,143. FIGURED FABRIC, A. Bonnem, London.
10,144. COPPERAS, &c., S. Hallsworth and R. Bailes, Leeds.
10,145. RAISING, &c., HEAVY BODIES, W. and F. Hornby, Liverpool.
10,146. WALLS, &c., J. Wilson, Liverpool.
10,147. STICKS for BROOMS, &c., W. P. Thompson.—(*J. Gocht—H. and W. Pataky—Germany.*)
10,148. AUTOMATIC REGULATOR, G. Burgess, H. D. Leeward, and J. Crompton, London.
10,149. STRAINERS for DOMESTIC PURPOSES, T. R. Pim, Bristol.
10,150. HORSESHOES, H. Lüdecke, London.
10,151. CONTINUOUS BRAKE for RAILWAY TRAINS, R. H. Orton, London.
10,152. TREATING COPPER MATT, J. Fleming, Glasgow.
10,153. CALCINING of SULPHUROUS ORES, J. Fleming, Glasgow.
10,154. CHAMBERS or TOWERS, J. Fleming, Glasgow.
10,155. BOTTLES, J. Coates and J. Darling, Glasgow.
10,156. ENAMELLED LETTERS, R. W. and A. J. Willis, London.

10,157. TRANSMITTING and RECEIVING ELECTRICAL SIGNALS, T. A. Garrett, London.
10,158. GAS SUPPLY to ENGINES, A. Fehlen, London.
10,159. SECURING STOPPERS of BOTTLES, M. Krukziener, London.
10,160. METALLIC PIPES, G. G. M. Hardingham.—(*P. J. Grouvelle, France.*)
10,161. RECREATIONAL GAME, F. Howcroft, London.
10,162. LETTER-CLIPS, F. E. Blackmore, London.
10,163. CONDUCTING a RECREATIONAL GAME, F. Howcroft, London.
10,164. TANKS and CISTERNS, J. Davies and W. S. Codner, London.
10,165. FLOATING SALOON for DEEP SEA, O. Pitts and W. E. K. Youlton, London.
10,166. REFRACTORY CRUCIBLES, &c., J. Imray.—(*A. Moszczensky, Russia.*)
10,167. DOMESTIC FIRE-ESCAPE, J. O. Spong, London.
10,168. GENERATING CARBONIC ACID GAS, W. H. Knowles.—(—— *Phol, United States.*)
10,169. STEAM GENERATORS, E. Charles and G. Babillot, London.
10,170. SEWING MACHINES, R. W. Anderson, London.
10,171. POINTING PENCILS, L. Wolff, London.
10,172. BILLIARD TABLES, &c., A. A. Lateulère and F. R. Wright, London.
10,173. FELT, A. Davidson, London.
10,174. PAD for HORSESHOES, F. S. Mills, London.
10,175. RAILWAY CARRIAGE COUPLINGS, T. Farmer and J. Farmer, London.
10,176. GAS MOTORS, E. J. Hahn, London.
10,177. TREATMENT of POROUS POTS, &c., E. L. Mayer and H. Liepmann, London.
10,178. PENS, &c., J. Hickisson and A. Mackintosh, London.
10,179. LOADING GUNS, R. C. Christie, M. Gledhill, and H. H. S. Carington.—(*J. B. G. A. Canet, France.*) [Received 20th July, 1887. Antedated 29th June, 1887. Under International Convention.]
10,180. DISTRIBUTING FLUIDS under PRESSURE, R. C. Christie, M. Gledhill, and H. H. S. Carington.—(*J. B. G. A. Canet, France.*) [Received 20th July, 1887. Antedated 29th June, 1887. Under International Convention.]
10,181. SURGICAL KNIVES, J. Schmitt, London.
10,182. SETTING UP ADVERTISEMENTS, A. E. Port and R. O. Ritchie, London.
10,183. STEAM ENGINES, W. Clarke, J. B. Ferneaux, and C. Dowsen, London.
10,184. STEAM PUMPS, W. Clarke, J. B. Ferneaux, and C. Dowsen, London.

