THE RAILWAY CLEARING HOUSE.

WE have all heard of the advantages that would result from being able to "see ourselves as others see us," and these advantages are likely to be all the greater where circumstances prevent us from seeing ourselves otherwise at all. The subject of the present article is a case in point. Almost everybody has heard of the Railway Clearing House as a vast establishment, situated near Euston-square, employing several hundred clerks, and occupied ceaselessly in unravelling and settling the complicated cross accounts of the various railway companies. But very few indeed know anything of the Railway Clearing House beyond this, nor, indeed, is it easy to increase that knowledge. The officials of the institution, as we know by experience, answer inquiries made even by responsible persons, and on substantial grounds, with the perfectly polite reply that their proceedings are strictly private. It is fortunate for outsiders, therefore, that a gentleman, being indeed an Englishman, but not resident in England, or employed by Englishmen, has somehow succeeded in breaking through this barrier of official reserve, and has had no scruple in giving to the public the full benefit of his success. This gentleman is Mr. Hugh Carlisle, of Riga, who has lately published a pamphlet in German, entitled "Allgemeine Darstellung des centralen Eisenbahn-Abrechnungs-Systems in England," the object of which is to describe the working of the Railway Clearing House, and to urge the adoption of a similar system for the railways of Russia. We propose to give our readers the benefit of the information thus acquired.

Starting boldly with the motto, *Salus populi suprema lex*, Mr. Carlisle lays down the three following laws of traffic, so to speak, to which, in the interests of public comfort and convenience, railway companies should, as far as possible, conform:—(1) The public should be able to travel from any one point to another without change of carriage, and without long halts by the way, and to send goods to their destination without the assistance of special carriers, and, if possible, without change of truck; (2) they should be able to pay in one sum all the charges for the different parts of such journey or freightage; (3) the finding of missing articles, and the settlement for lost or damaged articles, should be made as easy as possible.

These objects, in the opinion of many, can only be attained by placing the railways under the control of the State; but the author holds that this dangerous measure may be averted, and the results equally realised, by a better organisation among the railway companies themselves. For this purpose, he proposes as a model the English system of the Railway Clearing House, and proceeds to describe it in detail.

The Clearing House, as we learn, was founded in 1842 by Mr. Kenneth Morison, formerly accountant of the London and Birmingham Railway, with the support of Mr. Robert Stephenson and the present Lord Wolverton. It met at first with much opposition, and when actually started it numbered no more than four clerks, who undertook the accounts of only two lines of traffic—that from London to Darlington, and that from Manchester to Hull. Mr. Morison, however, lived long enough to see it rise into a great central organisation, embracing all the railways in the kingdom—now ninety-four in number—and presided over by a committee selected from the directors of the various companies, who there meet on neutral ground, and exchange their views and their experience. This committee meets four times a year, and at other times when summoned by the president. In addition, meetings, more or less frequent, are held of the following:—(1) Conference of general managers; (2) conference of goods managers; (3) committee for deciding doubtful claims on goods; (4) conference of traffic managers; (5) committee for deciding disputed questions of traffic.

It will be seen from the above that the Railway Clearing House deals not merely with accounts, but with all questions that can arise between different railway companies. In 1876 its total number of officials was nearly 1900, directed, under the General Committee, by a Secretary and three Heads of departments. The chief departments—excluding some, such as that for measuring and recording distances, which merit no special description—are the following:—(1) Department for goods traffic; (2) department for passenger traffic; (3) department for running of coaches and wagons; (4) department for lost articles.

(1) *Department for Goods Traffic.*—The main work of this department is the monthly division of the direct freight charges; *i.e.*, the charges on transport of goods, coals, minerals, cattle, &c., in goods trains which pass over more than one railway. With mere local traffic it has in general nothing to do. For the purposes of the division, the department receives from every station a monthly report on the whole of the goods despatched from it—the weight, the freight, whether including charges for loading or merely station to station charges, whether carriage paid or carriage forward, the number of the wagon in which goods have been sent, and so on. With these reports of goods despatched, each station also sends reports of goods received; and the first task of the department, when all these have come in, is to group them together, so that the goods despatched and goods received may be easily compared with one another. If any difference appears, it is noted on an "inaccuracy statement," which is sent to each station with margin left for reply. If the difficulty is not thus cleared up, further correspondence takes place, and the original entries—which by a general rule are held as binding—are consulted. Should the matter not be settled when the time comes for the monthly settlement, it is transferred to an "Outstanding Book," and is brought into the next monthly settlement after it has been finally adjusted.

The reports of the two stations having been verified, the report of the sending-station is transferred to the "Settlement Form," and the total amount of freight divided between the railways concerned. When this operation has been concluded for the total weight sent from each station, it becomes possible to distribute the terminal charges, which are rated at so much per ton on the gross traffic. For the purpose of this distribution goods are divided into three classes: (1) Goods which are hauled to and from the station by the railway companies; (2) goods which are simply sent from station to station; (3) coals, iron ore, stone, bricks, &c., which are all classed as "Minerals." The terminal charges are now deducted from the gross freight charges, as well as any special amounts laid out, say, by the sending company, with which the receiving company has nothing to do. The sum which remains is then divided between the two companies in the ratio of the distances traversed upon each. In spite of the general rule which fixes terminal charges at per ton, thousands of cases occur, from the variety of traffic, in which special principles have to be laid down for fixing such charges. Again it is sometimes hard to tell what the mileage belonging to each company really is. Thus, suppose goods to be sent from Brighton to Aberdeen; both the sending and receiving stations are often quite ignorant whether the goods were carted through London or sent by some suburban railway, or even which of the many routes from London to Scotland they may have followed. The Clearing House, however, can generally trace this by the report as to the wagon which carried the goods; or, if these have been transferred *en route*, by the stamp of the transferring station as affixed to the original way-bill. But when the route has thus been ascertained, the matter is not yet ended, for the Clearing House must take account of intervening circumstances. Thus, to recur to the despatch of goods from Brighton to Aberdeen, goods placed on the Battersea Wharf of the Brighton Railway cannot be hauled straight to, say, the Great Northern Company for transmission to Scotland, but must pass over an intermediate company, such as the London, Chatham, and Dover; and the freight due to this company must also be allowed for. If disputes arise on any such points, the Clearing House distributes the part which is undisputed at once, and reserves the rest until the point is cleared up.

All these items of charge are finally combined together into the monthly statement prepared for each railway company. This statement shows in detail the traffic between each pair of stations, the route taken by the goods, their classification as above, the amount received and expended on them at each station, the amount and mode of distribution of the terminal charges, the amounts due to intermediate companies, and, finally, the distance of transport over the lines of each company. The figures are so arranged on the two sides that the different columns balance each other, and their correctness is thus easily ascertained. These monthly statements also show what every station master or goods manager owes to his company, and the result is that any station can send goods to any other station, to which there is an established rate of freight, without the companies concerned paying the smallest attention to the charges involved; this business being wholly undertaken by the Clearing House. At the same time the companies have themselves full control of the Clearing House, and the results and totals are presented to them in a form which permits of the easiest possible verification. Thus if, as often happens, a goods train is running over the North London Railway, composed of wagons belonging to the Great Northern Railway, carrying goods from many different stations in the North of England, and drawn by a London and North-Western engine, a passer-by may rest assured that the proportion of charges thereby accruing to each railway concerned will be ascertained and set forth with an accuracy that makes even a trivial error at once difficult of occurrence and easy of correction. The department also fixes the charges to be paid as indemnity for goods lost, spoiled, or delayed, and undertakes the correspondence respecting claims under this head. The payment to be paid by the companies at fault is put against their account, in proportion to their respective interests in the freight for the goods. The goods department is by far the largest in the Clearing House. It contains about 700 clerks, presided over by a manager and by fifteen assistant managers. This staff has been doubled within the past ten years, in consequence of the increase in the work to be done.

(2) *Passenger Traffic Department.*—This department takes charge of all passenger traffic, and also that in horses, dogs, carriages, parcels, &c., which are usually carried in passenger trains. The arrangements have a general similarity to those already described for goods. In the case of parcels a half-yearly instead of a monthly settlement has been adopted, for the sake of economy in dealing with such numerous and minute items. At the same time control is constantly maintained by the Clearing House over these accounts and over the army of more or less uneducated clerks and porters by whom they are prepared. The station reports having been compared, and the amounts tabulated, as in the case of goods traffic, the amount is made out for each station, so that the companies may be able to check the reports of their station masters, and the gross sums paid in by them. These accounts give to each railway company the gross amounts received and expended on account of parcels carried between any station on their line and any station on another line. If in the traffic between any two stations the monthly receipts are less than 5s., the terminal charges alone which accrue upon it are carried direct to the account. From motives of economy these trifling sums are not divided with the scrupulous accuracy of larger amounts, but simply in proportion to the general division of traffic between the two companies concerned. For this purpose the various companies are formed into "Groups," in accordance with the extent of their mutual traffic in goods and parcels; and the balance taken from these groups, with the information supplied by the monthly accounts, is sufficient for the purposes of the division. With each monthly account is supplied an interim balance-sheet, made out by the data of the previous year; the assumption being that the ratio of the parcels traffic of any one company to the total parcels traffic of the whole kingdom will be the same in any one year—unless under special circumstances—as it was in the last. Payments are made by the companies to each other in accordance with these balance-sheets, and any errors which may thus arise are adjusted when the correct balance-sheet is made out at the end of the half-year. In the case of parcels the terminal charges are divided either per article, on the fixed basis of the sending station taking double of the receiving station on this account, or else by weight, as in the case of fish, vegetables, and other perishable articles sent in large quantities. In the case of parcels sent by passenger train the terminal charges are very small; they consist either of the booking-charges, when the parcel is brought to the station by the sender, or, in the opposite case, of the cost of bringing the parcel from the sender's house. For horses, carriages, and dogs there are usually no terminal charges, as they are taken to and from the station by the owners.

Another point of difference is with regard to the route taken by the parcel. This cannot be ascertained, as in the case of goods, by the wagon report, and therefore the way-bill must contain a specification of the train which takes the parcel. This, however, does not always give the route, and many companies therefore use a label attached to the parcel itself, which has to be stamped at each transferring station. These labels, however, are often missing or imperfect, and the subject is a source of great trouble and correspondence to the Clearing House. When the charges have been properly distributed, the statements for the different companies are made out in the same way as for goods traffic. The work is complicated by the system of interim balance-sheets, in consequence of which, where the traffic is pretty constant, the amount to pass between two railways at the end of the half-year is often a mere trifle, although the total of the transactions may have amounted to many thousand pounds.

The clearing of the passenger traffic takes another course, because the payment is always made in full on the taking of the ticket at the sending station. The only exception of any moment is in the case of elections to Parliament, when the companies have the practice of supplying the agents of the candidates with "Order Forms," on showing which voters are entitled to travel to and from the polling place free of expense. These forms, after collection, are sent back by the Clearing House to the railway which has issued them, and it is the station which has issued the order, not that from which the traveller has started, which is responsible for the money. The ordinary ticket system is somewhat complicated by the fact that every company is bound to issue a ticket from any of its stations to any other station in the kingdom. But there are many stations, a ticket between which is not applied for once a year. In such a case tickets are not kept printed, but the clerk enters the particulars on a blank ticket, of which he has a supply. These unprinted tickets require special looking after by the Clearing House, because they are not stamped, like ordinary tickets, with consecutive numbers, and thus are less easy to identify. At the Clearing House twenty-five boys are employed in sorting the tickets according to the despatching station, and they are then compared with the station report. If any discrepancy occurs, if a ticket has been taken over a wrong route, &c., the matter has to be put right, the correction noted, and the proper charges made. The numbers stamped upon the ticket at the time of issuing act as a further guide to the Clearing House in case of difficulty. The two divisions of the passenger department comprise about 300 clerks, divided into seven sections, and under the control of one head book-keeper.

3. *Wagon Department.*—Although the sum coming into the Clearing House on account of this department is comparatively small, the department is nevertheless of the greatest importance, since in many cases it serves as a sort of basis of operations. It takes note of all movements of rolling stock belonging to one company over the lines of another, and distributes the charges arising therefrom. The system is so arranged that it is impossible for a carriage or wagon to be run without the knowledge of its owners, to be directed wrongly, or to be detained on another line. For this purpose, special officials of the Clearing House are distributed all over the kingdom, whose business it is to watch the movements of the wagons, and take note of their contents. They are stationed at important junctions, &c., and on the passing of every train they note the number and descriptions of the wagons and tarpaulins, and the "nature of the traffic," under which term are comprised the kind of goods, the date, the names of the sending and receiving station, and the particulars of the route. This information they get from the wagon itself, and from the cards which are fixed in the card-holders on each side. At the same time the station at which any strange wagon arrives sends in a similar report, specifying the nature of the load, the station whence the wagon comes, and how and when it is further disposed of. In these reports the rolling stock of each railway company is entered separately, and carriages, wagons, and tarpaulins are also divided from each other. The comparing of these reports, the tracing of the course of each carriage, wagon, and tarpaulin, from the time it leaves its own line until it returns to it, and the adjustment of the accounts thence arising, form the chief work of the department. As mentioned above, these reports form a valuable assistance to the goods department, in tracing the route which any freight has taken, especially if it has gone astray. The accounts for rolling stock misdirected or wrongly detained are handed in to the companies every month, and contain full details on each case. The accounts for ordinary use of rolling stock, with the balance due, follow quarterly. The department consists of a manager and 280 clerks, divided into six sections. There are in addition five inspectors and about 500 clerks distributed over the country, in order to watch the traffic.

(4) *Lost Luggage Department.*—This department receives reports daily from each station where stray articles have been found, with an accurate description of them, and also settles all claims made on behalf of lost luggage. If an article described as found is seen to be identical with another described as lost, it is at once restored to its owner; if the article lost cannot be precisely identified, an exact description of it is sent to all stations, where similar articles have been found. As soon as a stray article is claimed

and taken away, the fact is notified to the Clearing House.

We have now described the departments into which this vast system is divided; it remains to say a few words on the extent of the business which it transacts. Taking the figures for the year 1876, the total sums brought into account were about 16½ millions sterling, and the cash balances actually handed over about 2 millions. The settlement forms made out in the goods department contained about 5½ million items, and in the passenger department about 3½ million. The number of carriage and wagon miles, for which charges had to be computed, was about 439 millions; the number of days on which demurrage was charged was about 1 million, and involved 29 million entries. The lost luggage department inquired into about 23,000 articles reported as missing, and registered about 347,000 reports, of which many, however, referred to one and the same article. It need scarcely be said that in so vast an establishment the welfare of the *employés* is well considered in every respect. A large number of institutions exist for their benefit. We have first the Pension Society, founded in 1873, to which every clerk in the department belongs. The arrangements of insurance are considered to be as favourable as is possible, consistent with security. The ordinary payment is 2½ per cent. on the salary, and to this the railways add an equal amount. A member who has paid for ten years can, by doubling his payment for five years more, obtain the right to a pension for ten years from that date. If a clerk leaves the office, he receives back the half of what he has paid, or the whole if he does not leave at his own wish; in case of death his heirs receive the whole, with a bonus of 4 per cent., after deducting any amounts already paid to him as pension. The amount of pension begins at 25 per cent. of the average salary in the ten years after joining, and rises by 1 per cent. each year, up to a maximum of 67 per cent. A member is entitled to pension after ten years' membership if he has reached the age of sixty, or at any age if he becomes permanently disabled. The society is managed by a committee of twelve, half of whom are paying members, and half members of the Clearing House Committee. In 1875 the number of members was 1912, and the capital £17,224. There is next a contingent fund, to provide for cases of a member being disabled by continuous sickness. There is a provident association, for assuring £50 at death; a deposit bank, guaranteed by the Clearing House, and giving 4 per cent. interest on deposits; a literary society, with reading-rooms, &c., and a library of 8000 volumes; a dining club, for providing meals at reasonable rates; a provision club, a coal club, and various clubs for amusement, including a monthly debating society, a cricket club, chess club, dramatic club, &c.

The foregoing description will have told our readers something of the advantages, the business, and the organisation of this enormous enterprise, which perhaps offers the best example known in England of the combination of large and conflicting interests for the common good. We cannot be surprised that Mr. Carlisle, to whom we are so much indebted, devotes the rest of his pamphlet to the task of recommending the system to the Russian railways, and explaining how it might be adapted to their requirements.

THE ARLBERG TUNNEL.

THE latest advices from Geneva state that the construction of the Arlberg tunnel is proceeding in the western gallery at the rate of 2·22 metres, in the eastern one at the rate of 4·37 metres per day, and that the making of the lines of access will shortly be taken in hand. The construction of the Arlberg Railway, from whatever point we view it, is a question of the utmost importance to the future commercial prosperity of the Austrian empire. Hemmed in, as she is, on her north-western frontier by Germany, and in the south by Italy, the bulk of her exports have hitherto been forced to pass over the railways of one or other of these countries *en route* for the West, and she has been restricted and hampered by all the vicissitudes and hindrances of protective and rival policies. The altitude of the Alps dividing Austria from Switzerland on the extreme Western frontier for a long time presented an almost insurmountable barrier; but the success of other similar undertakings has at last stimulated the Government to shake off the shackles of tradition, and boldly to strike out an independent course for themselves, which will shorten the distance of transit, and relieve the export trade from the dues and hindrances that have almost crippled it.

The most important feature in the undertaking is, of course, the Tunnel and its immediate approaches. More than eight years have been spent in studying the several routes proposed, and nearly every scientific body in Austria has been called upon or volunteered to discuss the different projects. The several routes will be seen by the accompanying plan, page 428, the one in a full line being that adopted by the Government in 1880. The alternative project, shown by the line dotted, is the one proposed by Herrn v. Nördling in the same year, but rejected for obvious reasons. As it has already been the subject for some of the warmest technical polemics, no further mention need be made of it than to say that it offered more disadvantages and less technical and commercial opportunities than any other.

The line itself, from Innsbruck to Bludenz, is 135·8 kilometres in length, 71·3 of which, from Innsbruck to Landeck, are of the usual character of railways in Alpine valleys. The ruling gradients are 1 in 200 and 1 in 500, with the exception of two lengths, of 3500 and 2200 metres, which rise respectively 1 in 120 and 1 in 110. The sharpest curve on this piece is 300 metres, or about 16 chains radius. The character of the line from Landeck to Bludenz is totally different. Starting from the former place at a height of 777·00 metres above the sea level, the route is obliged to leave the natural course of the valley of the Rosana, and rises with a series of gradients of 1 in 40 to the eastern entrance of the tunnel at St. Anton, at an elevation of 1302·00 metres above sea level. The distance between these two points is 28·5 kilometres, but is broken at Pians, Strengen, Flirsch, and Petneu by stations, each 400 to 500 metres long.

From St. Anton the tunnel rises with a gradient of 1 in 100 for a length of 4 kilometres to the summit, which is 1310·20 metres above sea level, or 533·20 above Landeck. From the summit downwards, on the other side, to the western portal at Langen, the gradient falls at the rate of 1 in 66 for a distance of 6270·00 metres, and at this point enters its worse phase—as the distance fron Langen to Bludenz is only a little more than 25 kilometres, and the difference of level 655·78 metres, Bludenz being 217·90 metres lower than Landeck, or 559·10 metres above sea level. This enormous difference is overcome by about 10 kilometres of 1 in 34½, and 15 kilometres of 1 in 33.

The difference between the several routes previously proposed and the one adopted will be seen from the sections Figs. 1, 2, 3, 4. An enlarged section is given in Fig. 6. Fig. 5 represents the Tunnel sections, proposed for single and double line. The Arlberg Tunnel, as well as all works on the open line, will be constructed for two lines of rails. The earthworks will be for a single line. The minimum radius adopted on the length, Landeck to Bludenz, is 250 metres, or about 12½ chains; this is somewhat in excess of the curves on the Brenner and Semmering lines, which have respectively 284 metres and 189·6 metres radius, but allowance had to be made for the steepness of the gradients. The formation width of the line is adopted in accordance with the requirements of the Deutscher Eisenbahn Verwaltung, viz., 5·7 metres. The rails are to be 7 metres long, of steel, and weigh 35 kilog. per metre. In every case the sunny side of the slope has been chosen. All the stations are on the level.

Since the wonderful improvements made in boring tools, and the solution of the question of ventilation in long tunnels, more care has had to be taken in projecting the approaches than the actual trace of the Tunnel in this railway. It is with the exception of the Pustherthal line, the only Alpine railway running from east to west. This direction has an immense influence on the climatic conditions of the pass. The winter is much longer and the collection of snow greater. In the Arlberg Pass the former lasts from seven to eight months, the temperature sinking to 30 deg. below zero Fah., or to 62 deg. of frost, and it is not an uncommon occurrence for the snow to lie several fathoms deep, caused by the ceaseless storms which rush backwards and forwards from the Valley of the Rhine to that of the Inns. The estimate for the execution of the works, including the piece from Innsbruck to Landeck, is as follows:—

Estimate Cost of Construction of the Line Bludenz Landeck and Landeck Innsbruck.

	Cost per kilom.	Total cost.
Surveys and direction of works	£1,502 ...	£96,900
Expropriation of land	1,426 ...	92,000
Earthworks	2,262 ...	146,000
Add. works	3,922 ...	253,100
Small bridges under 20m. span	1,134 ...	73,200
Large bridges and main tunnel	25,129 ...	1,621,600
Short tunnels	1,746 ...	112,700
Ballast and platelaying	611 ...	39,400
Rails, mechanical appliances, signals, &c....	1,895 ...	122,300
Fencing telegraph, tools, stores, &c.... ...	465 ...	30,000
Rolling stock	2,190 ...	141,300
Stations, pumps, water stations, &c.... ...	1,108 ...	71,500
Total for the length Bludenz Landeck	£43,390 ...	£2,800,000
Add the cost of the line from Landeck to Innsbruck...	10,578 ...	760,000
Average cost per kilo. for the whole line...	£26,105 ...	£3,560,000

It is estimated that six years will be occupied in the construction of the line.

THE INSTITUTION OF CIVIL ENGINEERS.

THE PRODUCTION OF PARAFFIN AND PARAFFIN OILS.

AT the meeting on Tuesday, the 31st of May, Mr. Abernethy, F.R.S.E., President, in the chair, the paper read was by Mr. R. Henry Brunton, M. Inst. C.E.

The discovery of paraffin wax, about 1830, was generally ascribed to Reichenbach, a German chemist; but, nearly at the same time, Dr. Christison, of Edinburgh, obtained a small portion of that substance from Rangoon mineral oil. The credit of producing this wax in merchantable quantities belonged, however, to Dr. James Young, of Kelly, in Renfrewshire. In 1848, Dr. Lyon Playfair directed Mr. Young's attention to an oozing of petroleum through a coal working at Alfreton, in Derbyshire. Mr. Young made arrangements to operate on this, and obtained a notable quantity of wax, as well as a light oil for burning and a heavy oil for lubricating purposes. After two years' successful working, the supply of petroleum at Alfreton ceased. Mr. Young then, as the result of numerous and protracted experiments, succeeded in obtaining, by the application of gentle heat to coal in close vessels, an oleaginous liquid similar in character to petroleum. Prior to this period (1848-9), the distillation of coal was conducted at high temperatures for the production of gas, Mr. Young being the first to attempt it with the ostensible object of obtaining liquid products. The process, the main feature of which was the gradual and gentle application of heat, was patented in 1850, and the patent was successfully maintained, notwithstanding numerous attacks.

About the same time the Boghead or Torbanehill mineral was discovered, from which Mr. Young obtained 120 to 130 gallons of oil per ton. It was worked out in 1862, and paraffin oil had since been derived from the bituminous shales existent in the coal measures. From 80 to 90 per cent. of that now worked was found in the counties of Linlithgow and Midlothian, and large fields were believed still to exist. The yield of oil from shale was only about one-fourth that from the Boghead mineral, yet the companies engaged in the trade were in a fair state of prosperity. There were eighteen establishments in Scotland for the manufacture of paraffin oil, using 1,036,000 tons of shale per annum, and producing 34 million gallons of oil. From this there were generally obtained, by the processes of rectification, 6 per cent. of naphtha, 35 per cent. of burning oils, 14 per cent. of lubricating oils, and 9 per cent. of solid paraffin, the remaining 36 per cent. being lost. The lightest portion of the naphtha, known as "Gasoline," was employed for carburetting air for the illumination of country houses, &c.; other portions were used for burning in open-air lamps and for dissolving caoutchouc; while the heavy portion was applied for dissolving paraffin scale in the process of refining it. "Burning oils" were sometimes divided into lighthouse-oil, which was of the greatest illuminating power and was the safest; No. 1 burning-oil; crystal-oil, which was No. 1 oil after treatment with acid and soda for removing its colouring matter and odour; No. 2 oil, and marine-oil; but these varieties were generally mixed together and sold under various appellations.

By the Petroleum Act of 1871, the flashing point, or temperature at which mineral oils should give off an inflammable vapour, was fixed as not under 100 deg. Fah. This point was decided by the "open" test, but the results obtained by its means were variable and incorrect. By the Act of 1879, the test was made a "close" one, the apparatus designed by Professor Abel being employed; the "flashing point" corresponding to 100 deg. Fah., as made by the old test, being fixed at 73 deg. by the "close" test. The value of mineral oils as illuminants varied considerably. Lighthouse-oil had been the subject of extended experiments; and, whereas, when this was first used, a great advantage was apparent, both in consumption and illuminating effect, over vegetable oils, recent improvements in lamps made by Mr. James N. Douglass, M. Inst. C.E., and others, seemed to have diminished, if not altogether to have destroyed, this superiority. But it was reasonable to suppose, owing to the larger proportion of carbon in mineral oil, that it should give better results, if consumed to the greatest advantage; and, in consequence, the inference was that the lamps at present in use were not perfect in this respect.

The lubricating mineral oils had the defect of being deficient in body. The viscosity of an oil was tested by measuring the time a certain quantity took to pass through a tube, and by comparing this with rape oil as a standard. This being represented as 1000, mineral oils had a viscosity of from 250 to 400. They were therefore mixed with vegetable oils in certain proportions, and an addition of from 20 to 30 per cent. was said to improve their lubricating properties. Paraffin wax was of varied fusibility: that of a low melting point was used in the manufacture of matches, and that having a higher melting point chiefly for candles. Paraffin candles, which were made with a slight admixture of stearine, gave a clear smokeless flame, and a considerably superior light to sperm candles. It was claimed for paraffin that it was pure olefiant gas in a solid form, was converted into this gas when exposed to heat, and consumed without giving off any impurities.

The manufacturing processes for conducting the distillation of shale, introduced by Mr. Henderson, of the Broxburn Oil Works, Linlithgowshire, had led to the production of an oil of 1d. per gallon greater value, with an increased yield of ammonia, and at a saving of 1s. 6d. per ton, in fuel and maintenance of plant, on the shale dealt with. Mr. Henderson's retorts were placed in an oven above the combustion chamber, and were not in direct contact with the fire. The carbon remaining in the spent shale was utilised, this being consumed as fuel for the retort, and by its slow combustion an equable temperature of about 800 deg. Fah. was maintained. In the old form of retort the fuel used was coal, and the difficulty of maintaining a moderate temperature was so great that temperatures ranging from 1200 deg. to 1500 deg. were sometimes reached. The vapours from the retorts were led through a series of pipes, and partially condensed. The uncondensed portions were, in some cases, further subjected to condensation by pressure, or by a scrubbing process in a coke tower. The gas, still remaining uncondensed, was used as fuel. The ammoniacal liquor, which separated from the crude oil, was placed in boiler-stills, and the steam blown through sulphuric acid for the production of sulphate of ammonia. By arresting the process before the formation of crystals in the "cracker" box, and allowing some time for the precipitation of the arsenic and iron, and afterwards effecting the crystallisation by means of the evaporation of the liquid, an excellent commercial salt was produced from sulphuric acid, made from pyrites. The first step in the treatment of the crude oil was its distillation to dryness, when pure vesicular coke was left in the bottom of the stills. The oil was then subjected to an acid and alkali treatment, and was fractionally distilled, being divided into naphtha burning-oil, and a heavy oil containing 30 per cent. of paraffin scale. The burning-oil portion received another acid and alkali treatment, and was again fractionally distilled, when more naphtha was separated, as well as a heavy oil containing 10 per cent. of a more fusible paraffin. The burning-oil then received a final treatment, and on distillation was divided into the different qualities already mentioned. Naphtha was rectified by distillation and treatment, it being also separated into the different gravities required by consumers. The heavy oil, from the first stage of purification, was run into bags, which were squeezed in hydraulic presses, and in this way a portion of the scale was separated. The oil so squeezed out, as also the heavy oil from the second stage of purification, was cooled by being put over a drum refrigerated by ether machines, to 18 deg. or 20 deg. Fah., and was again squeezed, when more scale was obtained. Different methods were adopted, both for the separation of the scale from the cooled oil, and for lowering it to the necessary temperature. The paraffin scale was refined by being dissolved on three occasions in naphtha, again crystallised by cooling, and squeezed under hydraulic pressure. Its deodorisation was effected by blowing steam through it, when in a melted state, for sixty hours; it was then agitated with animal charcoal, and was run through a paper filter into suitable moulds. The oil, pressed from the paraffin scale, received certain chemical treatments and was fractionally distilled, being separated into the required gravities; the light portion being returned as burning oil, and the remainder becoming lubricating oil, of 865, 875, 885, 890 gravities. Any paraffin scale which these might contain was further separated by being refrigerated and pressed as already described.

The tar from the acid treatments was heated in large tanks to about 150 deg. to 200 deg. Fah., and the dilute acid and oil in it set free. It was then consumed as fuel, either in the furnaces of the boilers stills, or with the object of evaporating dirty water. The soda contained in the tar from the alkali treatments was recovered by a process devised by Mr. Galletly, a chemist in the employment of Young's Company at Addiewell; 50 per cent. of the soda used being so recovered at a cost of about 3s. per cwt. Owing to the demand for paraffin oils being principally in winter, large storage accommodation was necessary for the summer production. This was afforded by malleable iron tanks of 50,000 to 100,000 gallons each, as the oil only slightly affected that metal, while it had a rapid action on lead or zinc. The paper only professed to describe the mechanical means employed in the manufacture, and no attempt was made to explain the chemical principles involved.

In the past twelve months there has been an increase of 59 members, 136 associate members, and 55 students, and a decrease of 14 associates, the honorary members remaining the same. There are now on the register and lists 1276 members, 1435 associate members, 565 associates, 18 honorary members, and 712 students, together 4006. Twenty-five years ago the total of all classes was under 800.

The Institution then adjourned until the second Tuesday in November.

MISCELLANEOUS ACCIDENTS ON ENGLISH RAILWAYS IN 1880.—In addition to the accidents on railways during 1880, the following accidents occurred upon railway premises, but in these the movement of vehicles used exclusively upon railways was not concerned, namely:—3 passengers killed and 71 injured whilst ascending or descending steps at stations; 33 injured by being struck by barrows, falling over packages, &c., on station platforms; 53 injured by falling off platforms; and 1 killed and 47 injured from other causes. Of servants of companies or contractors, 4 were killed and 633 injured whilst loading, unloading, or sheeting wagons; 222 were injured whilst moving or carrying goods in warehouses, &c.; 3 were killed and 131 injured whilst working at cranes or capstans; 6 were killed and 197 injured by the falling of wagon-doors, lamps, bales of goods, &c.; 2 were killed and 328 injured by falling off, or when getting on or off stationary engines or vehicles; 5 were killed and 172 injured by falling off platforms, ladders, scaffolds, &c.; 2 were killed and 139 injured by stumbling whilst walking on the line or platforms; 71 were injured whilst attending to stationary engines in sheds; 38 were injured by being trampled on or kicked by horses; 8 were killed and 346 injured whilst working on the line or in sidings; 4 were killed and 152 injured from various other causes. 7 persons who were transacting business on the companies' premises were also killed and 100 were injured, making a total in this class of accidents of 45 persons killed and 2733 injured.

RAILWAY MATTERS.

THE London, Chatham, and Dover and the South-Eastern Railway Companies announce that the new line between Dover and Deal will be opened for traffic on Saturday, the 15th inst.

THE total number of personal accidents of all kinds reported to the Board of Trade by the several railway companies during the year 1880 amount to 1180 persons killed and 6692 injured.

DURING March last there was a large number of broken rails and axles reported on the American railways, but, singularly, only one broken wheel is in the record, which is in marked contrast to the preceding month.

IN the construction of the new Tay Bridge, piers for a double-way bridge will be constructed entirely independent of the old piers. The wind pressure has been taken as 20 lb. per square foot, and the design allows for 56 lb. pressure on bridge and train. Some of the old girders will probably be used in the new bridge.

THE new bridge over the Nerbudda, designed to carry the Bombay, Baroda, and Central India Railway, by Sir J. Hawkshaw, was opened on the 16th ult. The bridge is one of the longest in the world—4687ft.—and has cost about £340,000, most of which has been paid out of surplus over guaranteed interest earned by the railway.

WRITING from Geneva on Tuesday a correspondent of the *Daily News* says:—"Experiments are being made with a view to running trains through the St. Gothard Tunnel by electricity, with motive power obtained from the Reuss and the Tessin. The boring of the Arlberg Tunnel proceeded last month at the rate of six and a-half metres per day. The making of the lines of access will shortly be undertaken."

MR. W. G. BAGNALL, of the Castle Engine Works, Stafford, has just completed the smallest locomotive ever fitted together for practical use. This tiny engine, The Hampson, has a 3in. cylinder and 13½in. wheel, and its maximum width is only 31in. It is 3-horse power nominal, and of 18in. gauge. The engine was tested on Friday with satisfactory results. Mr. Bagnall has recently sent engines of but slightly greater bulk to the Transvaal, Java, India, and other colonies, and the present one is destined for South America.

THE Belgian Minister of Public Works, Brussels, will adjudicate or let the tenders for 23,000 tons of steel Vignoles rails, to be delivered in 1882 either for money payment for the whole or part, or for a balance in gold in exchange for 10,000 tons of old iron rails, or for a balance in gold in exchange for 10,000 tons of old Vignoles rails, and 2500 old rails of various sorts and lengths. The adjudication of the contract or contracts will take place in the first-class waiting room of the station du Nord, Brussels, at mid-day, on the 29th inst.

A LIGHT railway is much wanted from Wareham to Swanage, taking several small places in its route. A line has long been under consideration by the South-Western Railway Company; but not only is this likely to remain the position of the project in that company's hands, but the line proposed would run short of Wareham, and lose half the advantages it might otherwise secure and confer. A tramway is also wanted to run from Bournemouth past Parkstone to Poole. This tramway should run a considerable part of its length along near the sea, so that it would connect Poole, the Sandbanks of the outer part of Poole Harbour, and the outer parts of Parkstone, which are now a long way from the South-Western Railway, and which, though being gradually opened out, would be rapidly built upon if such a communication were opened.

OF the 1238 railway tires which failed during the year 1880, 50 were engine tires, 50 were tender tires, 13 were carriage tires, 40 were van tires, and 1085 were wagon tires; of the wagons, 886 belonged to owners other than the railway companies; 993 tires were made of iron and 231 of steel, while the material of 14 was not stated; 50 of the tires were fastened to their wheels by Gibson's patent method, 1 of which left its wheel when it failed, 24 by Beattie's patent, 16 by Mansell's patent, 40 by Drummond's patent, and 1 by Brotherhood's patent, all of which remained on their wheels when they failed; 1090 tires were fastened to their wheels by bolts or rivets, of which 10 left their wheels when they failed; 17 tires were secured to their wheels by various other methods, none of which left their wheels; 96 tires broke at rivet holes, 215 in the solid, 13 at the weld, and 914 split longitudinally or bulged.

THE Lancashire and Yorkshire Railway Company, according to a contemporary, is about to build a single-span passenger station at Liverpool. It is to be no less than 75ft. greater in width than the splendid span of the Midland Railway Co.'s station at St. Pancras. This station was designed by the late Sir Gilbert Scott. The roof span measures 240ft., and the stations which in order of merit as to size stand immediately after it are: Lime-street, Liverpool, roof span, 222ft.; New-street, Birmingham, 211ft.; Central, Manchester, 210ft.; St. Enoch, Glasgow, 198ft. The total cost of the roof of St. Pancras Station, including the screens, was £53,483. The Lancashire and Yorkshire Company's proposed new station is to cost nearly half a million. In inviting designs, the company offer for the design accepted £750; for the second best, £500; and for the third best, £350. In addition to the sum of £750 as an honorarium, however, they will allow the successful competitor 2 per cent. on the capital expended.

OUR Birmingham correspondent writes that the railway rates and the short hours at the pits remain topics of grave complaint. Individual ironmasters continue to appeal to the railway companies for fair play with their competitors. Mr. J. W. Sparrow has addressed the London and North-Western Company, contending for the same measure for Staffordshire as is meted to Lancashire and the west coast. He asks that in these last districts the company carries minerals, say, 36 miles at 2s. 6d. in owner's trucks, and 3s. in company's trucks. Those also ought to be the rates over the like distance from North Staffordshire to South Staffordshire, and not, as is now the case, 3s. 10d. and 4s. 10d. respectively. Mr. Sparrow, in the same correspondence, admits that the "unjust and comparatively unfair railway rates" are not the sole cause of the decline of trade hereabouts. They aggravate, but do not originate the evil. The primary cause of our difficulties is the eight hours system, and so long, he adds, as the Earl of Dudley gives his sanction and support to that system, so long will our trade languish and continue to decline.

A CORRESPONDENT of the *City Press* calls particular attention to the necessity for the further consideration by the Common Council of what is to be done with Billingsgate, in order to cheapen fish by making the market more easy of access. An outlay of a million and a-half would not effect the requisite improvements, as there is not room in Billingsgate for any extension without one interest giving way. In the first quarter of the present century the advent of railways effected a complete revolution in the mode of transit, and commencing with about the year 1836 the supply by water diminished, and the supply by railway gradually increased, until now, as will be seen by the figures published, for the 52 weeks of last year, there were 95,548 tons of fish received by railway, and 26,587 only by water; that 95,548 tons brought by railway cost the consignor 5s. per ton for its delivery from the railway station in London to Billingsgate, and the railway companies are unanimous apparently in their desire to be relieved of the obligation of delivery, even at that price. There is also another serious charge for porterage, which amounts to 10s. per ton, and represents an amount in the aggregate on the 122,135 tons of fish that came to Billingsgate last year to £61,768. The delivery of the fish by steamers is an additional expense of about 6s. per ton, representing £7978 per annum. If one half of the charge for the delivery from the railway station to Billingsgate, and the "bobbing" or porterage could be saved, the gain to the owners of the fish would be about £55,000 a year. All these charges on fish, which are so excessive as compared with those on meat, render it necessary for a serious consideration of the question.

NOTES AND MEMORANDA.

PURE olive oil will saponify by combination with spirits of hartshorn.

THE new library at the Royal Observatory at Greenwich, which has been sanctioned by the Government, is to consist of a room of one storey, 50ft. by 18ft., with galleries at mid-height.

LARGE tracts of wormwood in American plains have been observed by M. Poyrot to be free from insect life of any kind, and he proposes to utilise wormwood leaves and stalks in various ways as a preventive of the ravages of the phylloxera.

IRIDIUM is being found in Oregon with gold, and appears as a black shining sand, in particles a little coarser than blasting-powder. There are portions of this State and the adjoining territory where it seems this metal may be found in abundance, for that which turns out to be iridium has long been familiar to the gold miners, and thought by them when noticed in the "blowings" to be iron.

In his annual report to the Board of Visitors, the Astronomer-Royal remarks that Halley's ancient tombstone, after its removal from Lee Churchyard—where it has been replaced by a new stone with a *fac simile* of the inscription—had been placed in the south ground, where it has been lying for several years. It has now been carefully restored, and mounted on the east wall of the lobby of the north dome of the Greenwich observatory.

M. TROUVE has been making experiments with a boat 18ft. in length, and 4ft. 3in. in width, driven by a small electro-motor and two sets of Wollaston elements, each weighing under 27 lb. The motor was placed on the rudder, and communicated motion by a chain to a small screw. A speed of 5100 yards per hour was made on the trial, which lasted a considerable time, the boat carrying three persons.

IN the *Comptes Rendus* appears an abstract of a paper "On a Mode of Graphic Representation of Phenomena Produced in Dynamo-electric Machines," by M. Deprez. A curve, called the characteristic of the machine, is got thus: Communication being first broken between the ring and the exciting electro-magnets, a known current, from an external source, is sent through the latter. The ring is then rotated with a given velocity; then the difference of potential between the two extremities of the (broken) induced circuit is measured. The auxiliary current is varied, and its intensities are taken as abscissæ; the ordinates are the differences of potential of the ends of the induced circuit.

ACCORDING to an analytical report on silicate cotton, as used for covering steam pipes, made by Mr. Chas. O'Neill, F.C.S., for Messrs. Wilson, Pease, and Co., of Middlesbrough, the mean of a great number of experiments shows an advantage in favour of the silicate cotton covered pipe of 5·8 per cent.; that is, for 100 parts of steam entering the pipes it will deliver 5·8 more than the felt covered pipe, or, in other words, condense so much less. The exterior of the felt covered pipe soon reaches its maximum temperature, say 93 deg. Fah., when the external air is at 52 deg. Fah. The silicate cotton covered pipe does not show its maximum temperature for a considerably longer time, and does not rise higher than 79 deg. Fah.

IN this column, in our impression of the 20th ult., reference was made to a small battery of four elements for the condensation and storage of electricity, made by M. Faure, and brought over to this country with about a million foot-pounds of energy stored up in it, and taken to Sir W. Thomson for experimental purposes. The box was only about a cubic foot in contents, and Sir W. Thomson has found that the million foot-pounds was not overstating the power of this power-storing box; for 260,000 foot-pounds was obtained from one of the cells after being discharged, and then recharged from the battery, after standing ten days. A little battery of seven boxes, one cubic foot each, will suffice to give the incandescence of a hundred Swan or Edison lights for six hours, without any perceptible diminution of brilliancy.

THE mean annual rainfall of Wiltshire for the past eleven years is 32·14in., the monthly maximum being 3·49in. in October, and the minimum 1·82in in March. As contrasted with the more strictly central districts of England, the summer rainfall is relatively less, and the autumnal and winter rainfall greater; and as contrasted with places more open to the Atlantic to west and south-westward, the rainfall is relatively greater in summer and less in winter. At seventeen stations observations have been made for at least six years, at which, if the averages be struck for the eleven years, differentiating where necessary, the largest mean rainfall is seen to be 40·32in. at Corsham, near the summit of the long ridge separating the North Avon from its tributary Box Brook, and the smallest 29·76in. at Pen Hill in the north on the high ground between the Thames and its tributary the Cole.

A CHEMICAL examination of the Buxton thermal water formed the subject of a paper by Mr. J. C. Thresh, read on the 2nd inst., before the Chemical Society. The author first had his attention attracted by the extraordinary statement of Playfair, "that this water contains 206 cubic inches of nitrogen gas per gallon." Muspratt increased the quantity to 504 cubic inches. The author has repeated these determinations, but could only find about 22 cc. of N per litre. The erroneous results of Playfair and Muspratt seem to have been obtained as follows:—The gas which is found over the spring, contains N 98·98 per cent., CO_2 1·02. They estimated the CO_2 in the water and assumed that the same proportion existed between the gases dissolved in the spring as was found in the gases evolved by the water. They completely overlooked the fact of the greater solubility of CO_2 in water.

DR. WALLACE, of Glasgow, has reported to the Clyde Navigation Trustees, on the corrosive action of the water of that river on metals used as sheathing for ships' hulls. The different metals immersed were in plates 14in. long by 3in. broad, and so placed in the water that any chemical action was equal on all sides. The general results are thus stated in the report:—"These lengthened experiments show that, if a sheathed vessel had been moored for twelve months at the east end of Yorkhill Wharf, the percentage of loss on its sheathing, if of copper, would have been only 1·83, and if of yellow metal, 1·02; if in Queen's Dock, the loss would have been 1·62 and 1·28 per cent.; if at the east end of Lancefield Wharf, 1·88 and 1·96 per cent.; if in Kingston Dock, 1·35 and 1·30 per cent.; and if at the wharf at the foot of Brown-street, 2·71 and 2·41 per cent. respectively; while on the east side of the sewer opposite the Custom House the loss would have been considerably less than the last-named, being only 1·66 and 2·28 per cent. respectively."

AT a meeting of the Chemical Society, on the 2nd inst., a paper was read "On the Action of Solvents on Saponified Oils and Waxes," by A. H. Allen and W. Thomson. No satisfactory process at present exists for the analysis of mixtures of hydrocarbons with animal and vegetable fatty matters, although a correct determination is often of considerable practical importance. The process at first adopted by the authors is as follows:—10 grammes of the sample is weighed out into a 5in. evaporating dish, 50 cc. of an 8 per cent. solution of caustic soda in absolute alcohol added, and the whole gently boiled, with stirring, until frothing occurs; 15 cc. of methylated spirit should now be added, and heat applied till the saponified oil is dissolved; 5 grammes of sodium bicarbonate are then gradually added with constant stirring; and, lastly, 50 to 70 grammes of clean ignited sand are stirred in. The whole is then dried for twenty minutes in the water oven. The mixture is transferred to a large test tube having an aperture at the bottom plugged loosely with glass wool. The tube is placed in a Xoxpette's fat extractor—a rather larger size than that usually made—adapted to a small flask, containing 100 cc. of petroleum spirit, boiling below 80 deg.; then the extraction is complete. The petroleum spirit is distilled off, and the dry residual matter weighed. The authors obtained the following percentages of unsaponifiable matter:—Lard, 0·23; olive oil, 0·75; German rape oil, 1·00; cotton-seed oil, 1·64; cod-liver oil, 1·32 and 0·46; sperm oil, 39·14 and 51·31; spermaceti, 40·64; beeswax, 52·38; Carnauba wax, 54·87; Japan wax, 1·14; resin oil, 98·72; mineral lubricating oil, 99·90.

MISCELLANEA.

A MEAT freezing establishment has been erected at Orange, New South Wales, and provision made for the daily slaughter of sixty bullocks and 400 sheep.

ON Wednesday night, the 1st inst., a singular accident occurred at the Leicester Gasworks. In consequence of the heat the iron roof of the retort-house seems to have been injured and weakened by expansion, and late in the evening it fell with a loud crash, not a single portion of the structure remaining.

PROFESSOR LOOMIS appears still to be experimenting in aerial telegraphy—telegraphing without wires—and it is now said that he proposes to establish communication, through the current which he claims is always found at a great altitude, between one of the highest peaks of the Alps, in Switzerland, and a similarly situated station on the Rocky Mountains.

ABOUT three months ago coal was advertised in Melbourne at from 22s. per ton delivered in town, to 29s. per ton delivered in remove suburbs. These prices are locally attributed to the "keen competition among the pit-owners at Newcastle and the shipowners in Sydney and Melbourne." The *Colonies and India* might try to get some of these coal and shipowners over here to London.

THE project for cutting a canal through the Isthmus of Corinth so as to connect the Adriatic and Ægean seas is being energetically taken up, and a concession has been granted to General Tuer, a French geographer. As the Emperor Nero started this job once it is hardly a new one, but Corinth needs it as much now for its prosperity as it did in days so long gone by, when it was abandoned and ineffectual forts erected in its line. It is surprising that this canal has never been cut.

THE firemen of Hull are on strike. About 140 have ceased work, and the number is increasing as steamers arrive. The present rate of wages is 25s. per week for weekly ships, and about £3 5s. per month for steamers running longer passages. The men say that, now trade has revived, they are entitled to their old rate of wages —28s. in weekly boats, and £4 a month in other vessels, the rates having been reduced during the late depression. The Hull ships' carpenters returned to work last week at the old terms, after three and a-half weeks strike.

COMMENTING on the yearly gathering of the German beetroot sugar industry, the *Cologne Gazette* remarks, that Germany, which last year with 409,000 tons ran Austria with its 460,000 tons very close, is likely this year with 530,000 tons to stand first in beetroot sugar countries. This development, moreover, has not been nursed by bounties, for the drawback on exportation, based on the calculation that 11·75 centners of best produce one centner of sugar is very near the mark, the last nine years' average having been 11·60. Home consumption, however, is rather declining than increasing, and the *Cologne Gazette* suggests a reduction of duty as in England and France to stimulate the consumption.

THE revenue of the Canadian canals for the year 1880 amounted to 336,296·74 dols., an increase of 175,173 dols. over the previous years, the revenue of the Welland Canal being 147,584 dols., that of the St. Lawrence Canals being 99,562 dols., and all the rest under 20,000 dols. The number of vessels passing through the several canals during the past season was as follows:—Welland Canal, 4104; St. Lawrence Canals, 11,340; Chambly Canal, 3296; Burlington Bay Canal, 989; Ottawa River Canal, 5202; Rideau Canel, 2682; St. Peter's Canal, 153; Newcastle District Canals, 8; making a total of 25,774. Of these 21,387 were Canadian vessels, and 4387 United States.

THE first sod of the new storage reservoir at Thustoke was cut on Saturday by Alderman Avery, the chairman of the Water Committee of the Birmingham Corporation. The reservoir will cover an area of ninety acres, and will have a storage capacity of 400,000,000 gallons. There will be a smaller reservoir capable of holding 20,000,000 gallons, into which the water from the river Bourne will flow, so that any solid impurities may subside before it passes into the larger structure. The cost of the reservoirs will be £78,900, and the engines, boilers, and buildings will bring the amount up to £125,000. The ceremony of cutting the first sod was followed by a luncheon, at which the Mayor presided, and presented Alderman Avery with a richly-chased jug and a pair of goblets.

SPEAKING of the steam engine indicator, the *American Machinist* remarks that:—"It seems rather ridiculous to consider a string as a connection to an instrument otherwise so delicately constructed. The rotary reciprocation needed for the paper cylinder ought to be accomplished by means of some positive movement attached to some positive detail of the engine which is accessible for the purpose by suitable connections." "A new indicator has been invented in Norway by which the ordinary motions are reversed. The card is stretched upon the quadrant of a cylinder, which receives the reciprocating motion from the steam in the cylinder, and the pencil is attached to mechanism connected with the piston rod. The pencil can be moved sideways, so that a continuous number of diagrams can be taken without moving the card. It is connected in the usual way with the steam cylinder."

FOUR years ago the owners of land in Somersetshire obtained a private Act of Parliament enabling them to improve their lands, and deal with the floods which have every year devastated the richest portion of their lands. Since then a body of thirty Commissioners have been engaged in establishing the machinery of the Act. They recently finished their labours. They have surveyed in all 123,000 acres. They have established sixteen Boards to carry out the cleansing, repair, and maintenance of the various drains and watercourses. They have established a Central Board to harmonise and control the whole area, to carry out all the arterial drainage of the county, and to adjust any differences between the Boards. The thirty Commissioners having accomplished their work are now retiring from office, and the elected Boards succeeded on the 1st inst. All this has been accomplished without any Government help of any sort. The cost has been over some lands 2s. 1d., and on others 1s. 7d.