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10,185 DRESS IMPROVERS, C. A. White, London.
10,186. BICYCLE, S. J. Rose, Witney.
10,187. CHECKING PICKERS IN LOOMS, T. Burns and T. Blades, Bradford.
10,188. TAPES for VENETIAN BLINDS, J. Monks, Manchester.
10,189. PORTABLE ELECTRIC LAMP, R. Bentham, Atherton.
10,190. PISTONS, C. Neville and A. H. Wallis, Basingstoke.
10,191. COAL-BREAKING APPARATUS, W. Pegge, Stoke-on-Trent.
10,192. ROUNDABOUTS, J. Howarth, Manchester.
10,193. APPARATUS for SALE of CIGARS, J. Parker, Hull.
10,194. SLEEVE HOLDERS for DRESS, W. C. Alldridge, Birmingham.
10,195. DYNAMO-ELECTRIC MACHINES, J. P. Hall, Manchester.
10,196. GAS METERS, D. Orme, Manchester.
10,197. ENGRAVING and MEZZOTINTING, J. L. Mills, London.
10,198. HYDRAULIC ENGINES, H. C. Bull and Co. and H. C. Bull, London.
10,199. ELECTRIC METALLURGICAL PROCESSES, H. C. Bull and Co. and H. C. Bull, London.
10,200. DYNAMO-ELECTRIC GENERATORS, H. C. Bull and Co. and H. C. Bull, London.
10,201. ELECTRIC STORAGE BATTERIES, H. C. Bull and Co. and H. C. Bull, London.
10,202. MOTOR, H. C. Bull and Co. and H. C. Bull, London.
10,203. CALCINING OVEN, H. C. Bull and Co. and H. C. Bull, London.
10,204. AIR-HEATING STOVE, H. C. Bull and Co. and H. C. Bull, London.
10,205. GAS-PRODUCERS, H. C. Bull and Co. and H. C. Bull, London.
10,206. METALLURGICAL PROCESS, H. C. Bull and Co. and H. C. Bull, London.
10,207. STOPPERING BOTTLES, T. Brooke and J. Brooke, Sheffield.
10,208. CARTRIDGE EXTRACTORS, C. H. Malcham, Sheffield.
10,209. SLIDING TRIVETS, J. Talbot, London.
10,210. BRAKE, A. Cooke, London.
10,211. STOPPING MACHINERY, C. J. Eyre, London.
10,212. BOUGIE CATHETER, J. Mayer, London.
10,213. CALKS of HORSESHOES, L. Scheib, London.
10,214. COLOURING APPARATUS to PRINTING MACHINES, J. M. Black, London.
10,215. COPYING APPARATUS, F. W. Zimer, London.
10,216. REGULATING the PRESSURE of LIQUIDS and GASES, G. Downing.—(*F. Morin, L. van Effenterre, and P. Thiercelin, France.*)
10,217. GALVANIC BATTERIES, J. Serson and J. O. Whitten, London.
10,218. PEDALS for HARMONIUMS, &c., A. J. Boult.—(*S. J. Laughlin, Canada.*)
10,219. FIGURING in RELIEF upon SHEETS of METAL, J. M. Newton, Manchester.
10,220. ELASTIC STAYS, M. P. de Jonge, Liverpool.
10,221. VENTILATING BUILDINGS, &c., the Acme Ventilating and Heating Company, Manchester.
10,222. FERRIC SULPHATE, S. Hallsworth and R. Bailes, London.
10,223. MATERIAL for DYEING, S. Hallsworth and R. Bailes, London.
10,224. FLOOR MATS, A. J. Boult.—(*W. Smith, Canada.*)
10,225. OVERHEAD LOCOMOTION, M. D. Rucker, London.
10,226. APPARATUS for DENOTING TIME, &c., for VEHICLES, E. F. Gwynne, London.
10,227. REMOVING DEBRIS from TRAM RAILS, W. J. Cock, London.
10,228. BRAKE-HOLDING DEVICES for VELOCIPEDES, W. Roselli, London.
10,229. HAIR BRUSHES, C. Klein, London.
10,230. BRAKE for PRINTING MACHINES, G. Brayshaw, London.
10,231. COIN-RETAINING and TIPPING APPARATUS, P. Everitt, London.
10,232. DELIVERY APPARATUS, P. Everitt, London.
10,233. ELECTRIC VAPOUR BATH, M. Maitland, London.
10,234. BOILERS, W. Hornsby and F. J. Cribb, Grantham.
10,235. SELF-ACTING BRAKE, A. J. Sendell, London.
10,236. ERECTION of WALLS of CONCRETE, &c., C. A. F. Gregson, London.
10,237. FOLDING CUPBOARDS, I. F. Clasen, London.