CORN is often used as fuel in some parts of the States, and is much cheaper than other fuels. It is, moreover, a fuel which can be yearly produced, while each year reduces the coal supply. The *Iowa State Register* looks at the question in a matter-of-fact way. It has tried corn as fuel, and finds that corn in the ear can be burned in stoves made for either soft or hard coal, and is an especially good fuel for cooking stoves. Moreover the cost of growing corn in Iowa is so small that it is as economical to raise corn for fuel on the prairies as it is to import coal or grow wood, certainly off the lines of railway. An acre of corn can be raised for about 6 dols., including the rent of the land. Fifty bushels of corn will weigh 3500 lb., or equal to a ton and three-quarters of soft coal. This, at 15 cents per bushel—which is as much as corn was worth on the farm away from railroads last winter—would be as cheap for fuel as soft coal at 4 dols. per ton.

AN American contemporary remarks that castings seem to manifest peculiar freaks and irregularities for which it is difficult to find the cause. "They occur sometimes in the sand, sometimes in the venting, and often with wrong facings. For instance, the quality of facing sand must always be graded, according to the castings to be made, heavy or light, deep or shallow in the mould. Again, inferior coal in facing sand is detrimental. Possibly the dealer in foundry facings has been grinding inferior stock, instead of getting a carbon in the form of coal dust to stand the iron pouring against the mould. There has been dirt and slate ground in with the coal. This is a cause of scabby castings, together with too fine a sand or a sand without body, which all moulders dread except for very light work. If moulders could only have good sands, good irons and good facings, and the same stock supplied each time, there would be little need of complaint; but the geology of our country is not such as to admit of digging moulding sand at every back door, when moulding sand costs from 40 dols. to 50 dols. a car delivered in a foundry yard."

MESSRS. NAGEL AND KAEMP'S EXHIBITION MILL AND MACHINERY.

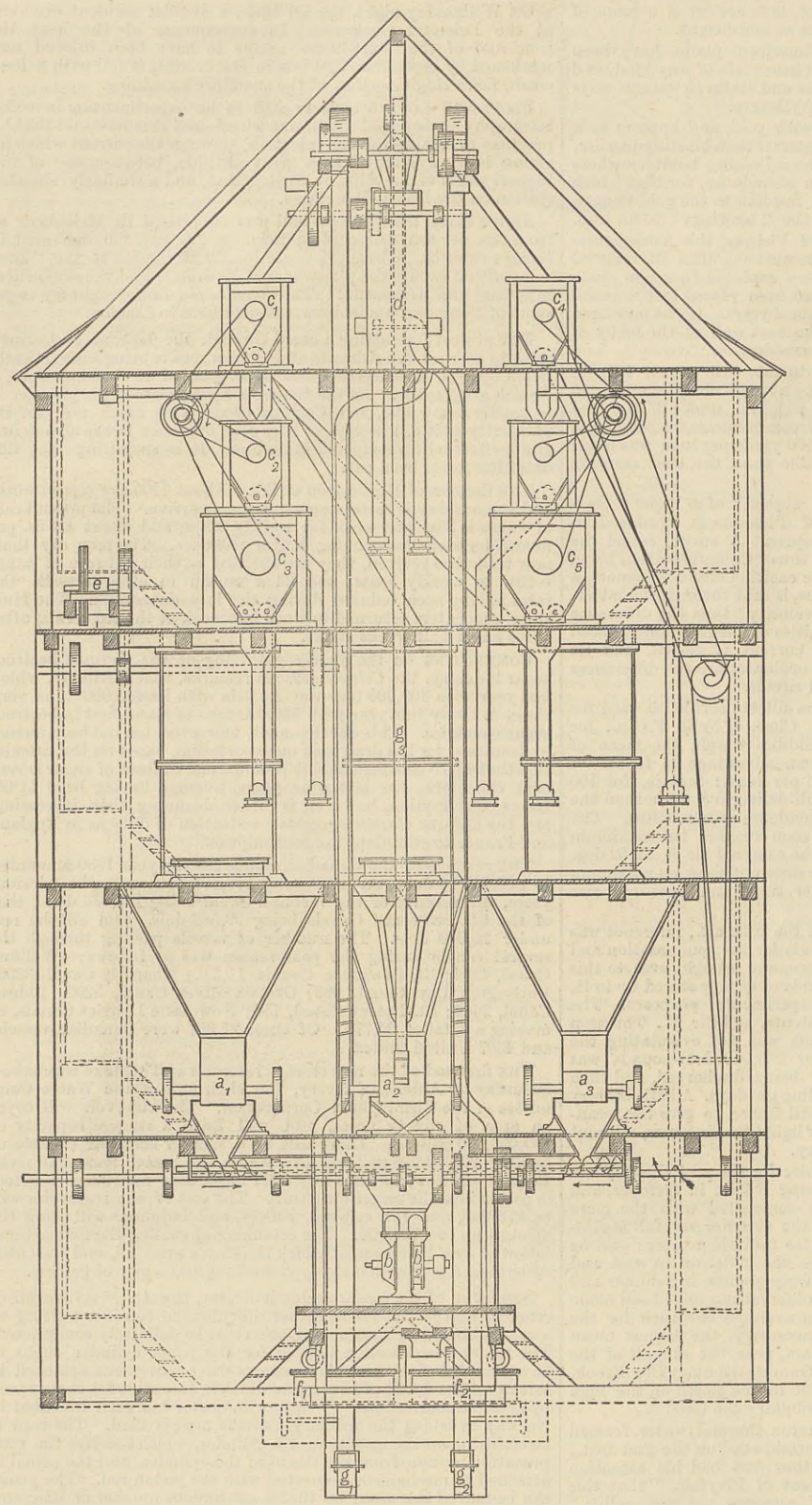


Fig. 44.—Longitudinal Vertical Section.

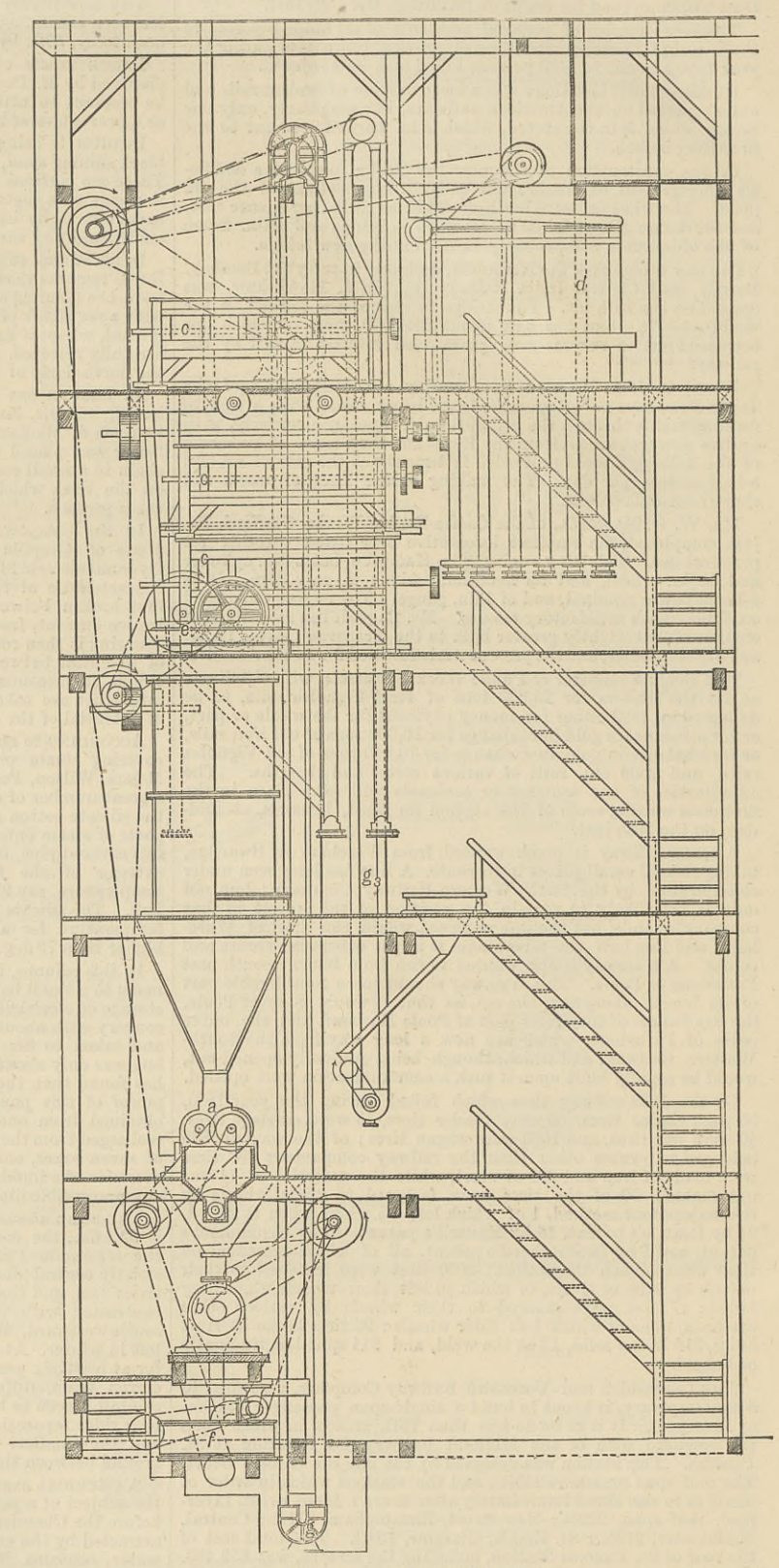


Fig. 45.—Transverse Vertical Section.

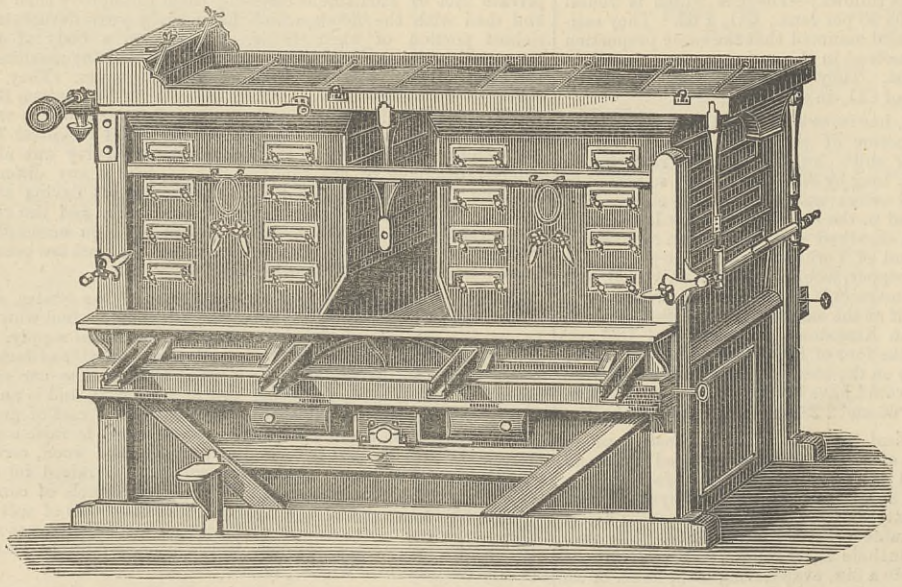


Fig. 49.

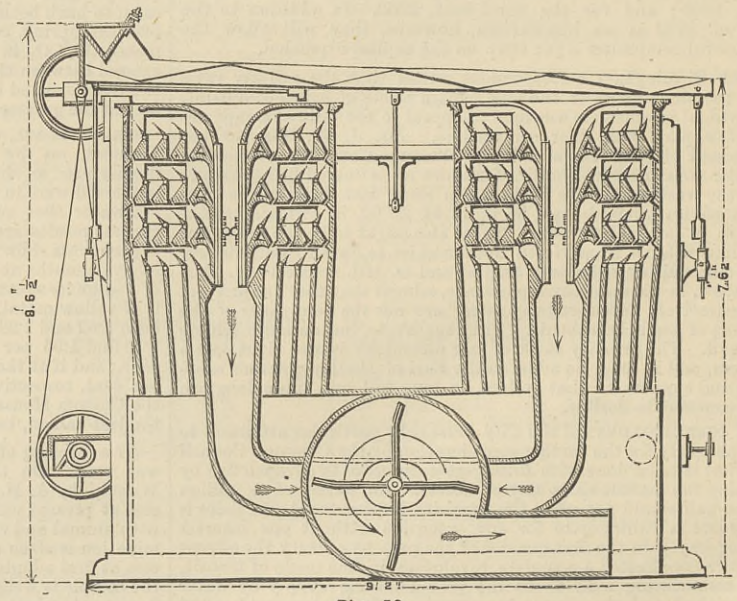


Fig. 50.

THE MILLING EXHIBITION.

No. V.

At the lower end of the Hall was a very handsome timber building containing the plant adopted by Messrs. Nagel and Kaemp, of Hamburgh, for whom Messrs. Sanderson and Gillespie, Mark-lane, are agents. As a structure this building was decidedly the best in the exhibition, the others being of a temporary nature and not intended to be noticed, save as platforms whereon to place machinery. The building was very ornamental in appearance, and of the Swiss chalet type. The building having five floors, is shown in longitudinal and transverse sections in Figs. 44 and 45 respectively. On the lower floor was a dismembrator, and beneath it the filters f; on the first floor the smooth crushing rolls are placed; on the second floor the spouts for sacking the flour and offals, and the store hoppers for wheat; on the third floor the dressing machines; on the fourth the scalping reels, purifiers, and stive-room. The centrifugals are at c and c_4, the dressing machines, c_3 and c_5, elevators are marked g and g_3. The wheat crushed by the rollers is passed into the dismembrator, thence into the filter, and next elevated to the centrifugal; here the heavy bran is separated and passed directly to the rolls a_2 and a_3 to be flattened. After crushing the bran is passed into the other side of the dismembrator, b_2, thence to the other filter, f_1; it is then elevated to another centrifugal and dressed. This process of rolling the wheat and bran is carried on simultaneously, and the finished products sacked. The semolina and middlings are purified and collected until the rolling of the wheat and bran is finished, then the machines just used are again brought into action for reducing the middlings and semolina to flour. Samples from a mill where this system is in operation were exhibited. The machinery is of very high class and workmanship.

The crushing rolls, Fig. 46, are well worth noticing. One roll runs in bearings fixed to the frame. This roll is driven by a belt at a speed of 250 revolutions per minute. The other roll is carried in a massive frame centred on both sides of the machine. By means of a hand-

MESSRS. NAGEL AND KAEMP'S MILLING MACHINERY.

Fig. 46.

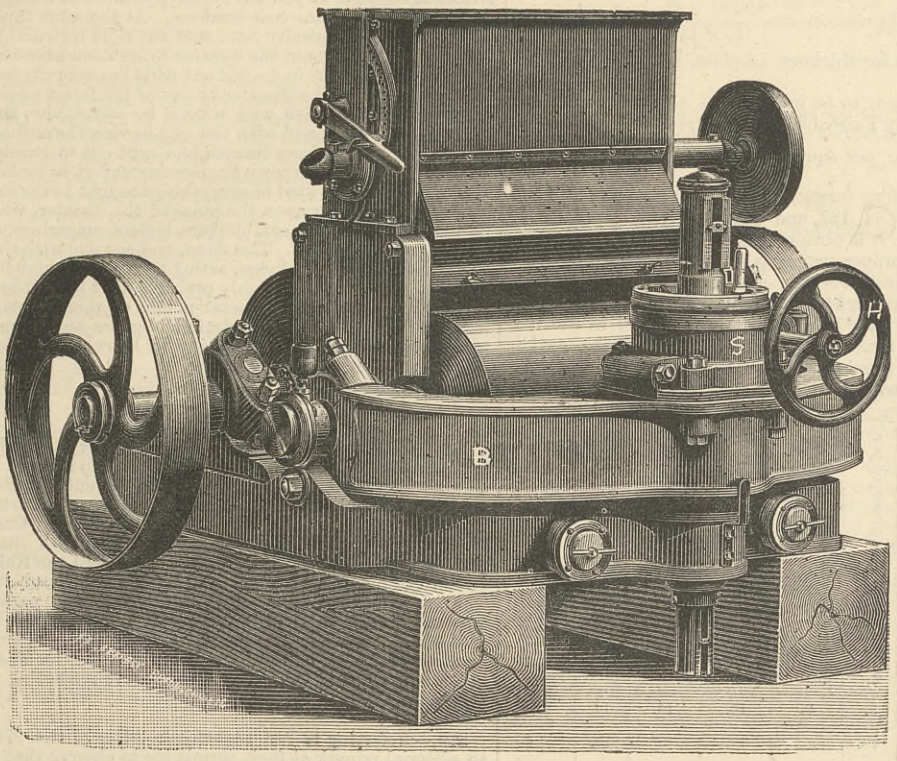


Fig. 47.

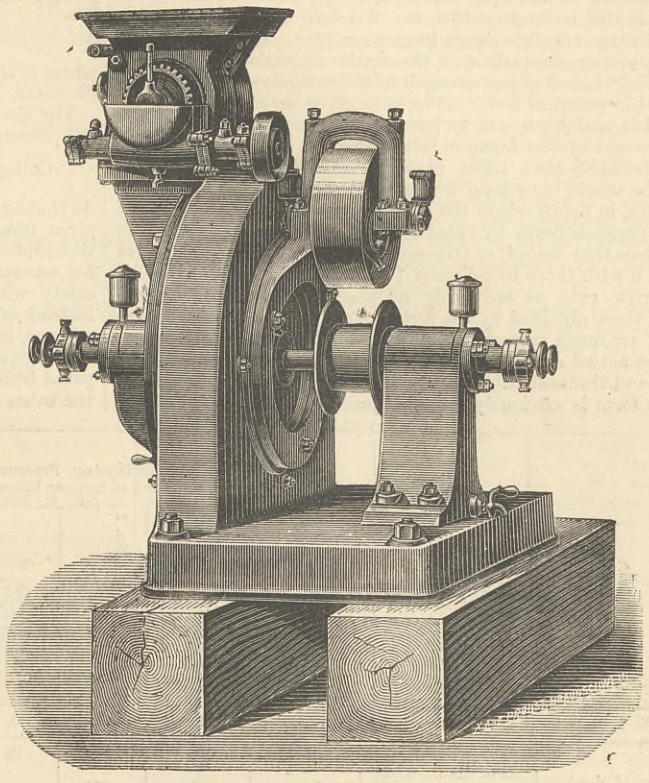
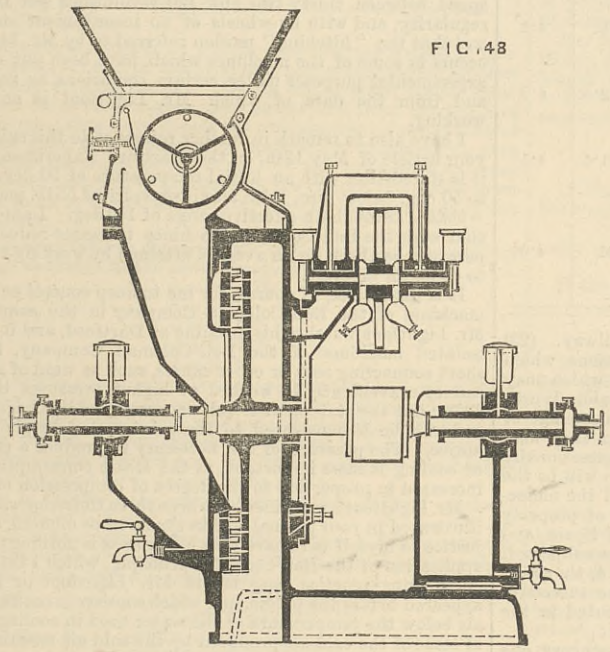


FIG. 48



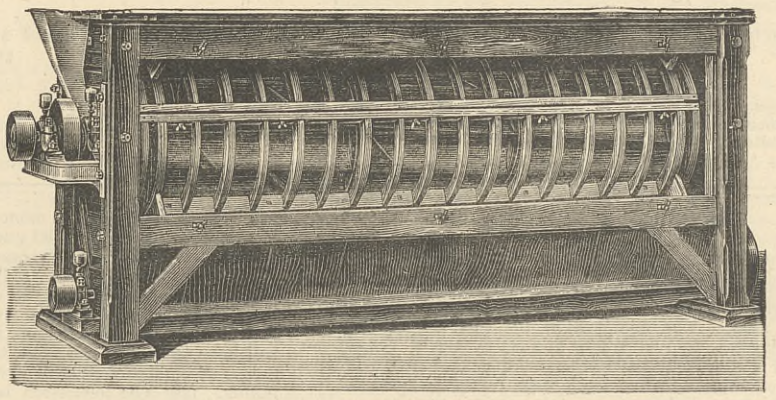


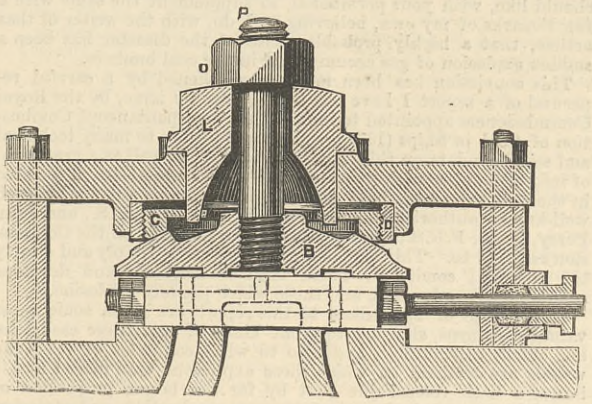
Fig. 48a.

wheel H, and worm gearing acting on a screw contained in the box shown, the curved frame B is raised, and so causes the front roll to come in contact with the driven roll. A spring is provided in the box S to give a slight elasticity to the pressure, and an index shows the amount of pressure. A feature of this machine is that one roll only is driven, the other is caused to revolve by being forced into contact with the driven roll. This ensures both running at the same surface speed, and gives a purely bruising action to the wheat. Notwithstanding the high speed, these rolls run with great steadiness—due, no doubt, to good workmanship and the massiveness of the framing.

After passing through the rolls, the crushed wheat falls into the dismembrator below. A single machine is shown in Figs. 47 and 48—that exhibited was double. This machine is very similar to the well-known Carr's disintegrator, and consists essentially of two discs, studded with steel pins. One of these discs is fixed; the other revolves at 3000 revolutions per minute. The steady working of this machine was truly remarkable. The bearings are unusually long, and are mounted in a peculiar manner, shown in the section. The casting carrying the "idle" pulley, for tightening the belt, is also a very neat piece of work; and the object of this machine is to detach thoroughly the adhering particles of the crushed wheat, and render it possible to separate the different products by means of the centrifugals. Any moisture which may have been set free in the crushing process is taken away by passing the crushed wheat through a machine below the dismembrator, called a "filter." This machine consists of an exhaust fan drawing air through flannel from the dismembrated products; at intervals the flannel is automatically shaken to detach the adhering flour dust, &c., which would otherwise clog it up. Fig. 48*a* shows one of Messrs. Nagel and Kaemp's patent centrifugals. Their action is much the same as those already described. For separating the semolina the outside cylinders are covered with wire or perforated zinc; for the finer separations, with silk. The castings as on all these machines were particularly good. The purifiers used in this system are Prokopec's patent, manufactured by Messrs. Nagel and Kaemp. Figs. 49 and 50 show one in perspective and by longitudinal section respectively. We give their own description. "By this machine the middlings or semolina are sized into four assortments, owing to the action imparted to the sieve, which is coated with the selected numbers of silk gauze. These assortments are guided to the compartments in the body of the machine intended for their treatment by inclined boards, where, by the action of the exhaust and the specific gravity of the particles, each assortment is again subdivided into four distinct separations, which are, however, usually re-united after purification, so as to form four or eight assortments only. The arrangement of the machine is such that each particle of the sixteen streams of middlings is subjected to the exhaust air four times; the purification is consequently perfect." A very ingenious and simple hoist is also exhibited, driven by frictional gearing, and provided with a safety catch. Messrs. Nagel and Kaemp's machinery was driven by one of Messrs. Robey and Co.'s engines.

JOHNSON'S BALANCED SLIDE VALVE.

A BALANCE cover for relieving a slide valve from pressure should be susceptible of immediate adjustment to the back of the valve, and of being held absolutely rigid when adjusted. The arrangement illustrated by the engraving herewith, which we reproduce from the *American Machinist*, it is claimed, meets



all the requirements. The balance cover B is pressed against the valve by the fine-threaded screw ring C, working in the nut D, the nut being a thin brass ring fitting a recess in the steam chest cover, and held from turning therein. The edge of C is dished, or made concave, to fit the portion of a sphere upon B, against which it presses, forming a ball-and-socket joint therewith, to insure perfect seating of the faces when brought together. The block L is for turning the ring C, the outer end being formed for a wrench, while the other end extends through the steam chest cover, and has prongs or projections, fitting openings in the flange of C. The bolt P and nut O are for securing the parts when adjusted, the nut being dished to fit against L, which is turned to a common centre with the spherical portion of the balance cover. The adjustment is made with the throttle open and steam pressure on, the engine being placed upon its centre, and the excentric rod disconnected, so as to move the valve by hand to ascertain when the valve is in balance, the manner and operation of doing which will be clearly understood from the construction. The inventor is Mr. William Johnson, Lambertville, N.J., United States.

THE STEPHENSON CENTENARY.—We have received one of the first impressions of a Stephenson memorial medal, executed and struck by Mr. Thomas P. Chapman, Buckingham Palace-road. The medal has on one side a very fair likeness of Stephenson, and on the obverse a view of "Locomotion No. 1," the first engine which ever drew a passenger train on a railway. The medal has been struck from very good dies.