22nd July, 1887.

10,238. METALLIC MOUNTS for BEDSTEADS, A. Heath, Birmingham.
10,239. VELOCIPEDES, C. K. Welch, London.
10,240. FIELD MAGNETS, L. Hanson, Halifax.
10,241. PATENT BOTTLE STOPPER, S. S. Tomlin and H. C. Aldom, Leigh.
10,242. WINDING YARN, G. Clegg, J. Thomas, and W. H. Harrison, Halifax.
10,243. PACKING for STUFFING-BOXES, J. Boyd, Liverpool.
10,244. MANUFACTURE of CEMENT, J. S. Rigby, Liverpool.
10,245. SWITCH-BACK RAILWAYS, W. Hallam, E. Birch, and J. Scott, Manchester.
10,246. AERIAL TOY, E. H. Chesterton, Birmingham.
10,247. ACCURATE PLACING of PHOTOGRAPHS in ALBUMS, W. G. Greenwood, Coventry.
10,248. ATTACHING BLINDS to ROLLERS, E. L. Miller and A. T. Foot, Bishopston.
10,249. BOTTLE STOPPERS, T. Duncan, Droylsden.
10,250. WOOD SCREWS, C. D. Rodgers, United States.
10,251. PROPELLING SMALL BOATS, E. Chatham, Rhosymedre.
10,252. COMBINATION GLOVE, PURSE, &c., A. Westwood, London.
10,253. SIGNAL LAMPS, J. L. Watkins, London.
10,254. TEMPERATURE REGULATOR, T. L. Callender, Hull.
10,255. SPRING BALANCES, G. Salter and J. Hughes, Birmingham.
10,256. STEAM BOILERS, G. Lowry and R. Wilby, Barnsley.
10,257. BRUSHES for CLEANING BOTTLES, A. J. T. Wild, London.
10,258. PERMANENT WAY JUNCTIONS, W. J. Ewing, Liverpool.
10,259. INDICATING TRICKS in CARD-PLAYING, H. Jackson, London.
10,260. MANUFACTURE of SALICYLIC ESTERS, C. Kolbe, London.
10,261. SHUTTLES for LOOMS, E. Dixon and H. Clayton, London.
10,262. AUTOMATIC SPRINKLING DEVICES, F. Moore, London.
10,263. SHIRT CUFFS, W. Pickard, London.
10,264. CARRIAGE RUG, E. T. Essex, London.
10,265. PRODUCING MOTIVE-POWER, G. Hannam, London.
10,266. CORES for CASTING TUBES, J. Wilks and E. Mapplebeck, London.
10,267. JEWELLERY, W. H. Sheldon and G. Mason, Handsworth.
10,268. FIXED GAS KILN, J. B. Payne and R. Davison, London.
10,269. INSULATING of PIPES, J. A. Breysse, London.
10,270. GAS STOVES, P. G. van Wie, London.
10,271. TELESCOPE HYDRAULIC LIFTS, A. C. Moffatt, London.
10,272. STORM SAILS for SHIPS, J. A. Yatman, London.
10,273. SIGNAL APPARATUS, J. A. Yatman, London.
10,274. DRESS PROTECTORS, J. A. Fayaud, London.
10,275. FASTENERS for SECURING WIRE to STANDARDS, C. Shaw, London.
10,276. PREPARATION of SODIUM, &c., C. Netto, London.
10,277. ARRESTING the ROTATION of SPINDLES, P., R., and J. Eadie, Manchester.
10,278. ELASTIC TIRES, E. C. F. Otto, London.
10,279. BUSTLES, G. McDonald, London.
10,280. COOKING UTENSILS, H. Fricker.—(*R. M. Wanzer, Canada.*)
10,281. STOVES, &c., Q. S. Backus, London.
10,282. SCORE-MARKING BOARDS, T. Campbell, London.

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10,283. OPENING CARRIAGES, T. Main, Liverpool.
10,284. WALLS, BUILDINGS, FLOORS, &c., J. Wilson, Liverpool.
10,285. ANTI-FRICTION APPARATUS for ROLLERS, J. Adams, Dawlish.
10,286. DRYING ROOMS, L. J. Wing and J. Young, London.
10,287. ELECTRIC TELEPHONES, F. King and W. P. Mendham, Bristol.
10,288. INCUBATORS, J. Gardner, Manchester.
10,289. WATCHES, W. Greenwood, York.
10,290. WRITING PAPER and CARDS, F. C. Lynde, Manchester.
10,291. PILED FABRIC MACHINES, C. E. Bennett and W. T. Browne, Manchester.
10,292. BOLTS for DOORS, J. Rhodes, Birmingham.
10,293. LOOMS for WEAVING, B. C. Sykes and G. Blamires, Halifax.
10,294. COMPRESSING TEA, A. J. Slaney and R. Nelson, Manchester.
10,295. AMMONIA, C. Wigg, Liverpool.
10,296. BALE FASTENINGS, H. Lindon, Little Sutton.
10,297. FRAMES, B. Shaw, Huddersfield.
10,298. FROST HORSESHOE, J. Christian, D. Durrant, and A. E. Jolley, London.
10,299. SERMON LEAF-TURNERS, W. H. Duncan, Coalbrookdale.
10,300. FASTENINGS for PACKING-CASES, S. W. Suffield, Birmingham.
10,301. PLATINE PRESSES, W. Heidenhain and H. Hoffmann, Berlin.
10,302. APPLYING BRONZE to PRINTED MATTER, W. Kleinertz, Manchester.
10,303. RAILWAY, &c., ROLLING STOCK, C. G. Owen, London.
10,304. GAS COOKING, &c., STOVES, W. T. Crooke, London.
10,305. COMPRESSING SEA-SALT, E. H. Hutchinson, London.
10,306. COMPRESSING DISINFECTANTS, E. H. Hutchinson, London.
10,307. CARBONATE of SODA, P. Bateson and M. C. Arnholtz, Liverpool.
10,308. TOOTH and HAIR BRUSHES, E. V. and E. Goad, London.
10,309. GENERATION of GASES for DISINFECTING, J. Hanson, London.
10,310. CISTERNS, A. G. Sutherland, Glasgow.
10,311. COCKS, E. Haines, London.
10,312. GAS HANGINGS, R. H. and R. S. Hughes, London.
10,313. SPRING CLIPS, G. H. Hill, London.
10,314. BELTS, G. Lichtenfeld, London.
10,315. SELF-CLOSING TAP, A. H. Griffiths and J. J. Brown, London.
10,316. FIXING RAILS to SLEEPERS, H. Law, London.
10,317. ROTARY SLIDE VALVES for STEAM ENGINES, C. Pfaff, London.
10,318. DRIVING BANDS and CORDS, J. E. Humphris, Thame.
10,319. COPYING PRESSES, T. E. Bergmann and A. Zeiss, London.
10,320. OIL CAN, H. Fricker.—(*R. M. Wanzer, Canada.*)
10,321. FLEXIBLE PIPE COUPLINGS, M. D. Legat, London.
10,322. CARBON MANGANESE ELECTRODES, C. Gassner, jun., London.
10,323. SMOOTHING IRON, J. A. Bourry, London.
10,324. PORTLAND CEMENT, W. Matthews, London.
10,325. LOADING APPARATUS for GUNS, W. Anderson, London.