KING'S COLLEGE ENGINEERING SOCIETY.—At a meeting of this society, held on Friday, May 27th, a paper was read by Mr. E. K. Burstal, M.I.C.E., entitled, "Some Notes on the Construction and Management of Waterworks." The author spoke of the extensive works executed by the ancients, and of the comparatively little progress made to afford a proper supply to towns, until quite recent years. In continuing the subject, the various sources of supply, and the relative cost of obtaining water from them was dwelt upon. A short description of the principal duties connected with the management of large waterworks followed, and the paper concluded with some remarks upon the transfer of undertakings from companies to local authorities, which the author considered was, on the whole, decidedly undesirable, urging some strong fact in support of his view.

CONVERSAZIONE OF THE INSTITUTION OF CIVIL ENGINEERS.—The president of the Institution of Civil Engineers gave a *conversazione* on Friday evening last in the South Kensington Museum and galleries. About 2000 persons were present, including a large number of distinguished guests of the president, by whom and Mrs. Abernethy the company was received. Besides the very numerous attractions of the museum and galleries, the entrance to the department in which the reception took place was most tastefully decorated with plants and flowers, and a celebrated Hungarian Band gave a selection of music during the evening, which was most attentively listened to. The attractions of the evening were, of course, chiefly in the gathering as a *conversazione*, but every possible arrangement for the refreshment and comfort of the company was made, and a very pleasant evening was spent by everyone present.

THE STRENGTH OF FLUES.

THE following table is taken from a report to the Marine Department of the Board of Trade, prepared by Mr. Richards, on the testing of two main boilers, a donkey boiler and a superheater of the steamship Pharos. We have referred at some length to this valuable report in another page. The table, it will be seen, gives a comparison of the results of various systems of calculating the collapsing strength of boiler flues, with the results obtained in practical tests. The rule given in column 7 is Mr. Richards's, and appears to be most consistent with facts.

In the case of the furnace tube tested at Leeds the collapse was believed to have taken place at a lower pressure than it otherwise would have done, owing to the presence of a bulge of about ¼in. in depth where the collapse began. This may account for the pressure borne by this tube being proportionally so much lower than that tested at Greenock. Comparing the figures in column 9 with those in columns 10 and 11, we see that whilst Fairbairn's rule as ordinarily adopted gives very inaccurate results, those obtained by the formulæ at the heads of columns 6 and 7 are much more nearly accurate. The greatest divergence from the actual results obtained by experiment occurs with the largest and thinnest tubes in which a slight deviation from the circular form is obviously most prejudicial. As the calculated pressures are in all cases but one in excess of the actual, the constants if further modified would evidently be reduced.

A formula used by some engineers for ascertaining the working pressure to be allowed for the furnaces of marine boilers is as follows :—

$$\text{Working pressure} = \frac{89600 \times t^2}{L \times D}$$

where t, L and D stand for thickness of plate, length of flue, and diameter.

The above would appear to be intended to allow one-ninth of the pressure obtained by Fairbairn's formula :—

$$\text{Collapsing pressure per square inch} = \frac{806{,}300 + t^2}{L \times D}.$$

As that rule with the five furnace tubes in the tabulated form gives results 235, 162, 64, 127, and 142 per cent. in excess of those actually obtained, it is obvious that it is an unreliable guide for ascertaining the proper working pressure. The factor of safety with the working pressure obtained by the above rule, instead of being 9, as might appear to be the case to some persons, is respectively only 2·6, 3·4, 5·4, 4·0, and 3·7 in the five cases given in the table. The rule, as might be anticipated from the results previously given, is most inaccurate with the tubes constructed with lap joints.

—	Dimensions of Furnace tubes		Description of longitudinal Joints.	Calculated collapsing Pressure per square inch of furnace tubes by				Actual collapsing pressure per sq. inch.	Calculated pressure in columns 6 or 7 greater or less than actual collapsing pressure.	Calculated pressure by Fairbairn's rule, column 4, greater or less than actual collapsing pressure.	Calculated pressure by Fairbairn's rule, column 5, greater or less than actual collapsing pressure.	Working pressure allowed by Board of Trade Rule.	Factor of safety with working pressure by Board of Trade Rule.
				Fairbairn's Rule No. 1. $\frac{806{,}300 \times t^{2\cdot19}}{L \times D}$	Fairbairn's Rule No. 2 $\frac{806{,}300 \times t^2}{L \times D}$	$\frac{465{,}314 \times t^2}{L \times D}$	Rule for lap-jointed tubes. $\frac{322{,}462 \times t^2}{L \times D}$						
1.	2.		3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
		ft. in.		lb.	lb.	lb.	lb.	lb.				lb.	
Fire-box of donkey boiler, S.S. Pharos	Mean diam Length Thickness	3 8⅜ 3 2½ 0 0 11/32	Lap.	545	670	—	268	200	34 °/₀ greater.	172 °/₀ greater.	235 °/₀ greater.	44	4·5
Furnace of main boiler, S.S. Pharos	Diameter Length Thickness	3 1 9 0 0 0 17/32	Lap.	605	683	—	273	260	5 °/₀ greater.	132 °/₀ greater.	162 °/₀ greater.	61	4·2
Furnace tube tested at Greenock	Diameter Length Thickness	3 2 7 2 0 0½	Welded.	648	740	427	—	450	5 °/₀ less	44 °/₀ greater.	64 °/₀ greater.	72·5	6·2
Furnace tube tested at Leeds	Diameter Length Thickness	3 2 7 0 0 0⅜	Welded.	351	426	246	—	187·5	31 °/₀ greater.	87 °/₀ greater.	127 °/₀ greater.	41·6	4·5
Furnace tube tested by the Engineer-in-Chief, United States Navy	Diameter Length Two Lengths of 3 feet joined by flanges Thickness	4 6 6 0 0 0¼	Butt.	239	311	179	—	128	39 °/₀ greater.	86 °/₀ greater.	142 °/₀ greater.	26	4·9

CONTRACTS OPEN.

RAILWAY FROM ZAFRA TO HUELVA, SPAIN.

TENDERS for the concession for the construction and working of this railway will be opened and adjudicated upon at Madrid on the 12th August next. The competition for Spanish railways is usually very limited, the restrictions and conditions of the concession being of a deterrent nature to outsiders; but we believe that large profits are in almost all cases realised by the concessionaires. The estimated maximum total capital required for this undertaking, allowing ample margin for contractor's profit, is two millions sterling. A deposit of £20,000 must be made with each tender.

The adjudication will be made by a sort of Dutch auction, the competition turning chiefly on the willingness of the parties tendering to accept from the Spanish Government a subvention of less amount than the sum named in condition No. 15 of the concession, and then upon reductions in the fares and rates to be charged, and upon the number of years for which the concession is to last. The promoter of this undertaking—Mr. Sundheim—will have the right of claiming the concession on the terms of the lowest tender that may be made, and should he not exercise his option, the successful competitor will have to reimburse him a sum of about £10,000, being the taxed value of the plans, surveys, and preliminary expenses incurred.

Subjoined are the chief conditions of the concession :—(1) The railway must be completed and at work in six years from the acceptance of the tender. (2) No variation of the approved plans may be made, except in accordance with the laws. (3) There are to be stations at Zafra, Medina, Valencia del Ventoso, Fregenal, Cumbresmayores, La Nava, Cortegana, Valdeanusa, at the junction with the branch line to the South-Eastern of Portugal Railway, La Zarza, Calañasmines, Gibraleon, and Huelva. (4) Within a fortnight from allotment of the concession, the concessionnaire must deposit the sum of one hundred thousand pounds as security. (5) The works must be commenced in three months from acceptance of tenders. (6) The rolling-stock is to consist at least of the following :—24 locomotives, of which 10 to be six-wheeled coupled; 90 passenger carriages; 15 luggage vans with brakes; 140 goods trucks, of which 20 with brakes; 120 mineral wagons, of which 10 with brakes; 35 cattle-trucks; 105 platform trucks, of which 15 with brakes. (7) First and second-class carriages to be cushioned. (8) The postal service is to be carried on free of charge. (9) At least two wires of the telegraph must be kept and maintained for the Government service. (10) Prisoners and convicts must be carried free, in vans of a class to be specified. (11) The railway may not be opened for working until inspected by the proper Government official. (12) No locomotive or carriage may be used until passed by the Government inspector. (13) On completion of the works a detailed plan must be made under official inspection and deposited with the Department of Public Works. (14) The railway must be worked in accordance with the subjoined tariff of fares and rates, which tariff is subject to revision every five years after opening of the railway. (15) This railway will receive a subvention of £440,000 sterling payable by equal monthly instalments during six years from the commencement of the works, and subject to their being duly proceeded with. Exemption from customs duties is also granted on all plant and rolling stock required for construction of the railway and during the first ten years of its working. (16) The concession will be voidable in case of non-fulfilment of its conditions by the concessionaire, or in the event of his bankruptcy, or if in three years from the date of adjudication of the concession there should not have been expended in works or material a sum equal to one-fourth of the whole estimated cost thereof; excepting always cases of *force majeure* duly provable. (17) The concessionaire must provide for the expenses of Government inspection. (18) The concessionaire may transfer his rights, subject to official approval. (19) During the last ten years of the concession the Government may apply the profits of the working to the maintenance of the railway should the concessionaire fail to comply with this duty. (20) At expiry of the concession the railway must be made over to the State in accordance with the law on the subject. (21) The State may at any time acquire the undertaking in the public interest, on a valuation of the profits thereof. (22) This concession is not to constitute a monopoly in favour of this railway. (23) The railway to be worked under bye-laws and regulations, which must be submitted to Government approval in matters which may affect the public interest. (24) The Department of Public Works will supervise and inspect as ordered by law the management of the railway, and its officials must carry out the orders they may receive from the Government inspectors. (25) The concessionaire will have to appoint an agent to reside in Madrid, who will be the means of communication between the Government and the undertaking. (26) The concession is subject to the rights of property and of third parties, as settled by the general laws of Spain, and is subject also to the tariff of maximum fares and rates subjoined. (27) After deposit of the sum named in condition No. 4, the grant of the concession will be duly made in favour of the successful competitor, with whom a formal contract will be executed in the terms of the conditions here specified.

Tariff of maximum rates and fares :—First-class passengers, one penny halfpenny per mile; second, one penny farthing; third, three farthings. Perishable goods by passenger trains, eightpence per ton per mile.

Merchandise :—First-class—Manufactured and fine goods, threepence halfpenny per ton per mile. Second-class—Raw goods, as sugar, indigo, copper, dye-woods, washed wool; also cotton-thread, metal work, cheese, homespun cloth, tallow, tobacco, &c., twopence three farthings per ton per mile. Third-class—Minerals, coal, coke, iron, steel, lead, brandy, wine, oil, cork, stone, bricks, tiles, lime, slates, timber, cotton, unwashed wool, oranges, flour, bran, &c., twopence farthing per ton per mile. Fourth-class—Corn. charcoal, and firewood, twopence per ton per mile. On goods carried less than ninety miles, a terminal charge may also be levied, varying from sevenpence to one shilling per ton.

A few further particulars may be obtained by application to Messrs. Yglesias and Son, 9, King's Arms-yard, E.C., London, and complete plans and specifications may be inspected at the porter's lodge of the Ministry of Public Works at Madrid.

LETTERS TO THE EDITOR.

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

THE LOSS OF H.M.S. DOTEREL.

SIR,—Having read with much interest the able article on the destruction of the above vessel in your issue of the 3rd inst., I should like, with your permission, to supplement the same with a few remarks of my own, believing as I do, with the writer of that article, that a highly probable cause of the disaster has been a sudden explosion of gas accumulated in the coal bunkers.

This conviction has been much strengthened by a careful perusal of a report I have had by me since its issue, by the Royal Commissioners appointed to inquire into the Spontaneous Combustion of Coal in Ships (1876), which, in addition to many technical and scientific data on this important subject, as well as a great deal of information from ship-owners and others practically interested in the coal export trade of this country, contains a paper by such well-known authorities as Professor F. A. Abel, F.R.S., and John Percy, M.D., F.R.S., both of whom were included on the Commission referred to. This valuable paper describes simply and clearly the chemical conditions which tend to originate and develope spontaneous combustion, and those which produce explosion.

In the form of appendices to this report, are given some most valuable returns, showing to what kinds of coal these casualties are chiefly attributable, and also to what countries or ports the vessels are destined on which these explosions take place; and it is not a little remarkable that by far the larger proportion of casualties to vessels from spontaneous combustion and explosion take place to vessels carrying coals to South America, the chief reason or explanation of this being, that the kind of coal mostly shipped to South America is from Wales, and being of a fiery or gaseous nature, is dangerous to carry on long voyages.

Having myself been engaged some few years in South America on engineering duties, I can, to some extent, confirm from my own experience the accuracy of these statistics, having on more than one occasion seen several vessels at one time, scuttled and sunk in the harbour of Monte Video from this very cause, viz., spontaneous combustion, the ships being scuttled to save them from fire and afterwards raised, their cargoes being first brought to the surface by the aid of divers, and as H.M.S. Doterel took in her last supply of coal at Monte Video before leaving for the Pacific, there is much reason to suppose, as you have clearly pointed out, that the seat of danger has been in the coal bunkers. At the same time it is to be hoped that the Admiralty have sent out rigid instructions to those engaged on the scene of the disaster to leave no stone unturned in the attempt to prove or to find out what has actually been the real cause of so dreadful a disaster to one of the latest additions to our navy, and accompanied with what is far worse, viz., the loss of so many brave hearts; and with this end in view the authorities at the Admiralty, I trust, have secured and sent out to Sandy Point the services of some well-known engineering expert to make a thorough examination on the spot of everything brought to the surface which can in any way bear upon the cause of the disaster, whether it be in connection with the coal bunkers, boilers, magazines, or any other possible seat of danger. This done, and coupled with the services of one or two intelligent divers, acting under the instructions of the expert referred to, it is highly probable that by-and-bye, not only the Admiralty, but the general public of this country would be relieved from a very serious strain and grave apprehension in connection with this painful subject by knowing to what cause its origin has unfortunately been due. JOHN HAYES.

27, Leadenhall-street, E.C., June 7th.

COLD AIR MACHINES.

SIR,—The great P. and O. steamer, Kaiser E. Hind, arrived in Southampton from India last week. This ship is fitted with a Bell-Coleman machine. Mr. Lightfoot is apparently unable to supply any practical data as yet, owing to the recent construction of his machinery, concerning its performance at sea. Mr. Coleman is not in this predicament. If he will kindly publish the log of the performance of the cold air machine on board the Kaiser E. Hind on her run home, he would no doubt set many doubtful points at rest. If he is unable or unwilling to do this, perhaps he will answer the following questions :—(1) What was the temperature of the meat room on the voyage? (2) Had the cold air machine to be stopped for repairs? If so, how often and for what time? If not, a statement to that effect would prove reassuring to

Liverpool, June 7th. ZERO.

SIR,—Referring to Mr. Lightfoot's letter of the 27th May, and an editorial remark at foot, permit me to observe that I had not in my mind maximum velocity when I wrote my letter, for I can show machines of the Bell-Coleman Company which do run at any speed between thirty-two and 120 revolutions per minute, with regularity, and with fly-wheels of no inconvenient size whatever, and that the "hitching" motion referred to by Mr. Lightfoot only occurs in some of the machines which have been put on board for experimental purposes under certain conditions as regards space, and from the data of which Mr. Lightfoot is now evidently working.

I have also to remark in further reference to this subject, that in your article of May 13th, on the Dartford Experimental Machine, it is stated that with an initial temperature of 90 deg. it cools air to 50 deg. below zero, with an air pressure of 55 lb. per square inch —that is through an effective range of 140 deg. I am able to state that with the Bell-Coleman machines the same reduction of temperature has been on an average attained by working at from 40 lb. to 45 lb. air pressure.

It is impossible, of course, for me to keep control over the many machines of the Bell-Coleman Company in the same manner as Mr. Lightfoot watches his machine at Dartford, and it may be that isolated machines of the Bell-Coleman Company, from having short connecting rods or other causes, such as want of steam power, cannot conveniently be worked at higher pressures than 30 lb. to 40 lb.; but the statement is quite accurate for the majority of them and can be demonstrated to those interested by giving sufficient notice. The pressure of air necessary to produce a given amount of cooling is most important, as the steam consumption is at least increased in proportion to the degree of compression of the air.

Mr. Lightfoot's machines have been three times described and twice illustrated in your journal within the last few months, and it is only justice to myself to remark that his process is nothing more than an application of the Bell-Coleman principle, which I introduced into engineering practice long before Mr. Lightfoot or Messrs. Hall appeared before the public, and which consists in cooling compressed air below the temperature of the water used in cooling it by means of some of the cold air produced by the cold air machine itself, and this for the special purpose of liquefying and removing aqueous vapour. Mr. Lightfoot will doubtless reply to this that the Bell-Coleman apparatus does not carry out the principle so well in practice as the double expansion with the water depositor between, to which I reply that for all practical purposes a single expansion is sufficient, and that if a double expansion is adopted it has to be paid for, both in prime cost and loss of efficiency in reduction of terminal temperature, and that as regards space occupied on shipboard, I find from some recent measurements that Mr. Lightfoot's machine with its water depositor is likely to occupy about the same floor space as the Bell-Coleman machine with its drying pipes.

As regards special forms of valves, &c., proposed by Mr. Lightfoot, no doubt there may be improvements desirable in this direction which are mere matters of detail, and which I am continually putting into practice myself. I find that Mr. Lightfoot's machine is to be tried at sea, and no doubt he will collect useful information both for himself and me. J. J. COLEMAN.

45, West Nile-street, Glasgow, June 7th.

SAFETY VALVES.

SIR,—I am sorry to trouble you again on this subject, but I am obliged to say a few more words, at the invitation of "J. H. W."—an invitation which I am quite sure he would not have extended had he read with a little more care my last letter. He seems to be very much pleased to find that during one year of my sea-going experience I sailed with some of Adams's safety valves, which gave me perfect satisfaction; and fancying that he has caught me tripping, he propounds this query, "If they worked all right in one boat, why not in another?" I have served for something over four years with Adams's safety valves; and as only twelve months of that time was spent in peace, as far as the safety valves are concerned, I may be allowed very pertinently to ask, not how did they work badly during three-fourths of my experience of them; but rather, by what fortunate accident did they work well during considerably the least period of my experience of them? The only answer I can make myself to this is, that the workmanship in this case was superior to that of the others. In my last letter I stated as my opinion that unless the angles of the valve and the depth of the cup were exactly what they should be, the thing would not work properly, and as this is uncontradicted I repeat it to "J. H. W." I see nothing incongruous in my acknowledging that the valves in the one case which I have cited worked well; nor do I think that by making the remark I lay myself open to a charge of self-contradiction; and if "J. H. W." cannot understand this, it really is not my fault. He winds up his last letter by challenging me to name a valve which is superior to Adams's. Now, Sir, my contention in my letters has not been the inferiority of Adams's valve to others, but rather to disabuse many people who know nothing practically of this valve of the prevailing idea that it is perfection's self. My experience, unfortunately, has been almost exclusively confined to this particular valve; and I am unwilling to mention any other valve as being its superior without having had practical experience with it, though at the same time I am quite of opinion that there are better valves in the market than it. My own absolute experience as a sea-going engineer, be it understood, only embraces one other valve —that made by Messrs. J. Jones and Sons, St. George's Works, Liverpool, and supplied to a few of Messrs. Lamport and Holt's steamers. I sailed to various ports in South America and back to

England with this valve, and during that time I never had the slightest trouble with it. The gentleman who wrote an excellent letter, under the *nom de plume* of "Billy Fairplay," may better answer this challenge of "J. H. W.'s," as he has safety valves by four different makers, of which the one by Adams seems to be the most inferior.

CHIEF ENGINEER.

June 7th.

A FEW DATA ABOUT NAVAL AND COAST DEFENCE GUNS.

SIR,—It is of importance, in choosing conditions for trials of guns, or deciding upon a new gun suitable for a given purpose, to have rules, by the aid of which results previously obtained by the trial of one, may with certainty be transferred to guns of a different calibre, and for any given calibre, to find the suitable weight of gun and projectile, its armour piercing power, &c.

Such rules have not before existed, which is clearly shown by the fact that in no paper bearing upon this subject has there ever appeared a critical analysis of the artillery trials, which during the last few years have been conducted on a large scale by Krupp, and to a less extent by Armstrong. There is consequently here a great want of rules, which will make systematic treatment possible, and it was with this in view that I, in the *Militart Tidskrift*, 1879, published a treatise on the "Relative Power of Guns." I attempted in this treatise to show that as well the weight of the projectile as the strains for unit of sectional area should as energy be reduced to a function of the calibre for the comparison and further treatment of the results obtained by different guns, and proposed for such reduction the following formulas:—

Weight of armour piercing projectile $P = a\,k^3$ kilogramme (kg.)

Strain per unit of sectional area ditto $\dfrac{P}{\left(\frac{\pi k^2}{4}\right)} = b\,k$,,

Total energy of ditto $\dfrac{1}{2}\dfrac{P}{g}v^2 = c k^3$ metretons (mt.)

Energy for cm. circumference of do. $\dfrac{\frac{1}{2}\frac{P}{g}\cdot v^2}{\pi k} = d\,k^2$,,

Energy for $c\,m^2$ sectional area of do. $\dfrac{\frac{1}{2}\frac{P}{g}v^2}{\left(\frac{\pi k^2}{4}\right)} = e\,k$,,

Where a, b, c, d, and e are coefficients depending upon the state of the technology of artillery, and are the same for all calibres; k_2 the calibre of the gun in centimetres; P weight of projectile in kilogrammes; v = initial velocity in metre; and g = acceleration of gravity = 9·81 metres.

From the above formulæ it will be seen how the weight of projectiles strains for unit of sectional area and energy should increase in proportion with the calibre. By the aid of these simple equations, rules for a whole system may be deduced from the trials of one single gun; they show clearly the comparative value of different systems of guns, even if there is no opportunity of comparing guns of the same calibre by actual firing. If the guns have different length of bore reckoned as multiples of the calibre, the results must first be reduced to the same length of bore by the equations of the inner ballistic.

The following table is characteristic of the state of the artillery technology as stated in the above-mentioned treatise—

$a = 0{\cdot}01175$
$b = 0{\cdot}015$
$c = 0{\cdot}1497$
$d = 0{\cdot}0477$
$e = 0{\cdot}191$

In a subsequent treatise in the same paper about the end of 1879, I predicted on the basis of some firing trials just completed that the coast defence gun would give a total energy = 0·21 k^3 m. t., an energy per cm. circumference = 0·0668 k^2 m. t., an energy per cm.^{2} sectional area = 0·267 k m. t. The energy of a few heavier guns was calculated for distances up to 4000 m.

In order to illustrate the practical application of the formulæ, I subjoin examples 1, 2, and 3:—

Ex. 1. It is ascertained that for a 24 cm. gun a 160 kg. armour-piercing projectile gives good results. What should be the weight of a 20 cm. and a 30·5 cm. projectile?

$$\text{Thus—}160 = a \times 24^3;\ a = \frac{160}{24^3} = 0{\cdot}01155$$

$$\text{Therefore } P_{20} = 0{\cdot}01155 \times 20^3 = 92{\cdot}5 \text{ kg.}$$
$$P_{30{\cdot}5} = 0{\cdot}01155 \times 30{\cdot}5^3 = 328 \text{ kg.}$$

Ex. 2. A 26 cm. gun has by firing developed an energy per cm. sectional area = 5 m. t. What energy per cm.^{2} sectional area will a 21 cm. and a 40 cm. gun of the same system develope?

$$5 = e \times 26;\ e = \frac{5}{26} = 0{\cdot}1925;$$

therefore energy per cm.^{2} sectional area for

21 cm. gun = 0·1925 × 21 = 4·04 m. t.
40 cm. gun = 0·1925 × 40 = 7·70 m. t.

Ex. 3. A 26 cm. gun with a length of bore = 22 calibres gave a total energy $= \frac{1}{2}\frac{P}{g}v^2 = 2600$ m. t., while a 24 cm. gun with 24 calibre length of bore, gave a total energy = 2420 m. t., which of these two guns has given the comparatively best result? As the 24 cm. gun has a length of bore 2 calibres greater than the 26 cm. gun, the energy 2420 m. t. must first be reduced to a length of bore = 22 calibres. This reduction may be made by using the formulas of either Messrs. Abel and Nobel or Mr. Grass, and is, say, 2200 m. t. In a length of bore = 22 calibres—

$C_{24} \times {\cdot}24^3 = 2200$ m. t., $C_{24} = 0{\cdot}159$
$C_{26} \times {\cdot}26^3 = 2600$ m. t., $C_{26} = 0{\cdot}148$.

The 24 cm. gun has, therefore, given a better result than the 26 cm. in the proportion of 0·159 to 0·148.

The coefficients of energy c, d, and e, increase with the length of bore, reckoned in calibres. The following table shows the values of these coefficients, which may be considered suitable for the calculations used in the construction of modern naval and coast defence guns of different lengths of bore.

Length of bore reckoned in calibres.	The coefficients.		
	c.	d.	e.
20	0·138	0·0439	0·176
21	0·148	0·0471	0·189
22	0·158	0·0503	0·201
23	0·167	0·0532	0·213
24	0·175	0·0557	0·223
25	0·183	0·0582	0·233
26	0·190	0·0605	0·242
27	0·196	0·0625	0·250
28	0·202	0·0643	0·257
29	0·207	0·0658	0·264
30	0·211	0·0671	0·269
31	0·215	0·0684	0·274
32	0·218	0·0694	0·277
33	0·220	0·0700	0·280
34	0·222	0·0706	0·283
35	0·223	0·0710	0·284

Ex. 4. What total energy may be demanded from a 28 cm. gun with a length of bore = 26 calibres? After table is for a 26 calibre length of bore c = 0·190, and the total energy for a 28 cm. gun $= \frac{1}{2}\frac{P}{g}v^2 = 0{\cdot}190 \times 28^3 = 4170$ m. t.