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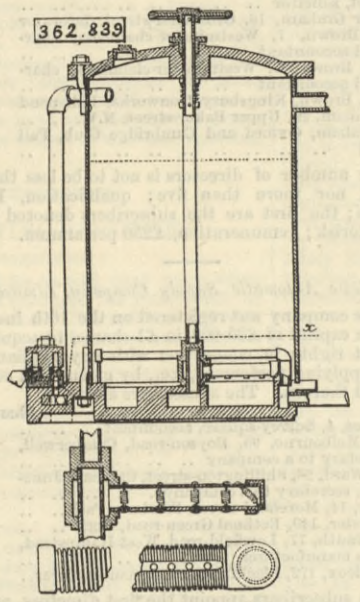
10,326. UMBRELLAS, W. Mellis, Manchester.
10,327. PRINTING MACHINES, J. Platt, Manchester.
10,328. GUMMING, &c., MACHINES, the Allen Machine Company, Halifax.
10,329. TREATMENT of WASTE ACIDS, T. Bayley, Birmingham.
10,330. KNITTING MACHINES, G. F. Sturgess and W., E., and F. Brown, Leicester.
10,331. SHUTTLES, J. Cooper, Glasgow.
10,332. PROTECTION of LETTERS, W. Wright and J. Dunham, Plymouth.
10,333. CONTROLLING ADMISSION, &c., of STEAM, J. Edge, Liverpool.
10,334. INK BRUSH, W. Freeman, Leicester.
10,335. SHOES and SLIPPERS, W. and A. Pickard, Leeds.
10,336. SWITCH-BACK and similar RAILWAYS, F. B. Welch, Manchester.
10,337. REGISTERING ELECTRIC and FLUID METERS, L. Gutman, London.
10,338. SAFETY BLASTING of SHOTS with a SAFETY BLASTING CARTRIDGE, J. Routledge, Ryhope Colliery, near Sunderland.
10,339. STAMPS for MARKING HEARTH-STONES, T. Carter, Rochdale.
10,340. STEAM BOILERS, J. Baldwin, London.
10,341. UNION JOINTS for HOSE PIPES, J. Wolstenholme, London.
10,342. SECURING the BOWS of KEYLESS WATCHES to their PENDANTS, A. R. Wilson, London.
10,343. MARKERS for SCORING in SHOOTING, &c., W. Mansfield, London.
10,344. ARTIFICIAL AERATED WATERS, J. W. Horner, Barnsley.
10,345. VELOCIPEDES, G. Townsend, London.
10,346. PURE and ACID VINEGAR, J. F. Peasgood, Streatham.
10,347. MOTIVE-POWER STEAM ENGINES, T. McCarter and T. Cooper, London.
10,348. SOWING SEEDS, D. Henderson, London.
10,349. CURRY-COMB and BRUSH, J. A. Page, Walsall.
10,350. REGULATING the SUPERHEATING of STEAM, M. Gehre, London.
10,351. BRACES, GARTERS, &c., W. Sachs, London.
10,352. EXPANDING TABLES, W. P. Thompson.—(*O. Walter, Germany.*)
10,353. BATHING BOX, G. Banzhoff, Germany.
10,354. WASHERS and RINGS, J. R. Fothergill and C. J. Seaman, London.
10,355. TILTING CASKS, J. Hill, London.
10,356. COIN-LIBERATED APPARATUS for SELLING, &c., A. G. Mumford and M. Belsham, London.
10,357. REPEATING ACTIONS for PIANOFORTES, A. Seppe, London.
10,358. SHIPS' DAVITS for LOWERING BOATS, J. Dunn, London.
10,359. CONVERSION of RECIPROCATING MOTION into ROTARY MOTION, J. C. Walker, London.
10,360. GAS MOTOR ENGINES, J. Dougill, Manchester.
10,361. VENTILATION of SEWERS, J. Phillips, London.
10,362. PIPE JOINT, J. Backhaus and C. Schüller, London.
10,363. ELECTRIC LIGHT FITTINGS, G. Binswanger and H. J. Coates, London.
10,364. SHUTTLE SEWING MACHINES, J. Bühr, London.
10,365. MACHINERY for ROLLING ROADS, &c., T. and J. E. S. Perkins, Peterborough.
10,366. NON-INTOXICATING BEER WORTS, A. Manbré, London.
10,367. MEDICINAL LOZENGE, E. Roberts, London.
10,368. CASES for NEEDLES, &c., G. L. Turney, London.
10,369. MACHINE GUNS, C. F. Wood, London.
10,370. STUDS for HOLDING CRAVATS, &c., E. Horbaczewski, London.
10,371. INGREDIENTS for LIGHTING FIRES, E. F. Gwynne, London.