Ex. 5. What energy per cm^2 sectional area may be demanded from a 24 cm. gun with a length of bore = 22 calibres? e, according to the table, is for 22 calibres length of bore = 0·201, and the energy per cm^2 sectional area = 0·201 × 24 = 4·82 m. t.

The weight of guns increased with the total energy required of them. In naval and coast defence guns of Krupp's new system of steel guns the weight may be calculated after the formula

$$V = \frac{\frac{1}{2}\frac{P}{g}v^2}{190 - 1{\cdot}7\,K - 0{\cdot}4\,n},$$

where K = the calibre of the gun in cm., n = length of bore in calibres, $\frac{1}{2}\frac{P}{g}v^2$ = total energy in metre-tons, and V = weight of gun in tons.

This formula may be used up to 30 cm. guns. For greater calibres the following formula should be used:—

$$V = \frac{\frac{1}{2}\frac{P}{g}v^2}{139 - 0{\cdot}4\,n}.$$

Ex. 6. What should be the weight of a 24 cm. steel gun, capable of developing an energy of 2250 m. t.? $2250 = c k^3$, $c = \frac{2250}{24^3} = 0{\cdot}163$. The table shows that to the value of c = 0·163 the length of bore should be 23 calibres, and therefore

$$V = \frac{2250}{190 - 1{\cdot}7 \times 24 - 0{\cdot}4 \times 23} = 16 \text{ tons.}$$

The weight of armour-piercing projectiles increases with the calibre, and length of projectiles in number of calibres, and the weight of projectiles properly designed may be found by the use of the following formula:—

$$P = (0{\cdot}0055\,n - 0{\cdot}0037)\,K^2,$$

where n = length of projectile in calibres, K = calibre of gun in centimetres, P = weight of projectile in kilogs.

Ex. 7. What is the weight of a 26 cm. armour-piercing projectile with a length of 3 calibres? $P = 0{\cdot}0055 \times 3 - 0{\cdot}0037) \times 26^3 = 225$ kilogs.

There exits, as far as I know, no particulars of trials for ascertaining the energy required to pierce wrought iron plates of a given thickness by projectiles of a greater weight than 0·0118 K^3. There are a great many formulæ for the armour-piercing power of projectiles, which give very different results. According to the latest experience of Krupp, the armour-piercing power of the projectile may be found by the following formula:—

$$t = \frac{19{\cdot}1\,A}{\sqrt{v}},$$

where t = the thickness in decimeters of wrought iron plate which the projectile will pierce, when striking perpendicularly, A = energy of projectile per cm.^{2} sectional area in metre-tons, v = velocity at moment of striking in metres.

Ex. 8. What will be the piercing power at the muzzle of a 30 cm. gun with a length of bore = 25 calibres? e for 25 calibres length of bore is, according to the table, = 0·233, and A = 0·233 × 30 = 6·99 m. t. c, according to the table is = 0·183; consequently

$$\frac{1}{2}\frac{P}{g}v^2 = 0{\cdot}183 \times 30^3 = 4940 \text{ m. t.}$$

If the length of the projectile is supposed to be = 2·8 calibres, the weight of same is $P = (0{\cdot}0055 \times 2{\cdot}8 - 0{\cdot}0037)\,30^3 = 316$ kilogs., and $v = \sqrt{\left|\frac{4940 \times 2g}{0{\cdot}316}\right|} = 553$ m.

If the values thus found are used in the formula,

$$t = \frac{19{\cdot}1 \times 6{\cdot}99}{\sqrt{533}} = 5{\cdot}67 \text{ decimeter.}$$

It will probably be superfluous to have more examples, as everyone easily will find out the various combinations in which the equations may be used, and be able to apply them to the proper extent.

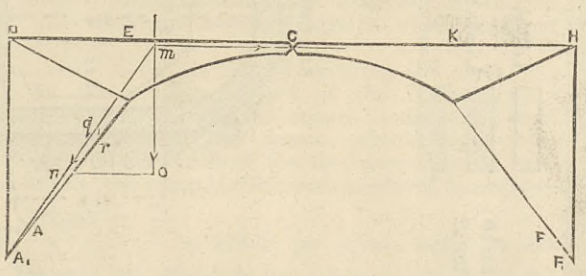
W. B. OLSSON,
Royal Norwegian Artillery.

June 3rd.

PROPOSED BRIDGE OVER THE DOURO.

SIR,—The three questions asked by your correspondent, "A Common Five-eight," can be most easily answered by reference to the accompanying skeleton diagram showing the leading lines of the proposed structure. The letters affixed to this diagram are the same as those upon the frame diagram printed on p. 365 of your issue for the 20th ult., with the addition of A_1, F_1, at the points where the centre lines A B, F G, of the main struts, produced, meet the centre lines of the vertical piers at D H. The vertical and diagonal bracing of the cantilever girders D B C, C G H, is omitted to avoid confusing the diagram.

As stated at the commencement of the article referred to, the structure consists primarily of two great cantilevers A_1 D C, F_1 H C, which, in place of being tied back at D and H, abut against each other at C. The actual springing points of the structure are A, F, at the hinged lower end of the main struts; while A_1 F_1 are imaginary points situated in the interior of the rock abutments, and having no real constructive existence.



By an error, the lines of action of the oblique resultant forces at the abutments, due to loads upon the structure, were taken as passing through the actual points of articulation A, F, instead of through A_1, F_1, the theoretical springing points of the two main cantilevers. Thus, for the case of uniform load over the entire span, the line m A should have been m A_1; similarly for the case of moving load over one-half span, the lines p C F, p A, should have been p C F_1, p A_1, respectively, the position of the point p on the vertical line $p\,m\,o$ being, of course, slightly altered. The effect of this error on the values of the component forces, and on the stresses in the various members of the structures, is only small, but it is necessary to draw attention to its existence.

Your correspondent asks first, "why the lines D E C and C K H should not form the letter V." Inspection of the diagram is sufficient to show that such movement, implying sinking of the point C, would require rotation of D B C, C G H about the points B, G, and consequent upward movements of the points D, H. As stated in the description of the project, means were contemplated for holding down the ends of the girders on the vertical piers at D and H, rendering such upward movement impossible. It is evident, however, that so long as the line of action of the oblique resultant thrust at A_1, as, for instance, m A_1, lies between the two lines A_1 D and A_1 D, the components at A_1 in both these directions will act downwards. Owing to the small ratio of the moving to the fixed load it was found that for no possible case of loading did the resultant thrust at A_1 make a greater angle with the vertical than that made by A_1 B. There was always therefore a certain amount of downward pressure at D and H, and provision against upward movement at these points was not required.

The second and third of "A Common Five-eight's" questions may be answered together. Take, for illustration, the case first examined of uniform fixed load over the span. The resultant of the load on the half span D C acts along the vertical line $m\,o$, and is met at m by C m, the line of action of the thrust at C, which is horizontal from the symmetry of the loads on each half span. The oblique resultant of the forces at m acts along the line m A_1—not m A as previously stated—and is represented in value by $m\,n$, obtained by setting off $m\,o$ = 800 tons, and drawing the horizontal line $o\,n$. Taking $A_1 q = m\,n$, and drawing the vertical line $q\,r$, the components of $m\,n$ in the directions of A_1B, A_1D are $A_1 r$, $q\,r$, respectively. It is evident that $A_1 r$ is less in value than $A_1 q$, when A_1 m makes a less angle with the vertical than A_1B, and that there is thus no analogy between this case and that of two struts inclined at angles of 15 deg. and 20 deg. with the vertical. It is evident, again, that $q\,r$, the vertical component of the oblique resultant at A_1, is transmitted along the line A_1 D to D, and is the upward reaction at that point. From what has been said above it will be seen that it was inaccurate to say that the corresponding vertical component at A represents the reaction in question.

The alterations in the values of the component forces, consequent upon the substitution of A_1 for A, are as follows:—

First, Fixed Load.—Horizontal thrust at C, $n\,o$ = 512 tons instead of 500 tons; vertical reaction at D, $q\,r$ = 112 tons instead of 120 tons. The effect for this case is to increase the stresses given on diagram 1 by 2·4 per cent., and to diminish the tension and compression on D B, D E respectively, due to the reaction at D, by one-fifteenth part. Diagrams 2 and 3 are not affected in any way.

Secondly, Moving Load over One-half Span.—The vertical and horizontal components at C become 45 tons and 60 tons, in place of 40 tons and 62 tons respectively; also, the total upward reaction at D becomes 112 tons + 60 tons = 172 tons in place of 190 tons.

Thirdly, Moving Load between E and K.—The only alteration of any moment for this case is in the value of the vertical component of the oblique resultant at A_1, which becomes 25 tons instead of 27 tons. The total vertical reaction at D is then 112 tons — 25 tons = 87 tons, in place of 93 tons, as stated on p. 366.

The total effect of these alterations upon the stresses as determined is of but small importance,

H. REILLY.

Lonsdale-chambers, Chancery-lane, June 7th.

LAW'S "CIVIL ENGINEERING."

SIR,—In the first place, allow me to thank you for the flattering terms in which you have spoken of the rudimentary work on civil engineering written by me now thirty-three years ago. In the second place, allow me to ask your assistance in calling attention to the manner in which the works of living authors are now frequently mutilated or "improved" without the author's knowledge or sanction. In the present instance the omissions are of the most serious character. The whole chapter on mechanics, comprising the composition and resolution of pressures, the moments of pressures, centre of gravity, laws of uniform and variable motion, motion of bodies about centres, *vis viva* and momentum, motion uniformly accelerated, motion under the influence of gravity, motion down incline planes, friction, and resistance of air and water, has been expunged. This chapter I consider the most important in the whole work. I am constantly referring to it myself, and you, Sir, have on more than one occasion quoted from it with approval; and, as you point out, many other valuable portions have been omitted.

I am further much concerned at the manner in which the whole systematic arrangement of the original work has been destroyed, and at the slovenly way in which the book has been "improved." When the work was first written concrete was never used in construction, but only in foundations or as filling, and the universal practice of engineers was to throw it from a height. Now concrete has become the most important material we possess. To throw it from a height is known to be a mistake, and the mode of its preparation is one of the first things to be learned by the engineering student. Mr. Clark, however, has contented himself with leaving the five lines upon this subject as I wrote them a generation back, and with the false direction to throw it from a height.

Another material of the utmost consequence has come into universal use, namely, Portland cement; but this is not even mentioned. Again, steel has become a most important material for constructive purposes, and its properties have become as well known as those of iron; but, on referring to the tables of the properties of this and other materials, I do not find that any of the blanks, which were unavoidable thirty-three years ago, have been filled in, although the means of doing so now exist.

I will not, however, occupy more of your valuable space by pointing out any other of the many imperfections in the book as it now stands; but I would wish most emphatically to express my entire disapproval of the work in its present form, and to protest against the system of "improving" the works of living authors without their knowledge and sanction; and also against the substitution of the scissors and paste-brush for the pen and brains, of which this book now forms such a notable example.

5, Queen Anne's-gate, June 7th.

HENRY LAW.

MODERN MILLING MACHINERY AT THE MILLING EXHIBITION.

SIR,—Seeing that the systems of milling in operation at the recent exhibition dispensed, except in one instance, with the well-tried servant, the millstone, it is perhaps not at all surprising that you should devote most attention to process, or roller mill, flour-making machinery. Makers of this new class of machinery have something new and attractive to show, while the makers of the millstone tackle refrain from exhibiting that with which everyone is, more or less accurately, familiar. Because, however, all this great show is made of the new sort of flour-making machinery, we must not be carried away with the idea that this is going to supersede the millstone in a hurry. No doubt very fine flour may be made with the roller mills, and very white flour may be made by the dressing at every step in the gradual reduction. Very fine flour is undoubtedly made this way, but it has got to be proved that this flour is as good in loaf or pudding as that made by the old method, or what is equally important, it has yet to be proved to millers and consumers that it is any better than that produced by hundreds of mills using the old plant. In fact, instances tending to prove the contrary might be cited. A large mill was fitted with the roller mill, or gradual reduction plant on the Shannon some time ago, but the proprietor lost trade and money, and afterwards gave up the mill altogether. Other instances might be cited of this character, while in others, trade has been lost because the flour has not been so good after the introduction of roller mills for treating the middlings, or the mills have been taken out again.

The fact that almost all the grinding machinery in motion at the recent exhibition was of the roller mill type, no doubt indicates the direction in which engineers and millers' machinists are moving, and the direction in which they will get speculative mill-owners to move; but I should like to know a little of the opinions of millers who can produce good flour from the old style machinery before my faith is shaken in the

FRENCH BURR.

London, 8th June.

SIR,—At the Islington Exhibition of Milling Machinery, fully described in your pages, it was a noteworthy circumstance that with very few exceptions only roller mills were exhibited. From this many persons might conclude that roller mills were now largely, if not exclusively, used in England. The contrary is the case. Roller milling is as yet but little in favour, and it will be long before the millstone is superseded.

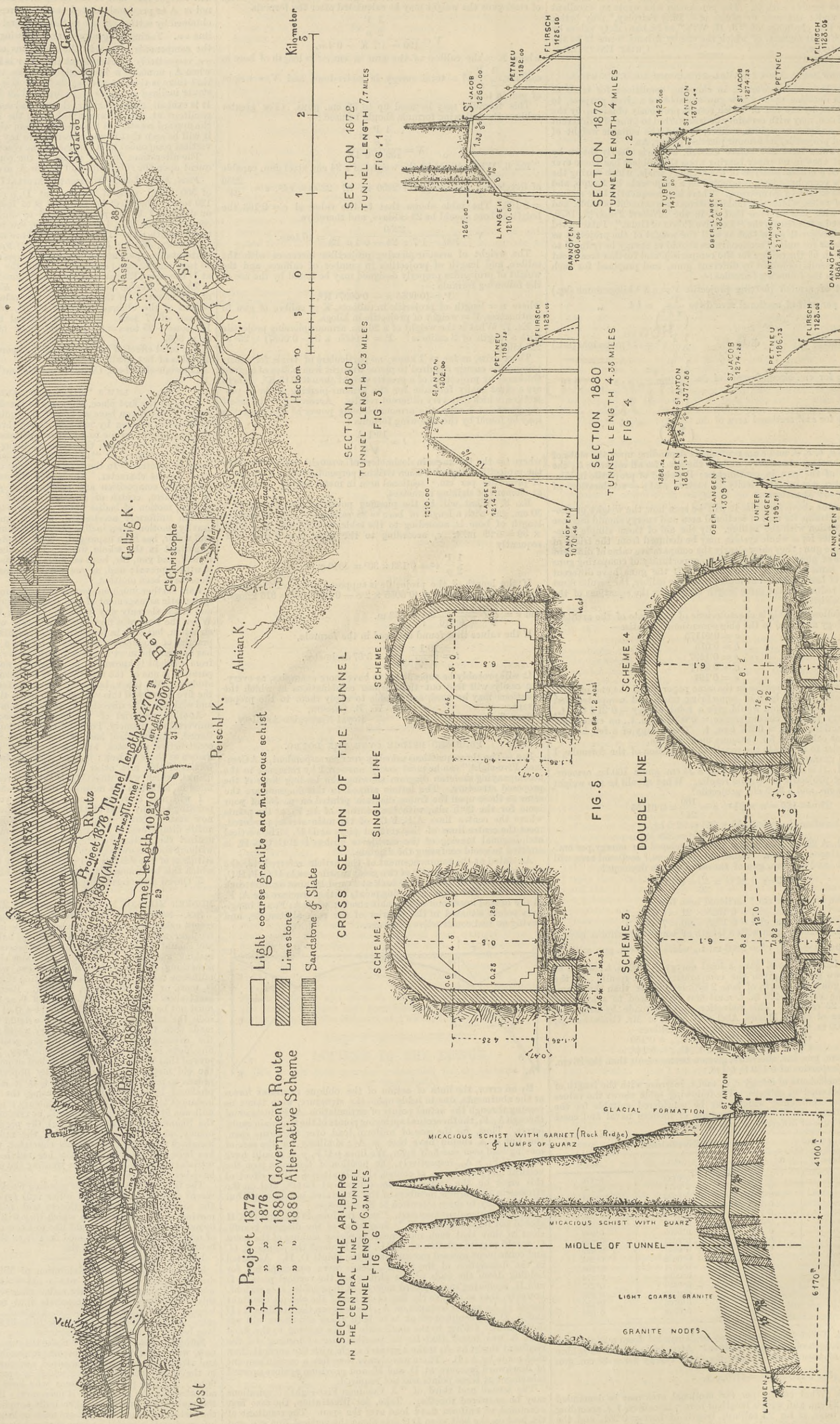
Millers do not find it easy to make the manufacture of flour pay now, with roller work it will become impossible. The cost of plant and attendance is largely augmented, and the best roller mill flour in the world lacks something which is present in the millstone flour. I could point to persons who have been ruined by the adoption of roller mills, were it necessary. It is almost time that the makers and users of roller mills supplied information as to the cost of making flour by these mills in England, and before that information is supplied I advise those who contemplate abandoning the old plan for the new to think twice.

QUERN.

London, June 3rd.

THE ARLBERG TUNNEL.

(For description see page 422.)



TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a 2d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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

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

WIREDRAWER.—*A letter lies at our office for you, and will be forwarded on receipt of your full address.*

J. R. (Birmingham).—*The patents expire in France and Belgium with the expiry of the English patents.*

J. S.—*Cargill's, "Strains on Bridge Girders and Roof Trusses," published by Spon, Charing-cross, will answer your purpose.*

J. P. AND CO. (Swansea).—*The first common furnace with a regenerator was made in* 1848 *by Mr. C. W. Siemens at the works of Messrs. Benjamin Hick and Sons, Bolton, to work his regenerative steam engine. His first patent for improvements in furnaces for producing currents of hot air by means of chambers containing refractory materials is dated May* 11*th*, 1857, *and numbered* 1320. *You can obtain a copy for* 2*s.* 11*d., including postage, from the Office for the sale of Patent Specifications, Cursitor-street, Chancery-lane.*

BELL METAL SLIDE VALVES.

(*To the Editor of The Engineer.*)

SIR,—In reply to "Engineer" in your issue for last Saturday, I beg to say that if he will use 2½ oz. of block tin to 1 lb. of copper, he can make a good valve, and, of course, add more tin if he wants to harden. I think he will find this mixture make a much better valve than the cast iron he speaks about. FOUNDRY MANAGER.

Ashford, June 7th.

(*To the Editor of The Engineer.*)

SIR,—As your correspondent "Engineer" appeals to me in his query in your issue of Friday last, I hasten to say that I will try to assist him if he will please supply a few particulars, of which I think it very desirable to be possessed, previous to venturing any opinion thereon, viz., working pressure per square inch, number of strokes per minute, space between back of steam chest and slide valve, and a section of valve, together with the buckle or other connection with the excentric. FOUNDRYMAN.

June 6th.

MEETINGS NEXT WEEK.

SOCIETY OF ENGINEERS.—Monday, June 13th, at 7.30 p.m.: A paper will be read on "The Prevention of Smoke," by Mr. A. C. Engert, the leading features of which are as follows:—The incombustibility of smoke. Smoke incapable of combining with other matter floating in the air. The extraction and consumption of the gases arising from coal, and the prevention of the formation of smoke in furnaces, open fire-grates, stoves, kitcheners, vertical boilers, and locomotives.

CHEMICAL SOCIETY.—Thursday, June 16th, at 8 p.m.: Ballot for the election of Fellows. "On the Isomeric Acids obtained from the Ether of Salicylic Aldehyde and from Coumarin," by Mr. W. H. Perkin. "Notes on Naphthaline Derivatives," by Mr. H. E. Armstrong. "On the Synthetical Production of Ammonia," by Mr. G. S. Johnson. "On the Sulphates of Aluminium," by Mr. S. Pickering.

THE METEOROLOGICAL SOCIETY.—Wednesday, June 15th, at 7 p.m.: "The Use of Synchronous Meteorological Charts for Determining Mean Values over the Ocean," by Mr. Charles Harding, F.M.S. "The Climate of Fiji," by Mr. Robert Langley Holmes, F.M.S. "Note on the Formation of Hail," by Mr. J. A. B. Oliver. "Note on a Comparison of Maximum and Minimum Temperature and Rainfall observed on Table Mountain, and at the Royal Observatory, Capetown, during January and February, 1881," by Mr. John G. Gamble, M.A., M. Inst. C.E., F.M.S.

DEATH.

On the 29th May, of typhoid fever, in Paris, WILLIAM, third son of Mr. CHARLES RICHARDSON, M.I.C.E., of 10, Berkeley-square, Bristol.

THE ENGINEER.

JUNE 10, 1881.

THE STRENGTH OF BOILER FLUES.

LACKING the experiments of Fairbairn, it would appear that boiler makers and engineers have had hitherto no data worth much consideration to aid them in determining the proportions which a steam boiler, intended to carry a given pressure, should have. Now Fairbairn's experiments were in reality few, and in many respects imperfect, and the circumstance that he was able to deduce from them certain rules which have proved useful and become popular, bears flattering testimony to his powers of inspiring confidence. But Fairbairn took very good care to allow large margins, and it is to these margins that engineers are indebted for the success with which they have followed his instructions. If, for example, a given tube was assumed to be competent to support a pressure of 300 lb. on the square inch, it was a matter of small practical consequence whether Fairbairn was right or not within 50 lb. or 60 lb., so long as the working pressure did not exceed some 40 lb. on the square inch, or thereabouts. The case assumes a different aspect, however, if it can be shown that Fairbairn was not 10 or 20 per cent., but 100 or 150 per cent., wrong; and it is obvious that it is desirable that the truth should be known. Within the last few years attempts have been made, both in this country and abroad, to find out what is really the strength of cylindrical tubes called upon to resist either bursting or collapsing pressures. The latest inquiry of the kind is one made by Mr. Thomas J. Richards, of the Board of Trade. This inquiry takes the shape of a memorandum or report to Mr. Trail on the experimental testing by hydraulic pressure of the old boilers and superheaters of the steamship Pharos. The experiments were carried out by Mr. Platten and Mr. Seaton, managers at Messrs. Earle's ship-yard, Hull. It is not necessary to describe the boilers or experiments in detail. It will suffice to say that there were two main boilers and a donkey boiler experimented upon. The donkey boiler was 7ft. high and 4ft. 6in. in diameter, with a furnace 3ft. 6in. in diameter at the top, and 3ft. 10¼in. at the bottom, and an uptake 12¾in. diameter; there were no cross tubes of any kind. The main boilers were of the ordinary cylindrical three-furnace type, 13ft. in diameter and 9ft. 9¾in. long. The plates were originally ⅞in. thick. The furnaces were 3ft. 1in. in diameter and 6ft. 6in. long. The boilers were tested in the usual way by hydraulic pressure, much care being taken to get accurate results as to pressure. As a matter of course, seams leaked and had to be caulked. With the details of the experiments, however, we need not concern ourselves. It will suffice to say that they were carried out in a very able and scientific way, and that as a consequence the deductions drawn from them possess great value. Let us see what these deductions are. It is with them that our readers have most to do.

According to Fairbairn's well-known rule $\frac{806{,}300 \times t^{2 \cdot 19}}{L\,D}$ = collapsing pressure per square inch, the fire-box of the donkey boiler ought to have withstood a strain of 545 lb. per square inch. It actually gave way with a pressure of less than 200 lb. on the square inch. Mr. Richards points out that in practice most engineers, to avoid the trouble of using the 2·19 power of the thickness of the plates, take the square of that thickness, by doing which they much augment the error; and Mr. Richards explains that if the square be used, then the constant 806,300 must be written 465,314, the formula then becoming $\frac{465{,}314 \times t^2}{L\,D}$. But no matter which of them is used, the result is very much too high. It may be said that this fire-box gave an exceptional result; but we think that this cannot be said with truth. Mr. Richards bears testimony to its excellence of workmanship, and it had lost very little of its original thickness by corrosion. Fairbairn's rule applies to tubes with butt joints, but in the case of the donkey boiler there were four lapped joints quartering all round. For such tubes Mr. Richards gives $\frac{322{,}462 \times t^2}{L\,D}$ as the proper formula, based on Fairbairn's deductions, and using this the collapsing strength of the fire-box was 268 lb., still in excess of that at which it really failed. It is worth notice, however, that the pressure at which the boiler ultimately gave way was but 175 lb. The fire-box was shored up after it had collapsed 2½in., and the pressure re-applied, when the flange uniting the top of the uptake with the top of the boiler gave way, and the leakage became too much for the pumps. Mr. Richards very properly calls attention to the circumstance that the boiler was practically destroyed at 180 lb., when permanent set took place.

One main boiler failed by cracking the shell; the other by the collapse of one of the furnaces at a pressure of 260 lb. on the square inch. By Fairbairn's original rule the furnace should have stood 605 lb. Using the square of the thickness it should have stood 683 lb., but using Mr. Richards's deduced formula we have $\frac{322{,}462 \times \frac{17^2}{32}}{9 \times 37} = 273$ lb. per square inch. In this case, however, Mr. Richards has taken the length of the flue as 9ft., which was the length of the bottom portion of the tube measured from the front to the inside of the back uptake or combustion chamber. By Wilson's rule $\frac{262 \cdot 4 \times t^2}{L\,D} = p$, where p is the collapsing pressure, t the thickness of tube in 32nds of an inch, L the length in feet, and D the diameter in quarter feet, the collapsing pressure would be nearly 700 lb. on the square inch.