SELECTED AMERICAN PATENTS.

(From the United States' Patent Office Official Gazette.)

362,839. APPARATUS FOR PURIFYING FILTER BEDS, *J. W. Hyatt, Newark, N.J.—Filed October 21st*, 1886.

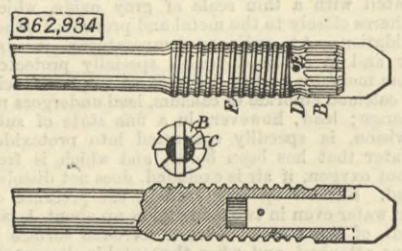
Claim.—(1) In a filtering device, a hollow radial washer arm attached to a central hub, a shaft for rotating such hub, a stationary sleeve for introducing water into said hub and arm, holes in the under side of said arm, and valves seated externally upon the holes and held thereto by springs, the whole being arranged and operated substantially as herein set forth. (2) In a filtering device, the outlet strainer pipes formed with rows of holes connected by grooves



upon the surface of the pipe, and having wire wound over said holes and grooves, with suitable spaces between the several coils of the wire, as and for the purpose set forth. (3) In a filtering device, the outlet strainer pipes formed with rows of holes connected by grooves upon the surface of the pipe, a screw-thread formed upon the exterior of the pipe, and a wire finer than the pitch of the thread wound in the same and secured to the pipe, substantially as herein shown and described. (4) In a filtering device, an outlet strainer having its screen formed of a wire wound spirally upon a hollow support, the coils of the wire being separated by water spaces, as described, and the interior of the support being provided with an inlet or outlet for the fluid, substantially as herein set forth.

362,934. COMBINED BORER AND REAMER, *J. P. Champion, Phelps, N.Y.—Filed September 29th*, 1886.

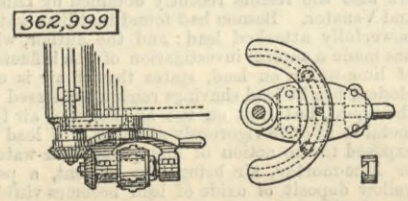
Claim.—The combination, with the reamer provided with head B, central passage C, circumferential grooves D, holes E, and screw-thread F, of the drill



consisting of a flat shank with a bevelled point, said shank extending up centrally into the passage and secured by a pin, and dividing said passage, in a manner and for the purpose specified.

362,999. MARBLE MOULDING MACHINE, *H. B. Reihlé, and M. F. Hatcher, Philadelphia, Pa. — Filed August 24th*, 1886.

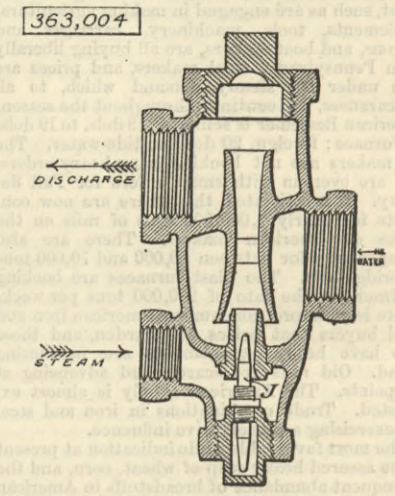
Claim.—(1) The main driving spindle, combined with a cutter carriage pivotted thereto, and thereby



adapted to rotate thereupon, and a guideway for such carriage, substantially as described. (2) A cutter carriage for stone moulding machines, pivotted to a main driving spindle so as to rotate about the same in a horizontal plane, a guideway for such carriage, a horizontal shaft supported in said carriage, and a cutter secured to said shaft and rotating therewith, and means to rotate said shaft, substantially as described. (3) A main driving spindle provided with a bevel gear at its lower end, a cutter carriage pivotted to said spindle, a shaft supported by said carriage, a cutter secured to said shaft, and a bevel gear on said shaft driven from the bevel gear on the spindle, substantially as described. (4) The main driving spindle, a cutter carriage pivotted to said spindle so as to rotate thereupon in a horizontal plane, a guideway for said carriage, and means, substantially as described, for connecting the guideway and carriage and permitting the movement of said carriage to any desired point on said guideway, substantially as described.