It is true that Mr. Wilson advises a high factor of safety, say six to one, to be used. But it is evident that if his rule gives the collapsing pressure at more than twice as great as it really is, that the factor of safety becomes three to one instead of six to one, and the former is too small in boiler work. Mr. Wilson's book is regarded, and rightly regarded, as a standard authority on the construction of boilers, but it will apparently require some considerable modifications to make it trustworthy on this most important point. Mr. Richards gives a table in his report which we reproduce in another page, in which he compares the strength of the furnace of the donkey boiler of the Pharos, that of the furnace of the main boiler, that of a furnace tested at Greenock, of another tested at Leeds, and, finally, the strength of a flue tested by the Engineer-in-Chief of the United States Navy, with the calculated strengths obtained by Fairbairn's rules, No. 1 and No. 2, and his own two modifications of these rules, from which we find that the fire-box of the donkey boiler was 34 per cent. weaker; that of the main boiler of the Pharos was 5 per cent. weaker; the flue tested at Greenock was 5 per cent. stronger; that tested at Leeds was 31 per cent. weaker; and that tested in America 39 per cent. weaker than it would appear to be by Mr. Richards's rule. Thus it cannot be said that Mr. Richards's rule errs in being adverse to the tube; on the contrary it favours it too much, but its error is as nothing compared to that involved in Fairbairn, Wilson's, and the received modifications of Fairbairn's rule. Broadly speaking, indeed, it may be said that, while Mr. Richards's rule gives a fair approximation to the strength of either butt-jointed or welded flue tubes, the accepted rules are wholly and dangerously misleading. It may, perhaps, be urged that Mr. Richards's formulæ and conclusions are based on a limited number of experiments; but, on the other hand, it must not be forgotten that Fairbairn's experiments were also few in number, and by no means as representative as those from which Mr. Richards has made his deductions; and it will be incumbent on those who hold that Fairbairn's rules are applicable to the modern practice of boiler engineering to prove that Mr. Richards is wrong. To attempt to reconcile the two sets of formulæ is obviously hopeless. Fairbairn's rule would make a boiler flue appear to be about three times as strong as it probably is. Mr. Richards's rule gives a fair approximation to its actual strength. Is it not possible that there are at work at this moment many boilers with a very much smaller true margin of safety than their owners think? A very strong case indeed will have to be made out to overset the accuracy of Mr. Richards's deductions, and some action ought to be taken on them. It seems to be impossible that the formulæ which are now used should continue to enjoy confidence after what Mr. Richards has said concerning them.

THE EDUCATION OF ENGINEERS.

IT used to be a ground of complaint that engineers took much money from apprentices—or to use the more euphonious phase, articled pupils—and taught them little in return. Five, six, or even eight hundred pounds were paid now and then in the shape of premium to civil or mechanical engineers, who, in return for the money, permitted the so-called pupil to walk about the office or wander through the shops as much as he pleased. We have heard of one pupil who, wishing to learn something, was employed to screw bolts for three months, and at the end of the time, on remonstrating with the foreman, he was promised a change of work, which came at the end of the half year, when the lucky articled pupil was put to screw nuts. As the foreman said "he might as well go through with the thing when he had begun it." It is more than probable that this and similar stories are exaggerated; but there is no room to doubt, even after all due allowance is made, that pupils did not invariably get a full return for the money paid for their instruction in the art and mystery of engineering. Many thousands of premiums have been paid since, let us say, 1830, when the dawn of the railway era woke men up to learn that there was a new calling open for their sons; and of these thousands it is quite certain that only a small proportion have become first-class men. A few hundreds have attained to a decent mediocrity; and of the remainder the less said the better. The reason why so many young men failed to become engineers in any true or laudable sense of the words, must not be sought wholly in the defects of the education they received; but it was, nevertheless, in a large degree due to the want of regular, disciplined, systematic instruction; and for the rest we must bear in mind that the pupils did not in all cases avail themselves of the educational opportunities offered to them. It was no one's special business to see that the son of wealthy parents was prevented from wasting his time; and we regret to add that the bare fact that a man had served his time, no matter how his time had been employed, with a big engineer was once a sufficient passport to a very good position. In the early days of railway engineering, pupils were scarce, and the engineer who had them was of necessity compelled to teach them to be useful to him as soon as possible. But in a few years the rush set in, and the trouble then was to find work for the pupils to do. Many of our best and greatest engineers limited the number of their pupils, or refused to take any at all; and step by step for years the education of engineers grew more and more imperfect, until it at last became apparent that there was some danger that the English engineer would be the most ignorant engineer on the face of the earth. Then a change took place. Education of all kinds was being treated on scientific principles, and attempts were made to reduce engineering to an exact science, and to teach this science to pupils in our universties. Glasgow, Dublin, London, all established Chairs of Engineering. Degrees began to be granted, and it came to be thought that highly-trained and competent engineers could be manufactured in colleges. This view is still held by many—the Indian Government, for example—and although it has long been abandoned if it ever was entertained by really competent and experienced judges of the merits of men, the theory is still liked by heads of colleges, Governments, and many folk who ought to know better. As this belief has caused no small trouble and disappointment, it is worth while to say a few words on the subject which may serve to set matters right. No college training can by itself make a competent engineer, because all training of the kind is to a large extent based on the assumption that engineering is an exact science, whereas it is nothing of the kind; and furthermore, there is this broad distinction between the college training of the engineer and that of other professional men, that the engineer is not taught by those practising what they pretend to teach, while other professional men are instructed by those daily doing what they undertake to teach students how to do. For example, a student of medicine or surgery is trained by physicians or surgeons who are in active practice. From books they learn the theory of their profession; but the practice of it they acquire at the same time in hospital wards. But the student trained in college only, can learn but the theory of his business there, and

when, in after life, he comes to apply that theory in practice, he will most likely find himself all astray. We may take, for example, the construction of retaining walls. Nothing is treated with more exactitude than the theory of such walls, but nothing, save practice, will enable the student to apply the theory. So much depends on the nature of the soil that it is simply impossible to say from books what it will and will not do when penned up behind a wall. In the same way English contractors, knowing nothing of mathematics or theories, made money by constructing railway cuttings and embankments which did not fall down or fill up, when foreign engineers, men of immense mathematical resource, entirely failed. We do not for a moment wish to convey that training in theory is useless to the engineering student; very far from it. But we do wish it to be very clearly understood—much more clearly than it is understood now in fact—that theory is but one half the education of the engineer; that practice is the other half, and that if but one half can be had, then let it be practice.

Leaving practice altogether on one side, let us see whether the college, or other theoretical training of the present day, is as good as it can be. It will be conceded, we think, that the most should be made of the time spent at college; that the object of the teacher or teachers should be to impart as much useful instruction as possible in the time available; and that time spent in teaching the pupil to do that which he will never have to do in after life is time wasted. Judged by this standard, we fear that more than one school and college are in fault. Things are taught —and much time is spent in the teaching—which are never afterwards of the smallest use to the pupil. For example, at the School of Mines, South Kensington, it is assumed that young men are trained to become mining engineers. They are supposed, indeed, to have learned the whole theory of their profession when they leave the school, and to have acquired besides some practical portions of it. Chemistry, for example, is, we have reason to believe, very well taught by Dr. Frankland. It is evident that the mining engineer should know how to make drawings of machinery, to plot surveys, and to take levels. At the School of Mines, during the first two years a surprisingly large amount of time is simply wasted in teaching the pupil solid geometry; and in the examinations a considerable number of marks is awarded for skill in making cardboard models of cones, pyramids, and cubes. We hasten to assert that the time spent in learning solid geometry of this kind would be much better employed in learning the names and uses of various parts of a steam engine, and how to draw them correctly to scale; but this kind of thing is hardly taught at all at the School of Mines. We have heard it argued that learning solid geometry opens the pupil's mind, but the same thing might be said of anatomy or astronomy, and a knowledge of the former would certainly be as useful, perhaps much more useful, to the mining engineer than a minute knowledge of solid geometry possibly can be. If, leaving the School of Mines, we turn to other colleges, we shall find in all a vast amount of time wasted, under the mistaken notion of "opening the pupil's mind." If professors would but think, they would be compelled to admit that there is plenty of information to be acquired by any pupil which will be directly useful to him in after life, and which will answer every needful purpose of opening the mind. For example, we find in some colleges, not only high mathematics, but all but the highest mathematics taught to engineering pupils; and yet no question can arise in the life practice of an engineer demanding a knowledge on his part of such mathematics. About the most abstruse questions which can turn up are connected with the designs of large bridges; and engineers of experience know that when these questions spring up it is far better and more convenient to state a case for a professed mathematician than to attempt to grapple with it themselves. But such cases do not occur twice in a lifetime. On the other hand, the engineer, who is also a highly-trained mathematician, is usually quite unfit for practical work; his designs indeed cannot be carried out with the minute accuracy, in the absence of which his calculations become valueless. We could cite as an example a large lattice bridge in France. The calculations for the bridge occupied months, and when the specifications came out the dimensions of the various bars were stated to the hundredth part of an inch. Tenders for the iron were sought both in this country and abroad; but we need hardly add that no iron manufacturer would guarantee to roll bars to the 0·01 of an inch in thickness, and no bridge builder would undertake to plane them all over at a reasonable price; so that the bridge was not built until relaxations were made in the specifications, which rendered months spent in elaborate calculations time wasted. Here again we must point out that we do not wish to assert that mathematics should not be taught to engineering pupils, but only that no mathematical knowledge should be imparted that was not likely to be useful to the engineer in after life.

One reason why college training is so defective is to be found in the system. New professors are expected in too many cases to work on old lines. It is the object of the pupil to pass his examination, and it is the object of the teacher to get him through. If the teachers instruct in one way, while the examiners examine in another, the wretched pupil will come to the ground between them. Unfortunately, the examiners are seldom very practical engineers, and the papers they prepare can hardly be read, in but too many cases, without a smile by engineers practising their profession. We have seen papers in which the cost per yard of dressing stone, per thousand of bricks, and per ton of iron was given in figures outrageously wrong, and very well calculated to mislead the student. The examination papers are in the present day the crying evil of engineering education in schools and colleges; and when they are not prepared by the professors themselves they baffle every attempt to do better than has been done hitherto. We maintain that there is no valid reason why a three years' college course of instruction in engineering should not constitute a most valuable training for the young engineer; but to render it such, considerable changes are wanted in the greater number of colleges which undertake to train engineers, both in this country and abroad; and these changes should all take the same direction, should all tend to prevent waste of time, and secure the thorough teaching of everything which can be useful to the student in the subsequent practice of his profession, and of nothing certain to be useless. The college may be said to supply the man with tools, and to teach him in a limited degree how to use them. To give him tools which he will never use, and to waste time in teaching him what to do with them, is a manifest absurdity.

NORTH-EASTERN DOCK ACCOMMODATION.

It has been stated that the directors of the North-Eastern Railway have in contemplation the extension of the dock works at Middlesbrough, and that it is possible that they may become the sole owners of the docks at Sunderland. What truth there may be in the reports it is impossible to say yet, but they bring up the question of the dock accommodation of the north-east coast. During the past few years much has been done to improve the dock accommodation of the North. The North-Eastern Railway Company some eight years ago completed an extension of the Middlesbrough Dock, which is now becoming productive, and the same company is now completing its extension—long needed—at West Hartlepool; whilst on the Wear and the Tyne local bodies have done much to improve the position of the docks and ports. It is rather unlikely that any large addition will be speedily made to the dock accommodation at Middlesbrough, not only because of the comparatively recent enlargement of the dock, but because it is so situated in the midst of works that it is scarcely possible much to increase its extent, though near its entrance a slight enlargement might be made. It is worth notice at the present day that some years ago a proposition was made by Alderman John Dunning, of Middlesbrough—his scheme being laid before a local engineering society in 1872. The idea was to convert part of the channel of the river Tees into a dock, making a new channel through the Saltholme marshes. The advantages claimed for the scheme were the relief of the great traffic along the present lines of railway, the giving to almost every ironworks existing on the Tees a quay and wharf, and the obtaining of a very large amount of room on the river and on the island that would be formed by the new and the old channel. The estimated cost was £400,000—a large sum, but one which would not be too large if the advantages claimed were attainable, and one that would be comparatively small for the formation of over 360 acres of dock area and 12,000 lineal yards of quay. In fact, the idea seems to be the making for the Tees docks much in the method in which docks were made at Ipswich and other places. The scheme was unquestionably a bold one, involving the cutting of a new channel from above Middlesbrough to below Eston, and as it was merely a project on paper it is not needful to discuss its merits or demerits. But the fact that such a scheme was projected may come fittingly in as a reminder to those interested in the subject of the dock accommodation in the north, that it is advisable if their dock accommodation is to be increased, that it should not be a mere addition of a few feet of quay walling, or the putting on of one or two acres of water area. With the vast trades of the North, and the probability of a great and a further growth, it is desirable that those who are interested should endeavour to ascertain the needs of the district, and prepare to supply them by a bold and well-considered scheme which will satisfy those needs for many years to come. On the Tyne there has been made such provision, and the comparative briskness of the shipping trades there is a proof that that policy has been the best. The Tees has in dock accommodation hitherto depended too much on the railway company which serves its district; and it is worth the consideration of those interested whether the commissioners of the river should not take into account the need that there is for greater accommodation and meet the wants of the district themselves. The policy of these commissioners has been by bold steps to make works that will meet the requirements of the river and its traders for many years to come, and it would add to their revenue, and very materially increase the trade of their port if they would undertake the construction of a scheme of docks which should in some degree compete with those of the railway company, and which at any rate should enlarge the trading facilities of the river, and prepare it for that fuller trade that seems about to dawn on the Teesside district.

THE REGISTRATION OF TONNAGE.

The difficulties attending the proper registration of vessels for the purpose of obtaining fair data upon which to levy harbour, custom-house, and lighting dues have long been a source of trouble and annoyance to all concerned; and if the Royal Commission, which has been engaged taking evidence at the principal British ports upon the subject, should be able to afford a satisfactory solution of this knotty problem, its labours will assuredly not have been in vain. A fresh and somewhat curious illustration of the difficulty alluded to is supplied in connection with the exaction of dues by the Greenock Harbour Authorities, who by a peculiar reading of the 23rd Section of the Merchant Shipping Act, 1854, are about to sustain a serious loss of revenue. The clause referred to provides "that in every ship propelled by steam or other power requiring engine room, an allowance is made for the space occupied by the propelling power, and the amount so allowed is to be deducted from the gross tonnage of the ship, and the remainder is to be the register tonnage of such ship. . . . And whenever such measurement is so required the deduction is to consist of the tonnage of the space actually occupied by, or required to be enclosed for, the proper working of the boilers and machinery, with the addition, in the case of ships propelled with paddle-wheels, of one-half, and in the case of ships propelled by screws, of three-fourths of the tonnage of such space." It appears that this clause has now been interpreted to mean that "space occupied by the propelling power," which originally formed no part of the gross tonnage of the vessel, must now be deducted, together with the ordinary deductions for crew space, bunkers, &c. The effect of this new reading of the clause is forcibly shown in the case of the river steamer Lord of the Isles, whose gross tonnage was 384, and which until recently registered 213 tons, and has now been reduced to 163 tons; the Iona, 393 gross and 132 net, reduced to 112; Windsor Castle, 199 gross and 95 net, reduced to 65; Lord Clyde and Lord Gough, 705 gross and 433 net, reduced to 320; and the tug Clyde, 87 tons gross and originally 8 tons net, is now minus 4·64 tons, or more than 4 tons less than nothing. The absurdity of this result is, of course, apparent. We are informed that out of a list of thirty-five steamers whose tonnage has been so reduced there will be a deduction of 1293 tons, and a loss of upwards of £880 of revenue to the harbour trustees. The latter some time ago appointed a committee to consider in what way this loss could be made up, and they have made the following recommendations:—(1) That the compounding rate upon all coasting steamers be raised to the maximum rate of 21s. per register ton per annum; (2) that the calling rate upon the foresaid class of steamers be raised from 3d. to 3½d. per ton; (3) that upon river steamers the present *ex gratia* rate of 18s. per ton be raised to 23s. per ton per annum; and (4) that a police rate of 1d. per ton per week be levied upon tugs in addition to the existing charges of 2s. per ton per month. These changes are to come into force at Greenock on the 1st July. The Board of Trade are said to be opinion that the clause has been misconstructed, and to contemplate the introduction of a short Bill to remedy the defect. The advantage to owners of vessels of the system of compounding for rates is illustrated by the fact that last year one of the Clyde river steamers paid dues on 108 trips, and was enabled to make as many as 834 trips free. There are numerous other examples of a like description. Under the proposed new harbour rules, while some of the steamers will have their rates increased £15 to £18 per annum, others will still obtain deductions amounting to over £50, and it is anticipated that there will be after all a comparative deficit in the harbour revenue.

THE STEPHENSON CENTENARY AT NEWCASTLE.

On Thursday, Newcastle-on-Tyne held high holiday in commemoration of the centenary of the birth of George Stephenson. Its decorated streets were crowded; its works were idle, the Tyne was given up to pleasure; and into the town poured by road, rail, and river a continuous stream of people. Not the least important of the methods by which the centenary was commemorated was the display of modern and ancient locomotives. In our next issue we hope to treat the subject a little in detail, but it may be interesting to say here that of old locomotives there were shown one of Stephenson's Killingworth engines; the Darlington "Locomotion;" one constructed by Mr. Kitchin at Darlington between thirty and forty years ago; and the Hetton Company's old engine. Of typical modern engines the chief railway companies have sent examples. The "Stephenson," from the Brighton Works; a fine Midland engine designed for the occasion by Mr. S. W. Johnson; two or three heavy Lancashire and Yorkshire locomotives; two from the North British line; and four or five North-Eastern engines are shown; whilst of models, there is a large collection. The primary object of the promoters must be held to be successfully accomplished.

LITERATURE.

Beilage zum Ingenieur-Kalendar. By Von H. Fehland. Julius Spinger, Berlin. 1881.

This is a small book, containing, in comparison with its size, an immense amount of useful information for the every-day use of mechanical engineers. It is somewhat like an abridged edition of the extremely valuable German "Ingenieurs' Taschenbuch," which is so much superior to our own Molesworth or Hurst, that the Englishman has some reason to be ashamed of the comparison. Molesworth's Pocket-book is now always some years behind date in the information it offers, and the mass of matter in it is flung together in a haphazard style, without much method or system. The Taschenbuch is in this respect much better, but both it and its English counterpart are somewhat too expensive for a large class of poorly-off persons, to whom an engineering pocketbook would be useful, but whose slender stock of pocket-money requires them to think two or three times before committing the extravagance of spending 6s. or 7s. in the purchase of one. This present work gives a great deal of sound, practical information, presented in a clear, concise form, with the assistance of an abundant supply of excellently-drawn illustrations, and for very little money. In two and a-half pages some useful formulæ of algebra and trigonometry are given. In the next two and a-half the formulæ of theoretical mechanics are stated succinctly, and in a ready form for arithmetical application. Next comes the design of machine details, which occupies sixty-two pages. Here we have tables of the dimensions of screws, nuts, rivets and rivetting, proportions of shafts, couplings, bearings, wall-brackets, pulleys, toothed wheels, cranks, connecting rods, guide bars, stuffing boxes, valves, pistons, &c., all explained by well-printed illustrations, with the proportional dimensions marked on them. The method used is the excellent one introduced by Reuleaux, and followed by Unwin in his useful little book on machine design. Then comes a *résumé* of the patent laws, which must be very useful to German inventors. This is followed by a synopsis of the most important parts of the laws regulating industry, the *personnel* of the Government offices that have to do with industries, and tables giving the customary fees charged by "techniker," *i.e.*, by professional designers of engineering work.

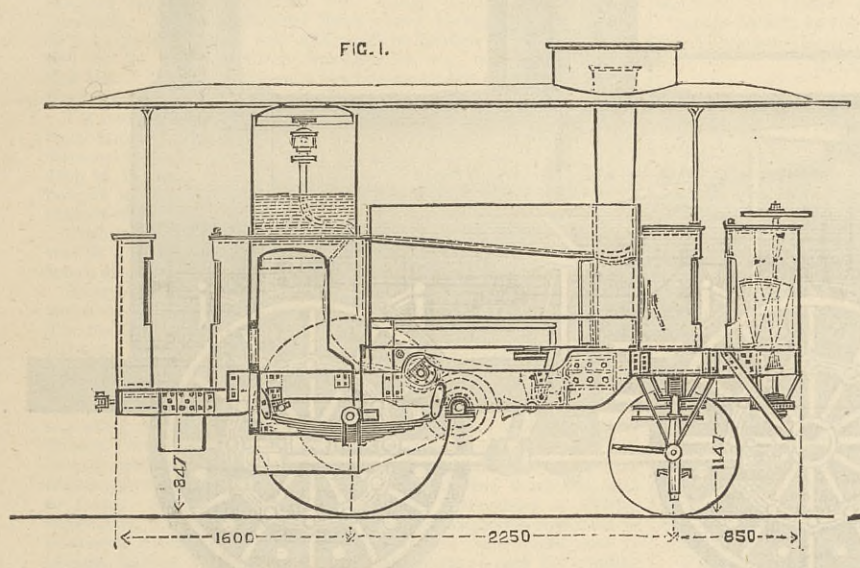
We wish some of our publishers would bring out an English counterpart to this very useful little book at a price that could readily be afforded by all without exception. We are sure it would command a large sale if well got up. Besides cheapness, shortness and simplicity possess another great advantage in making the book usable by a large class who know nothing of scientific engineering, and who yet wish to express their ideas in drawings sufficiently correct to let practical engineers understand, estimate for, and carry out the things desired. Professional engineers might then be saved some ungrateful labour in interpreting unintelligible fragmentary sketches, to estimate from which is impossible, and to interpret which into a proper design from which to estimate, costs more trouble than the chance of profit is often worth

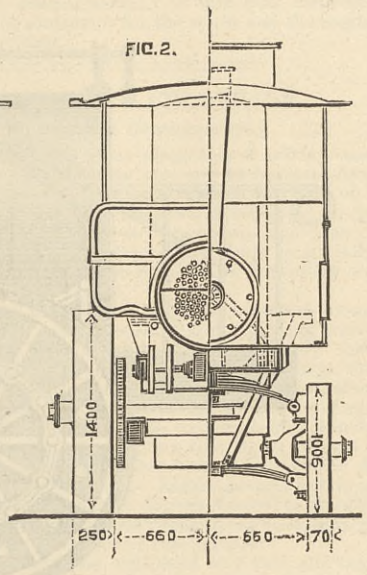
Sanitary Institute of Great Britain.—At an examination held by the Sanitary Institute of Great Britain on June 2nd and 3rd, six candidates presented themselves, and the Institute's certificate of competency as local surveyor was awarded to Samuel S. Grimby and to Arthur Whitcombe, and the Institute's certificate of competency as Inspector of Nuisances was awarded to John Tatem Cowderoy, to Joseph Rains, and to William Wilkinson.

Strike on the Hull and Barnsley Railway.—A strike of apparently formidable character has, says the *Eastern Morning News*, taken place amongst the navvies employed on the Hull and Barnsley Railway. Upwards of 700 men have struck for an advance of sixpence per day, with a reduction in the hours of labour. The movement has taken place at a time when, favoured with fine weather, the contractors would have been able to push forward the work with great vigour.

THE BOLLEE STEAM CARRIAGE.

IN this article we purpose to give some account of a new steam carriage for common roads, as lately described by Herr Kesseler, before the "Verein für Eisenbahnkunde" of Germany. Figs. 1 and 2 show a goods van for street traffic, and Figs. 3 and 4 a mail carriage. A "steam caléche" on the same principle has for some time run with success at Berlin. We will describe the mail carriage, although the mechanical arrangements are essentially the same in all. There is a single carriage frame, which supports an upright Field boiler at the hind end, and a pair of vertical cylinders at the front end. The crank shaft is continued under the carriage, in the line of its axis, and turns by special gear, to be described hereafter, a transverse shaft, divided in the middle, and of which each half is coupled to one of the hind wheels by a "Gall" chain. The hind wheels are connected to the frame by ordinary leaf springs; but the front wheels have two transverse springs, one above the other, and





connected by vertical bolts, passing through eyes in their ends. On these bolts are hung axle-boxes in which run the inner ends of short axles, carrying the front wheels. By means of lever-arms placed at right angles to the axles, and a steering apparatus, these boxes can be made to turn about the vertical bolts. By this means each front wheel is rendered independent of the main frame, and movable about a vertical axis nearly coinciding with its own vertical diameter. The two springs are connected in the middle by a large casting, through which passes a vertical steering shaft, having a hand wheel at the top, and a spur wheel near the bottom, gearing into a horizontal rack quadrant. This quadrant swings on a pin fixed to the frame, and on the other side of this pin carries two lever arms set at an angle of about 35 deg. with each other, and one on each side of the axis of the frame. Connecting-rods unite these lever arms to the lever arms already mentioned on the boxes carrying the front wheels; which boxes are thus made to swivel about their vertical axis by the action of the steering shaft. But the extent of this action is by no means the same in the two cases. It will be seen by reference to Fig. 4 that when the wheels are swivelled into the dotted position, the lower or right-hand lever in the quadrant has its eye close to the centre line of the carriage, and consequently acts upon its connecting rod with a pull nearly at right angles; whilst the left-hand lever, being far from the centre line, acts on its connecting rod with a thrust at a very obtuse angle, and therefore with much less effect. Hence the two wheels are not in parallel planes, and the lines of their axles, instead of being parallel, meet in some point outside the carriage. This point is so chosen as to be on the prolongation of the hind axle, and therefore, the lines from this point being at right angles to all four wheels, the point forms a centre round which the whole carriage turns with ease and rapidity. This arrangement has the further advantage that the carriage always rests on a safe and level basis.

As already [mentioned, the power is conveyed to the driving-wheels by a chain and chain wheels, from a divided transverse shaft. By means of what are called addition and subtraction wheels, the uniform rotation of the crank shaft is so conveyed to the two parts of this shaft that on curves each wheel receives exactly the velocity required by the different length of path which it may have to traverse. Thus the wheels only *roll* on the road, they do not *grind* upon it, as wheels going at equal speed must do—a defect which has existed in many previous road steamers. The connection between the motive power and the wheels being through springs is very elastic, and the whole motion is as easy and smooth as can possibly be conceived.

The driver sits on an ordinary coachman's box, which also forms the water-tank, and manages the carriage by means of the steering shaft and wheel already described, and by a brake shaft, which passes through the centre of the hollow steering shaft. These shafts are straight before him, while on his right hand are the regulator and reversing handle. Between the box and the boiler is the body for passengers, covered with a movable head. The fireman stands behind the boiler, and has a supply of coal for seven or eight hours' run. The consumption of coal on the level is about 1 kilog. per kilo. (3·6 lb. per mile), and that of water 270 litres per hour (60 gals.). On a good level road the carriage runs at about eighteen miles per hour, and it mounts inclines of 1 in 12 with ease and safety.

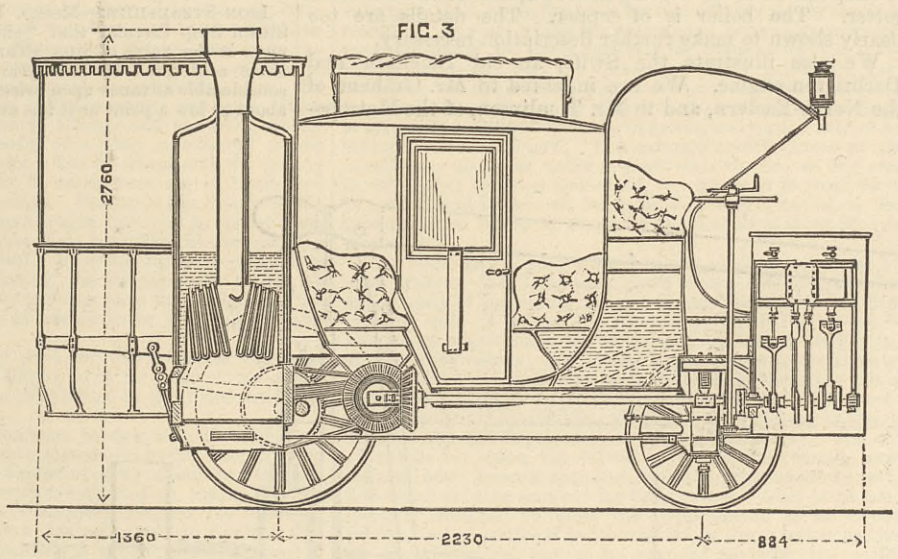
The traction engine for goods, shown in Figs. 1 and 2, is of similar mechanical arrangement to the steam carriage, and has a truck of special construction coupled to it in such a way that the hind wheels of the truck can also be used as driving wheels. It is intended to haul 20,000 kilog.—20 tons—on inclines of 1 in 20, and double that amount on the level. The leading particulars are as follows:—

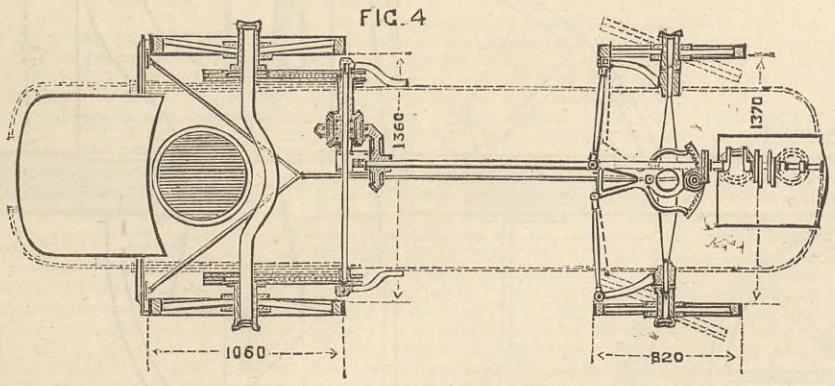
	Millimetres.
Diameter of driving wheels	1,400
Breadth of tires of ditto	250
Width of gauge between tires	1,320
Diameter of leading wheels	900
Breadth of tires of ditto	190
Width of gauge between tires	1,320
Wheel base	2,250
Total length of engine	4,700
Total height of engine, including spark-catcher	3,100

Heating surface, 19 square metres (for 45-50-H.P.)	
Coal space, 1 cubic metre (for 8 hours' consumption).	
Water space, 1200 litres (for 1¾ hours' consumption).	
Speed, 7·2 kilometres per hour.	Kilogs.
Weight of engine, empty	7,500
Weight of engine, loaded	10,000
Load on hind wheels, with full load	7,000
Load on front wheels, with full load	3,000

A similar engine, but of three times the power, is now in course of construction.

So little has been heard of late in England with regard to steam carriages on common roads that the above short account of what is certainly a very ingenious specimen of the class cannot



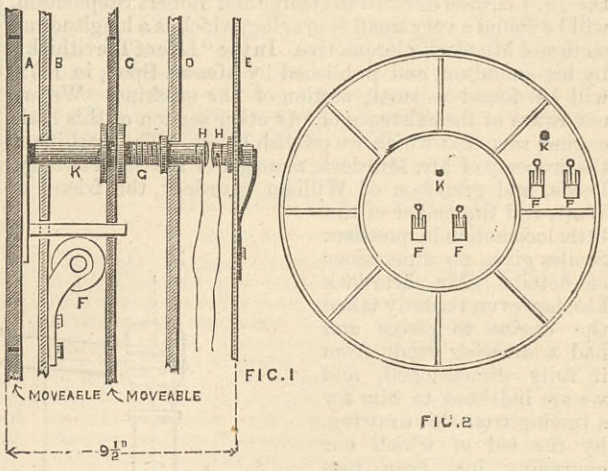


fail to be of interest. At the same time, the reception given to the idea, even at the meeting where it was introduced, does not seem to have been altogether favourable. Herr Kaselowsky, well known for his invention of tire fastenings, gave, in particular, a long and somewhat amusing account of his experiences with an earlier steam carriage built by L. Schwartzkoff, of Berlin, in 1863; and especially of his difficulties with the peasants of the district through which he plied, who not unnaturally looked on the new engine as destined to destroy their ancient and valuable privilege of hauling by wagon. His experience was that, apart from such obstacles, running by steam on common roads was a very safe, pleasant, and easy amusement in good weather; but that with rain and mud troubles began that gradually wore out the strongest enthusiasm. He gives a vivid, if not a pleasant, description of the descent of a long hill in a damp, dark evening, when the wheels were thick in mud, the brakes refused to hold properly, and the engine and train went bowling down to the valley at a perilous speed, the driver steering his course by the sole help of the successive poplar trees, as they showed dark against the sky, and devoutly hoping that no vehicle would be coming up the hill at that hour, since he must certainly run over it. By good luck and good steering they reached the valley in safety; but the general result of this and similar adventures seems to have been to impress strongly on Herr Kaselowsky's mind the very superior comfort and safety of the iron road, and to make him thankful that railways had been invented. We believe his experience will be confirmed by others. Those who care to turn back to our issue of October 27th, 1871, will find a very lively account of Mr. Crompton's trip from Ipswich to Edinburgh, on the "Thomson" road steamer "Ravee;" and despite his skill and energy in the overcoming of difficulties, they will probably agree that his experiences do not offer great encouragement. The Indus steam train, which Mr. Crompton subsequently worked with so much energy, and which was described by him before the Institution of Mechanical Engineers, in 1879, was finally abandoned; and nothing has been heard of that system of transport in India during recent years, when the exigencies of war and famine might have been thought specially likely to call it forth. Again, Mr. B. Blackburn exhibited, at the Horticultural Gardens, about two years ago, a "mechanical dog-cart" of very ingenious construction, which, as far as starting, stopping, running, and turning are concerned, performed all its duties with entire success. But we have heard nothing of the invention since, and presume that it has proved impracticable to get it fairly taken up. Thus, all experience seems to be against the success of steam carriages, or engines, for rapid traffic on common roads. Of course, the heavy traction engines made by Messrs. Aveling and Porter, and others, for hauling great loads at slow speeds, come under a different category; though, even here, success has only been achieved within a certain limited sphere. Whether the Bolleé system, with its undoubted ingenuity, is destined to revolutionise our ideas, and make a road steamer into a success, we will not presume to state positively; but the present experience with it is certainly not sufficient to justify such a claim.

SELF-REGISTERING TARGET.

WE give herewith illustrations showing a design for a target invented by Lieut. Finney, Hazel-grove, Stockport, intended to fulfil the desirable object of registering the hits in competitive rifle shooting, so as to prevent the possibility of foul play.

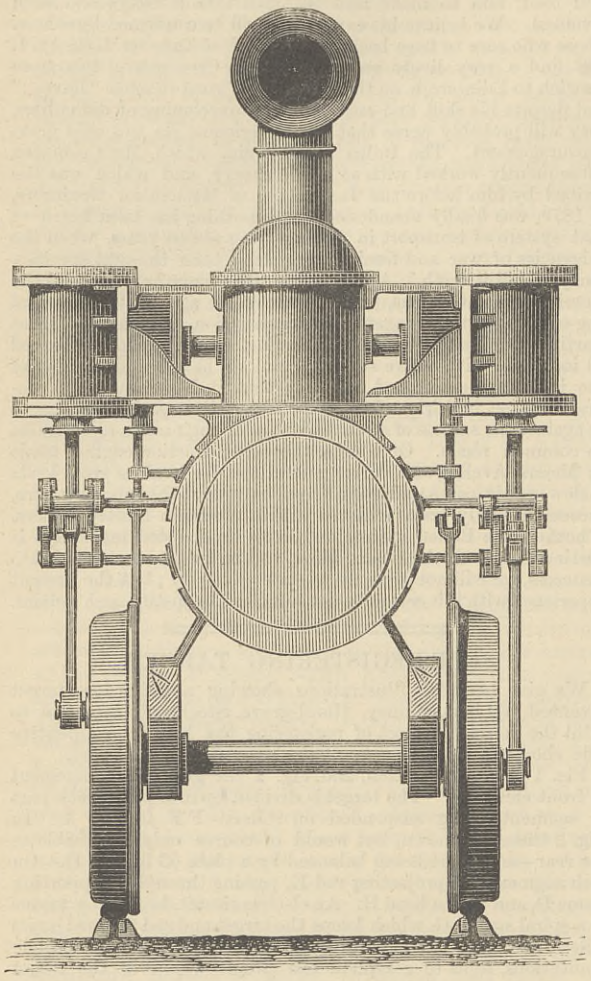
Fig. 1 shows the section, and Fig. 2 the general arrangement in front elevation. The target is divided up into parts, each part or segment being suspended on rollers—F F in Fig. 1. In Fig. 2 these are shown, but would of course only be visible at the rear—each part being balanced by a plate (C in Fig. 1). On each segment is a projecting rod K, passing through a supporting frame D, and with a head H. An electric circuit, broken by means of a spiral spring G, which keeps the target and rod forward on its rollers, so that it is separated from H, to which are fixed electric connections, so as to complete the circuit whenever the target segment is pressed back, compressing the spiral spring, and causing H and H¹ to come into contact with each other. This is intended to be effected by the impact of the bullet, so that whichever portion of the target is struck a certain electric circuit is completed, and a corresponding signal is made.

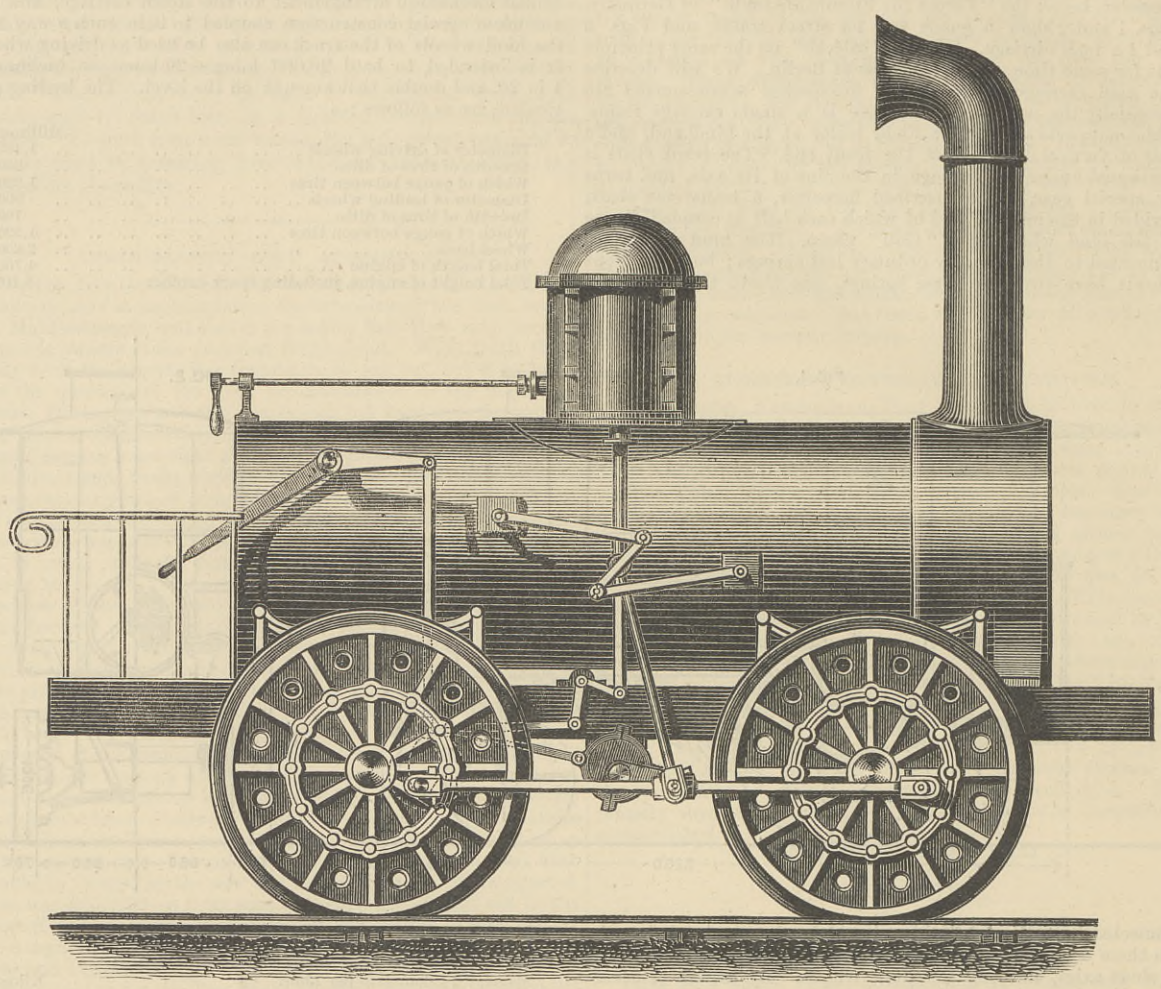


It may be well to point out, however, that it is very questionable in our judgment if this would act without some modification Probably in some form it might be a great success. As designed the impact of the bullet has to move a heavy weight on rollers, and compress a spiral spring which need not be opposite, but may be laterally several inches distant from the point of impact. At Enfield there exists a target for registering the moment of impact, which is on a somewhat similar principle. In that, however, the target is suspended, and the spring employed so light that the merest touch moves it. The target vibrates rather than swings, and this arrangement acts so well that the superintendent of the Royal Laboratory is making a similar one to test velocities on the range in the Royal Arsenal. Obviously, therefore, the possibility exists of perfecting the idea suggested for the registration of place of impact, though we think the present form would need modification.

METROPOLITAN WATER SUPPLY.—According to the analyses and report of Mr. W. Crookes, F.R.S., Dr. W. Odling, and Dr. C. Meynott Tidy, the waters supplied to the metropolis during the month April 20 to May 19 by the companies deriving their water from the Thames and the Lea were throughout the month uniformly clear, bright, and almost colourless, and had all been well and efficiently filtered. Examined chemically, they showed excellent aeration and great freedom from organic matter, and in the words of these eminent water examiners left nothing to be desired for dietetic purposes. They say that these waters reached a condition of extreme purity somewhat earlier than usual. Even Dr. Frankland reports that the Thames water distributed by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies showed a very decided improvement upon that supplied in March, being, indeed, of superior quality to any sent out from this source during the past six months. In all cases the water was efficiently filtered before delivery. Of the water drawn from the Lea the East London Company's supply was the best, but that of the New River Company ranked above the Thames water. The supplies of both companies were duly filtered previous to distribution. The good condition of the river water derived both from the Thames and the Lea is due partly to the protracted drought that prevailed during the greater part of the month, and partly to more efficient filtration. Seen through a stratum 2ft. deep, the waters presented the following appearances:—Kent, Colne Valley, and Tottenham, clear and colourless; East London, clear and nearly colourless; West Middlesex, Southwark, Grand Junction, Lambeth, and New River, clear and very pale yellow; Chelsea, clear and pale yellow. Fortunately for Londoners, the President of the Local Government Board is now getting satisfactory information on the river water, and he will be in possession of the facts which show that it is not the river water that is at fault, but the dirty cistern system of supply, and the filthy and heated state of the cisterns in summer.

THE SWIFT, STOCKTON AND DARLINGTON RAILWAY.





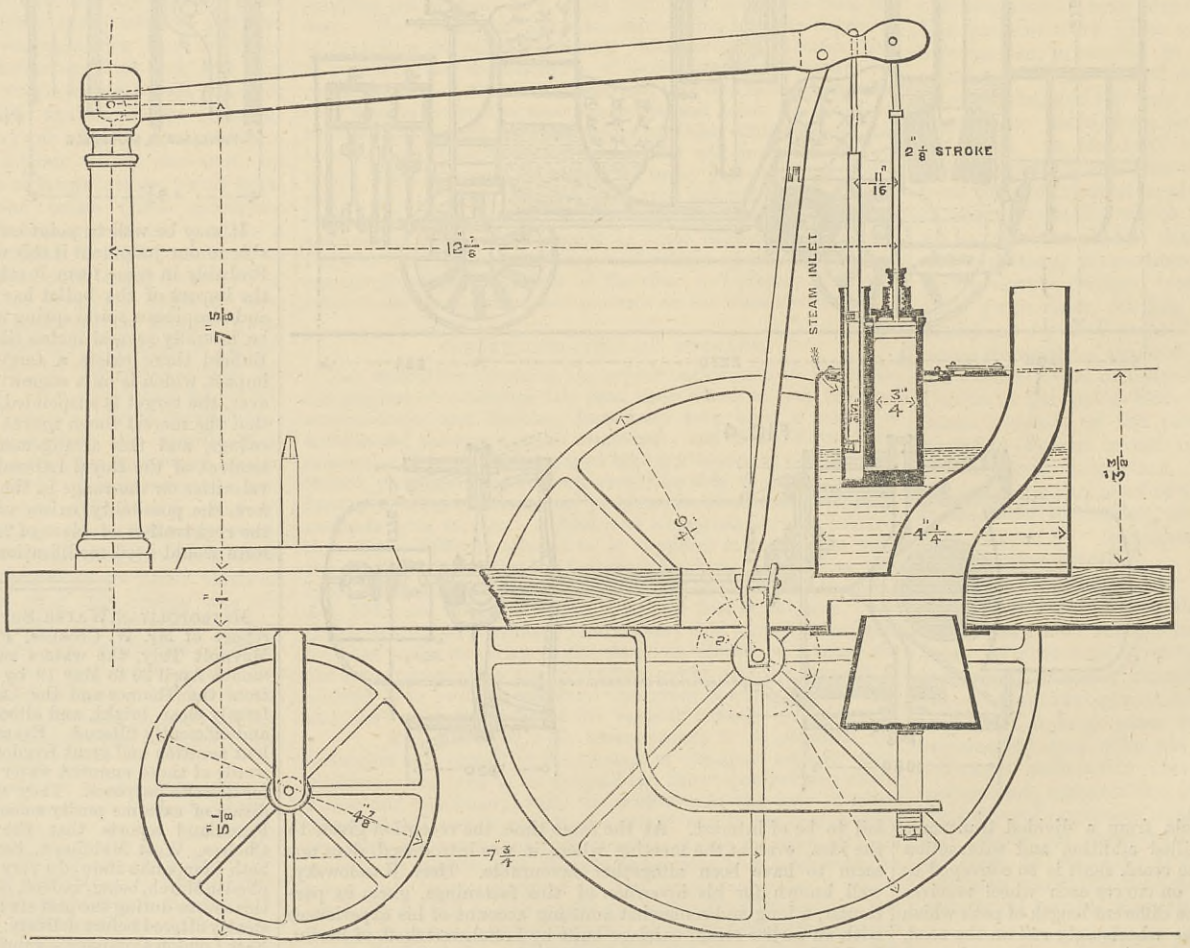
LINKS IN THE HISTORY OF THE LOCOMOTIVE.

No. XI.

In Smiles' "Lives of the Engineers," n the volume of the 1874 edition devoted to George and Robert Stephenson, will be found a very small engraving, which is a longitudinal section of Murdock's locomotive. In the "Life of Trevithick," by his grandson, and published by Messrs. Spon, in 1872, will be found a small section of the machine. We are not aware of the existence of any other section of this little engine, save that which we publish below. The machine is the property of Mr. Murdock, manager of the Sun Foundry, Leeds, and grandson of William Murdock, the friend of Watt, and the maker of the little locomotive in question. Smiles gives no dimensions or details. Mr. Murdock has, however, recently taken the engine to pieces and had a drawing made from it fully dimensioned, and we are indebted to him for a tracing from this drawing, by the aid of which our engraving has been prepared. Mr. Murdock has had the engine under steam, and found that it readily made 100 revolutions a minute when supported with the driving wheels off the ground. It is one of the most interesting mechanical relics in existence, for there is no reason to doubt that it is the first locomotive steam engine ever made in England. The first locomotive ever constructed was built by Cugnot, a French engineer. The original model was made in 1763, and the machine itself was tried in 1769. It was not successful because the boiler was too small. In 1772 Oliver Evans in America invented a steam carriage to travel on common roads. In 1784 William Symington made, it is said, a model of a locomotive in Scotland, and in the same year Murdock produced the model we illustrate. It was not until 1802 that Richard Trevithick, Murdock's pupil, took up the subject. Those who wish to learn what he did will find it fully recorded in "The Life of Trevithick," referred to above.

The Murdock model has been exhibited many times, and it is to be regretted that it does not now repose in some museum where it could be seen, while it remained in perfect safety. It consists of a flat board, at one end of which is a wooden upright on which is pivotted a wooden beam. The cylinder is placed underneath the other end of this beam. This slide valve is actuated by a tappet motion, the beam striking it up and down alternately at each end of the stroke. The connecting rod has a transverse joint near the top, intended no doubt to compensate for imperfect workmanship, in the same way that Watt used a universal joint in his earlier connecting rods, as may be seen, for instance, in a Watt engine which is, or was until a very recent date, at work at Messrs. Frost's rope works in Bermondsey. The disc seen round the vertical pivot of the steering wheel is a leaden weight, apparently put on to keep the front of the engine down, and so make it steer better. The boiler is of copper. The details are too clearly shown to make further description necessary.

We also illustrate the Swift, an old Stockton and Darlington engine. We are indebted to Mr. Graham, of the North-Eastern, and to Mr. Tomlinson, of the Metropolitan Railway, for all the little information we have obtained concerning this engine. It was in use for many years, and drew passenger trains of five coaches, weighing about five tons each. It had a boiler very like the first boiler of the "Locomotion No. 1," that is, it had a single flue—in one end of which was the fire-grate—straight through to the smoke-box. The valve motion was of the gab type, with loose excentrics, and the reversing lever shown was really double—two levers working side by side—to throw each engine into gear separately; a suspending link carrying the excentric rods. Mr. Graham states that the weigh shaft went right through the boiler, inside a transverse tube provided for the purpose. The chimney was fitted with a revolving cowl, which could be turned round to suit the direction taken by the wind.



MURDOCK'S LOCOMOTIVE, 1784.

IRON STEAMSHIPS.—Messrs. H. E. Moss and Co. state in their Steam Ship Circular that "since December a further improvement in the value of iron steamships has taken place, and that those contracted for last year cannot be repeated except at a considerable advance upon prices then ruling. Iron has fallen to about as low a point as it has ever been, the present price of ships' plates at Middlesbro' being about £6 and of angles £5 per ton, but any advantage derived from the fall in value of material, has been equalised by the great advance in labour. A large number of orders for new steamers, principally of large dimensions, have been given, and the majority of shipbuilders and engineers are consequently very full of work. There are still a few who have been holding themselves free from large engagements, and from them fairly quick delivery can be obtained. The number of steamers in course of construction is greater now than at any time during the last decade, but the losses have been proportionately heavy, and the demand greater through the gradual expansion of steam in trades hitherto carried on by sailing ships. The French Bounty Bill, which, has been promulgated and made law, has induced many French owners to give large orders, principally for new boats. A preference ha been given to French builders, but their resources are so limited that English builders have had a very large share of the work, and as we are informed that the French have now plenty of orders for some years to come, French shipowners will have to contract with English builders. Even though French builders and owners are granted premiums by their Government, we can still offer buyers such delivery and terms which make it more advantageous to build in England than in France, even though only one-half the premium is awarded to English-built steamers registered since the promulgation of the Act. America still holds to its so-called protectionism, but the day will soon come when she will have to permit the purchase of foreign built tonnage or else see the few vessels she still possesses gradually supplanted. Several orders for steamers of 3000 to 4000 tons dead weight capacity have lately been placed. Iron sailing ships, with full East Indian outfits and highest class, of about 1800 tons register, have been placed at from £12 to £13 per ton. Freights from San Francisco have ruled very high, and over £4 10s. per ton for grain has been paid from Portland, Oregon, whilst Indian freights have also been plentiful and afforded remunerative employment for both steam and sail. The emigration trade has been unprecedentedly great and is likely to continue so, but in homeward freights there is room for much improvement."