363,004. INJECTOR, *Louis Schutte, Philadelphia, Pa. —Filed January 13th*, 1887.

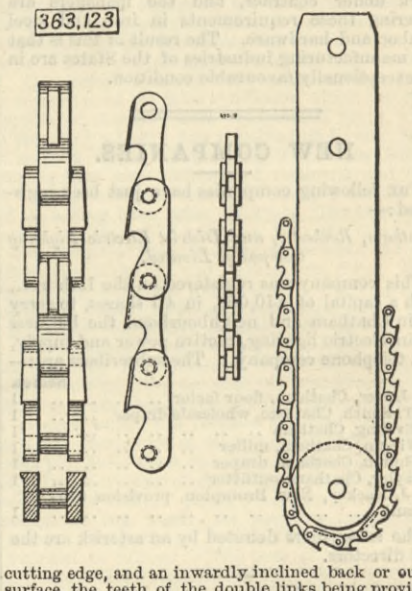
Claim.—(1) In an injector having a steam nozzle, a mixing tube, and a discharge tube, an external body inclosing and sustaining said parts, said body provided at its discharge end with duplicate threaded delivery-openings at right angles to each other, and with a plug changeable from one to the other of said openings at will. (2) In an injector containing a steam nozzle, a mixing tube, and a discharge tube, an



internal body inclosing and sustaining said parts, sai body provided at its end with duplicate openings at right angles to each other, and with a plug changeable from one to the other of said openings at will. (3) In an injector or jet apparatus having a combining and a discharge tube, a reversible spindle having its two ends of different sizes. (4) The spindle J, having the central collar and the screw threads, in combination with a plug or support adapted to permit the reversing of the spindle therein.

363,123. CHAIN CUTTER FOR MORTICING MACHINES, *C. H. Douglas, Chicago, Ill.—Filed March 26th*, 1884.

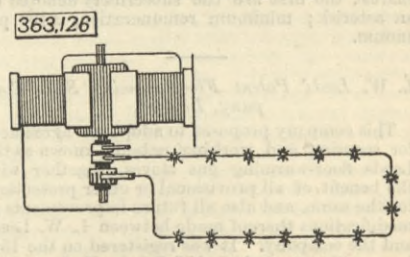
Claim. — An endless chain cutter for morticing machines, consisting of a series of alternate double and single links, each member of each link forming a tooth provided with a cutting edge at its outer forward extremity, a throat or gullet beneath said



cutting edge, and an inwardly inclined back or outer surface, the teeth of the double links being provided with lateral ribs upon their external sides at the junction of the sides and back, said ribs projecting beyond the sides of the teeth, having plane surface of some width from the backs inward and extending from the cutting edge to the rear of the teeth, substantially as and for the purposes specified.

363,126. SELF-EXCITING ALTERNATE CURRENT ELECTRIC GENERATOR, *J. W. Easton, New York.—Filed July 3rd*, 1886.

Claim.—(1) In an alternate current electric generator, the combination, with the armature coils, of the field magnet coils having one terminal permanently connected with one terminal of the armature coils, and a circuit controller connecting the remaining terminal of the field magnet coils directly with the remaining terminal of the armature coils during the generation of currents of a given polarity and interrupting said connection during the generation of



currents of the opposite polarity, and at the same time connecting the terminals of the field magnet coils directly with each other. (2) In an alternate current electric generator, the combination of an armature, two contact rings upon the shaft carrying said armature, with which the respective terminals of the armature coils are connected, contact brushes applied to the respective contact rings, a work circuit connected between said brushes, a circuit controller upon said shaft, consisting of two insulated segments, respectively connected with said contact rings, a brush-making contact with the segments alternately, a connection from said brush with one terminal of the field magnet coils, and a connection from the other terminal with one of the first-named brushes.