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

(*From our own Correspondent.*)

COMMON bars were in demand to-day—Thursday—and yesterday in Wolverhampton, and were to be bought at as low as £5 15s. for minimum sorts; yet buyers sought to place their orders on even less satisfactory terms to the makers. Medium bars sold at from £6 up to £6 10s.; marked bars were dull of sale at from £7 to £7 10s. and £7 12s. 6d.

Baling strip orders were likewise coming forward, and were placed at from £6 down to £5 15s. in a few instances. The iron is needed mostly upon United States account, merchants in Birmingham and Liverpool being the chief purchasers from the ironmasters. Likewise upon United States account there were inquiries for puddle bars needed by certain American iron mill owners.

Sheets were less in request than last week as to heavy lots. As a rule ironmasters declined the terms at which buyers professed they would alone purchase. Good singles were again quoted at £7 10s., doubles at £8 to £8 5s., and trebles at £9 to £9 5s. The galvanisers reported themselves well under orders, especially for Australia. Some established firms asked to-day £18 per ton for 26 w.g., packed in felt and delivered in London or Glasgow; and £16 for 24 w.g.; while in bundles, 24 w.g. was to be had at £14 10s. The same sizes are procurable on the same ratio at the works, less carriage.

Pig iron was offered to-day on slightly easier terms than could be obtained by consumers a week ago; yet consumers were less disposed to buy. Certain good hematites could have been got at a drop of 1s. 3d. a ton. The brands of all-mine pigs which could be bought at £3 had increased in number, and there were more makers of common pigs than a week ago who would accept 37s. 6d.

Coal orders were well competed for. Good furnace thick coal was 8s. a ton into boats; forge thin coal, from 7s. to 5s. 9d.; thick rough slack, 4s. 6d; thin, 3s. 3d.; and engine slack, 2s. 6d. per ton.

Exceptionally massive iron and steel making machinery is being prepared for despatch from the Wolverhampton district to Russia. The makers are Messrs. Thomas Perry and Son, Highfields Works, Bilston. The machinery consists mainly of a horizontal engine of 500 indicated horse-power, and a three-high train of 32in. rolls, having a steam-actuated platform before and behind the rolls. The mill is for the "cogging" of steel ingots, which will be subsequently rolled into rails by a 24in. reversing rail mill supplied by Messrs. Perry, who have already constructed for the same firm and have despatched to the same destination, forge and merchant trains, engines, saws, shears, straigthening and punching machines, and so forth. All has been to the order of a company of British capitalists, who are developing the coal and ironstone resources of Southern Russia, and have erected iron and steel works near to Odessa, having appliances of the most approved sort for treating very heavy masses of rolled iron and steel. The cogging mill now completed will easily manipulate steel ingots of one-ton weight. Facility in the handling of such ingots will be secured by the steam platform which is 27ft. long on either side of the rolls, and upon which the millmen will be able to ascend with the ingot and pass it pleasantly through even the topmost rolls. The following proportions will afford an idea of the weight of the machinery:—The engine, including disc crank, shafts, carriages, and wheels, weighs 115 tons; the three-high pinions and housings, 40 tons; the fly-wheel, 50 tons; the three-high rolls and housings, 65 tons; and the bed plate, couplings, and spindles, 34 tons. Because of the extra high railway rates and carriers' charges made for the weights above 10 tons each piece, the last described 149 tons, out of this total of 304 tons, are being cast from the blast furnaces in Russia. I had an opportunity of inspecting the engine and the other machinery which has just been finished at the Highfields Works, and have no recollection of a high-pressure engine of this power of more suitable or more economical construction for the work which it has to do. The engine was not fitted with a condenser. It was heavy, strong, and powerful, wholly devoid of ornamentation—a model of a plain substantial engine suitable for a first-class ironworks. The fly-wheel and the driving wheel shafts, each of from six to seven tons, are of hammered iron, and run in gun-metal bearings. Taking in the fly-wheel, the engine as it will stand will cover a length from end to end of some 65ft. I am inclined to think that there is nothing in that country similar to the steam lift described. Its value, however—almost its indispensableness—for manipulating one-ton ingots in three-high rolls is manifest. Messrs. Perry and Son have made some of the best mill machinery standing at ironworks in this country and upon the Continent.

The safe trade is unusually good for this season of the year. Export orders are finding full employment for most of the operatives, but the firms who confine themselves to the home trade are comparatively quiet.

Manufacturers hereabouts continue to view with dissatisfaction the strong tendency towards protection shown by the French Commissioners to engage with the representatives of our own Government in discussing the next French treaty, and on Friday last the Wolverhampton Chamber of Commerce adopted the following resolution:—"That this Chamber, having regard to the fact that the French Legislature has decided to adopt specific instead of *ad valorem* duties, and that the duties on hardware and iron are at present prohibitory, considers that unless the new treaty be distinctly in the direction of free trade it will be desirable to refrain from negotiating a treaty altogether, and thereby relieve ourselves from existing obligations." This resolution the secretary was instructed to forward to the English Commissioners, and also to send a copy of the foregoing resolution to the Commissioners appointed to negotiate with the French delegates with reference to the proposed new treaty, and also to Mr. C. J. Monk, M.P., and to Mr. James Hole, secretary of the Associated Chambers of Commerce.

The nut and bolt manufacturers are displaying a readiness to remove from the minds of their men all reasonable cause for uneasiness or dissatisfaction. They have, therefore, as an association, indicated to the men's secretary that they are prepared, eight of them, to meet as many delegated workmen, and together discuss the points which the men have raised about the deviation of sizes.

Agents are being sought in this district for the sale of a German polished horse-nail with varied hammered heads, and the United Horse-nail Company are pushing the sale of the Globe horse-nail, yet the poor operative horse-nail makers with the strange infatuation which now and again seizes them, have turned out on strike for the 3s. per 1000 wages rate. Not only is the competition of machine-made horse-nails severe, but the stocks of hand-made nails in the warehouses of local firms are mostly heavy. There is, therefore, little prospect of the strike being very successful.

An important exhibition of dairy stock produce, and appliances, poultry, goats, bee-hives, wool, &c., was opened yesterday—Tuesday—at Bingley Hall, Birmingham.

There is every prospect of a working arrangement being made between the colliery owners and the mineowners touching the requirements of the Employers' Liability Act. It is merely a question of the relative payments of employers and employed to the mutual insurance scheme that has found general favour. There have been interviews between miners' delegates and mining engineers. As was to have been expected, these can as yet hardly see eye to eye. It is established that the present system of what is locally termed "field pay," and relief in the case of accidents costs the masters a third part more than the men per week. Under the projected scheme a payment will be needed of 4d. per week in all, and the advantages of the men will be largely augmented. Thin coal miners are willing to pay 3d. per week to the masters' 1d.; but the thick-coal men, who have hitherto paid nothing, desire to contribute only 1d. to the masters' 3d. The mining engineers, on their part, hold that they should pay 2d. to the masters' 2d. The question is being again laid before the miners in the fashion peculiar to unionist arrangements.

The Birmingham Corporation are likely soon to be ridding their chief streets of the unsightliness of the overhead telegraph wires, and at the same time remove the risk which accidents to these wires occasion to the safety of the public who use the thoroughfares. At a meeting of the Corporation on Tuesday, the Public Works Committee were, upon the motion of the Mayor, instructed to report as to the feasibility of laying down telegraph wires under the footpaths, instead of carrying them over the streets. The mayor said that he did not propose that in all the streets this should be done, but he held that they might very well begin by clearing the main streets of the wires. Upon this theme it is noteworthy that the Corporation of Stafford objected to allow the Imperial authorities to usurp their functions. The Postal Telegraph Department having made application for permission to lay down telegraph wires in pipes through Stafford town, began the work before they had obtained the sanction of the local authorities. At the last meeting of the Stafford Town Council, the Mayor moved, and the Council unanimously carried, an amendment to a proposal of the Waterworks Committee to sanction an application of the Post-office authorities. By this amendment the matter has been deferred for further consideration. It was also resolved that "notice be sent to the contractor for the work, and the engineer of the Telegraph Department."

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Whitsuntide is so altogether a holiday season in this district that no really serious attempt at business has been made during the past week. The usual market was held on Tuesday, but although there was a moderate attendance, there was almost a complete absence of any inquiries, and prices were scarcely mentioned. As there was nothing doing to actually test prices, quotations can merely be said to be nominally without alteration.

During the few days prior to the holidays, a limited amount of business was being done. A few sales of Lancashire pig were made at about late rates, makers' quotations for delivery into the Manchester district remaining at about 43s. for No. 4 forge, and 44s. for No. 3 foundry, less 2½ per cent., and one or two transactions are reported in good brands of Lincolnshire and Derbyshire forge iron at prices equal to about 43s., less 2½, delivered into Manchester, but there are considerably lower figures than those current in the market, and the whole of the transactions put together do not represent any great weight of iron. Middlesbrough iron is quoted at about 46s. 10d. per ton net cash delivered equal to Manchester, but the lower prices at which other brands can be bought practically keep north-country iron out of this market.

The finished iron trade has continued very dull, and beyond a moderate demand for sheets, which, delivered into the Manchester district, are quoted at about £7 15s. per ton, there has been very little new business stirring. For bars delivered into the Manchester district the average quoted prices remain at about £5 12s. 6d. to £5 15s. per ton.

In some cases iron and engineering works have been closed for the whole of the week, and generally operations were stopped for the holidays on Tuesday evening until the commencement of next week.

In the coal trade the position of affairs is much the same as in the iron trade. The collieries throughout the Manchester district were stopped on Tuesday and Wednesday until next week, and in other Lancashire districts work is more or less interfered with by the holidays. For all classes of fuel the demand has been extremely dull, house fire coals moving off very slowly owing to the season of the year, whilst the stoppage of works has restricted the requirements of the lower qualities for ironmaking and manufacturing purposes. Very low prices are being quoted for gas coal contracts, which are being placed at about last year's rates. With the exception of the better classes of slack, which are scarce, there is generally a want of firmness in prices, and a good deal of underselling to secure orders. The average quoted prices at the pit mouth are about as under:—Best coal, 8s. 6d. to 9s.; seconds, 6s. 6d. to 7s.; common house coal, 6s.; screened gas coal, 6s. 6d. to 7s.; steam and forge coal, 5s. to 5s. 6d.; burgy, 4s. 6d. to 4s. 9d.; good slack, 3s. 9d. to 4s. 3d.; with the best sorts about 3d. per ton more.

The other day I paid a visit to the engineering works of Mr. Wm. Turner—late Ommaney and Tatham—Salford, and had an opportunity of inspecting one or two novelties which the firm are bringing out. A powerful hydraulic cotton baling press, which was being constructed for an up-country station in Egypt, first attracted my notice. Mr. Turner's patent presses are already well known, and a description of their principle is therefore not necessary; but hitherto, so far as Egypt is concerned, they have been erected only at Alexandria, where the final packing of the whole of the cotton for shipment is at present performed. The obvious advantage of baling the cotton in the interior would, however, seem to have become apparent, and the press which I saw is the first which is being sent out for this purpose. This press has been specially designed to meet the requirements of an up-country station, and of course is not so massive in construction as those in use at Alexandria, but it is intended to press the cotton by means of five hydraulic rams to the same density as by the larger machines.

The introduction of complicated machinery into flour mills is rendering a careful attention to driving power and gearing an increasing necessity, and Mr. Turner is constructing special machinery to meet the requirements of high milling, which, although not, perhaps, absolutely new inventions altogether, may be briefly referred to. These consist of a roller mill—Dark's patent—for crushing wheat and middlings, driven by an engine with Dark's patent automatic cut-off gear. The chief feature in the mill is the method of ensuring an equal pressure of the rollers. In many cases this is effected by means of independent screws and springs on each side of the roll, the adjustment of which is left to the skill of the attendant, but in Mr. Turner's mill the pressure is applied through a spring in the centre of a beam free to move on a central pin, and the ends of this lever are connected by suitable links to the bearing of the back roller. By this method any pressure applied to the centre is equally divided on each side, and an equal pressure is secured throughout the whole surface of the roll. This machine, which was exhibited, together with an 8-horse engine, fitted with Dark's cut-off gear at the London Flour Mill Exhibition, has, I am informed, been tested for several months crushing 3500 lb. of wheat per hour.

In passing through the works my attention was also directed to an apparatus for filling air vessels with air, and for reducing the heavy beat of valves. The apparatus is very simple in construction, and as applied to an ordinary pumping engine consists of a small cylindrical vessel with no working parts, the water itself forming the piston. At the bottom of the vessel is a small pipe fitted with a regulating cock, which is attached to the pump valve box, immediately below the delivery valve, and at the top of the vessel is fixed a small gun-metal valve-box, fitted with inlet and outlet air valves, and from this a delivery pipe communicates directly to the air vessel. I understand that a number of these small machines are now working at waterworks and collieries.

Barrow.—My reports for the last few weeks have hinted that the output of hematite pig iron must shortly be reduced, should the demand continue in its present dull state. Makers, I am assured, will considerably lessen the output of metal when existing contracts are worked out a little more, as the demand does not meet the supply, or anything approaching it. Stocks are accumulating very rapidly, and makers recognise the necessity of drawing the line pretty soon. The only reason that can be assigned for keeping up the heavy output for so long a time is that makers were over-sanguine of an early advance; and the fact of there being so much metal on hand delays the advance in prices much more than it otherwise would have been. I should not be at all surprised if even lower figures were reached than those now quoted, and buyers, or those in want of pig iron, seem to hang back from placing their orders from a similar impression. This week the holidays interfere a good deal with business, and the transactions made cannot, perhaps, be taken as a sure indication of the tone of the market; still, the tendency is downward. All round qualities of Bessemer are selling at about 56s. per ton, and No. 3 forge, 53s. Iron ore is in very fair demand. The steel trade is busy, though Whit week has interfered with the work. Prices are low, and makers are not over anxious to contract on that account. A very fair tonnage of this metal is being shipped. The shipbuilding trade is busy, and a very heavy tonnage of shipping will soon be launched; they have work for some little time longer. The coal and coke trades are only quiet. Shipping moderate.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THE Whitsuntide holidays have interfered as usual with the work in the mills and other works during the week. There is no town in England where Whitsuntide is more heartily held, and with the exception of one or two departments in which work cannot well be suspended, general holiday is held. The engineers and boilermakers are ordinarily busy at these seasons in the repairing of machinery which has got out of gear, or in laying down new plant, and making extensions.

I hear of several fresh orders for steel rails being received in this district during the past fortnight, and the inquiry is not confined to the railway companies of England and Scotland. A considerable weight of rails is being produced for the United States, as well as for New South Wales, and several of the South American districts. Prices are maintained at the figures quoted last week—£6 5s. per ton, which just leave a profit, and no more.

The activity of the shipbuilding yards tells favourably on the firms engaged in the manufacture of boiler and ship plates. These have never been busier than they are at present. The armour-plate department is also fully employed both at the Atlas and Cyclops works.

Messrs. Ball and Burgon, sheep-shear manufacturers, Malin Bridge, Sheffield, have heavy orders in hand at present for South America. This week they sent off seven dray-loads, which were the first shipment of a large order for that market. I am informed that the other producers are also well off for orders.

From returns kindly supplied by Dr. Webster, the American consul, I learn that the exports of Sheffield goods to the United States for the month of May show a considerable increase compared with the total amount of exports in May of last year. In May, 1881, the total value was £121,379, as compared with £99,878 in May, 1880; while the total is £21,501 in excess of the corresponding month of last year, it is noticeable that the value of cutlery exported to the States has decreased by £781, and steel by £1767.

The iron trade continues very quiet. At Elsecar a good order for rails and plates has been secured; and at Thorncliff the workmen engaged in the manufacture of gas apparatus are well employed on the contract for the new gasworks at Manchester. Very little pig iron is being made at present, and the lessened production has the effect of causing prices to be firmer.

Large stocks of coal accumulating on the pit banks form the best proof of the stagnation in the coal trade. In steam coal the keen competition keeps prices very low. I see it stated that more than half of the coal sent to the Humber ports is now carried by water, owing to the lowness of the freights. If it be true that coal is now being carried to Goole at 1s. 6d. per ton, this rate is 9d. less than the railway charge.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

As might have been expected there was but a small attendance at the Cleveland iron market at Middlesbrough on Tuesday. Fully two-thirds of the usual attenders were absent, either holiday making or from some other cause. There was very little either buying or selling, what transactions did take place gave evidence of a lower level of prices to the extent of about 3d. per ton. No. 3 g.m.b. may now be said to be 36s. 3d. at makers' works; forge 1s. per ton less, warrants 9d. per ton more. The expectation that three furnaces might be put out of blast at Monkland, near Glasgow, has been disappointed; as it seems to have been decided to carry them on under the management of trustees. The statistics for May have been published, and to them may, in part, be attributed the lowering of prices. It appears that 2021 tons more Cleveland iron was made in May than during the previous month, besides 1455 tons more of hematite. The number of furnaces on both kinds of iron was exactly the same as before, viz., 94 on Cleveland and 25 on hematite, but the month was one day longer. The net increase of stocks was 13,376 tons, or very much in excess of what even pessimists predicted. Shipments were 78,894 tons, against 81,829 tons for April, which again is regarded as the reverse of favourable. Altogether the returns seem to point towards lower prices, and some say that 35s. for No. 3 will very shortly be reached. Nothing apparently is likely to produce a reaction except the blowing out of some furnaces somewhere. It is not expected that this will be in Cleveland, on account of its more than usually favourable position as to cost of production. At all events, Cleveland firms maintain considerable cheerfulness as to the issue of the severe struggle which is now going on, and the severity of which is likely to increase.

In manufactured iron there is no change to report. All the works have been standing for the holidays, but recommenced on Wednesday. The ironworkers have apparently scarcely yet realised the downward turn that trade has taken, for they are still troublesome at various works. At Bowesfield the puddlers are on strike for some concession as to prize money which was given at the West Stockton Works when they were restarted under a new management a short time since. Should they get their way now the alteration will no doubt have to be made at all the works, although it is directly contrary to the provisions of the sliding scale arrangement which was mutually agreed to. At both the plate mills at Middlesbrough there has been prolonged trouble with the shearers' helpers, who obtained so large an advance in the spring. These men, having more money than they can legitimately spend, lie off and get drunk on the slightest excuse, and generally three or four at a time. A stoppage of the mills is the result. Four or five of such delinquents were before the stipendiary magistrate a week or two since, and were fined £6 each, including costs, which they are now repaying at the rate of 5s. per week. They were all Irishmen. It is not generally known that the late Mr. Henry Pease was a considerable owner of steam shipping property. He at all events was the sole proprietor of three very fine cargo ships which trade from Middlesbrough, and are under the management of Mr. William Taylor. It is believed they have been very successful since they started three years since, having been mainly employed in exporting iron, steel, and coal, and in importing Spanish ore.

It has been announced that Mr. Proudlock, from the works of Messrs. Robert Stephenson and Co., of Newcastle, has been appointed general manager of the Tees-side Iron and Engineering Co., Limited. It is also said that the site of the old rolling mills is about to be devoted to the building of marine engine works, the outlay required being estimated at £50,000. A new industry of this kind located at Middlesbrough will be most advantageous to the town. The firm of Blair and Co., at Stockton, has achieved a reputation for marine engines second to none, and there is no

reason why a trade so much in requisition, and already so successfully established in the district, should not be extended. The chairman of the company is Mr. Henry Fell Pease, eldest son of the late Mr. Henry Pease.

The annual report of the Skerne Ironworks Company at Darlington has been issued. The present company has had possession only one year, and has suffered a loss during that time of about £8000. This arose mainly from buying a large quantity of pig iron at the high prices of last spring, and being unable to effect sales of finished iron to a corresponding extent, until the heavy fall in the market, which rapidly followed, had taken place. Losses of this kind are unfortunately only too common in the iron trade, and are what make it the notoriously risky business it is. The chairman, Mr. Corner, of Whitby, was able to offer a crumb of comfort to the disappointed shareholders by reminding them of the result of Mr. Parker's recent experiments on corrosion. These proved, he said, that mild steel corrodes in ships 19 per cent., and in boilers 44 per cent., faster than ordinary iron. The samples of the latter which stood so well were partly from the Skerne Ironworks.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

EXCEPT that the past week's shipments of pig iron have been considerably larger, there is no marked improvement in the trade. The shipments amounted to 14,509 tons, as compared with 11,943 in the preceding week and 13,193 in the corresponding week of last year. This is so far satisfactory, but the exports for the year to date exhibit the large falling off of 118,000 tons, which it is hardly likely will be made up for during the remainder of the year. There has been a fair business doing in warrants on speculative account, but the demand for makers' iron is limited, and prices a shade easier. The week's additions to stocks amount to 1255 tons, bringing up the aggregate to 561,778, and this is only the stocks in Messrs. Connal and Co.'s stores, exclusive of those in makers' yards. The same number of furnaces continue in blast, viz., 121, as against 116 a year ago. Continental and American advices still represent the inquiry for Scotch pig iron as dull, and the prices as weak.

Business was done in the warrant market on Friday forenoon at 45s. 7½d. to 45s. 10d. cash, and 45s. 9d. to 45s. 10d. one month; the afternoon prices being 45s. 8d. to 45s. 10½d. cash, and 45s. 9d. to 46s. one month. The market was closed on Whit Monday. On Tuesday the market was somewhat affected by the report of the large increase of stocks in Cleveland during the past month. Transactions were effected at 45s. 11d. cash and 46s. one month to 45s. 8½d. cash, and 45s. 10d. one month. Business was done on Wednesday at from 45s. 9d. to 45s. 10½d. cash, and 45s. 11½d. one month. The market was firmer to-day—Thursday—at 46s. cash and one month, to 46s. 3d. cash, and 46s. 4½d. one month.

Makers' iron is quoted as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 54s. 6d.; No. 3, 47s. 6d.; Coltness, 55s. and 48s.; Langloan, 55s. 6d. and 47s. 6d.; Summerlee, 54s. and 46s. 6d.; Calder, 54s. 6d. and 47s.; Carnbroe, 51s. and 46s. 6d.; Clyde, 48s. 6d. and 45s. 6d.; Monkland, 47s. and 45s.; Quarter, 47s. and 45s.; Govan, at Broomielaw, 47s. and 45s.; Shotts, at Leith, 55s. 6d. and 49s.; Carron, at Grangemouth, 52s. 6d. (specially selected, 56s.) and 51s. 6d.; Kinneil, at Bo'ness, 47s. and 45s.; Glengarnock, at Ardrossan, 51s. and 47s.; Eglinton, 46s. 6d. and 44s. 6d.; Dalmellington, 46s. 6d. and 44s. 6d.

Manufactured iron is flat and prices are lower, bars now ranging from £5 15s. to £6 5s. per ton; iron boiler plates, £6 15s.; ship plates, £6 10s.; angles, £5 12s. 6d.; steel boiler plates, £11 10s. Engineers, as a rule, continue well employed.

There has been rather more doing in the coal trade, the coastwise shipments for the week being 19,861 tons, and the foreign 36,812, a total of 56,673 tons, as compared with 52,646 tons in the preceding week, and 48,415 in the corresponding week of last year. The backward weather has tended somewhat to improve the inland demand. The trade at Glasgow, Leith, Burntisland, Ayr, Troon, and Irvine has been good, but at some of the other ports there has apparently been less doing. Main coals sell, free on board in the Clyde, at 5s. 6d. to 6s. per ton; ell, 6s. to 6s. 6d.; and split, 6s. 6d. to 7s. These prices are low, and such as ought to attract customers.

An attempt has been made to establish a new miners' society in the Glasgow district. About 600 have joined, and it has taken the name of the Scottish Association. But the colliers are just now disinclined to unite, being apparently of opinion that the unions bring them nothing but trouble. At one of the Clackmannan collieries the men have struck work on account of the erection of a new weighing machine, which they contend tells to their disadvantage. The miners of Fife and Clackmannan celebrated the anniversary of the eight hours' movement at Leven, in Fifeshire, on Saturday, when between 5000 and 6000 were assembled, with bands of music. Mr. Macdonald, M.P., who was prevented by illness from being present, sent the men a letter, in which he deplored the proposal of the miners of Mid and East Lothian to break up their union and distribute the funds, and called upon the miners of Fife and Clackmannan to stick by their association. He added that in a short time there would be a great struggle to get improvements that were so much needed in the mines of this country. The secretary, Mr. Weir, submitted the financial statement, showing that the funds amounted to £1324. Resolutions were passed in favour of sweeping away entirely the doctrine of "common employment;" preventing employers from contracting out of the Liability Act; and in favour of the extension of the borough franchise to the counties.

The directors of Young's Paraffin Light and Mineral Oil Company, Limited, have issued their annual report, in which they state that they have made a profit of £27,338, out of which they propose to pay a dividend of 5 per cent., carrying forward £3000 to next account.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

THE condition of the coal trade is still favourable, the demand being well maintained, and prices are showing a greater degree of firmness than they have exhibited for some time. Whether this will culminate in an advance it is difficult to state—I am inclined to think not. There are several collieries which have not worked full time on account of faults or wagons running short or so, and when the Blaenavon collieries, two in number, and the additional one at Tredegar now being fairly completed by the vigour and ability of Mr. Beith are ready, the large output of the district will be still more considerably increased.

I am glad to note that my warning *in re* the sliding scale has been taken up by the local papers, and some good may result.

Cardiff keeps up its exports of coal well, and matters are better both at Newport and Swansea. The total from Wales was slightly over 150,000 tons for the last week.

It is contemplated to place a steel plant at Tredegar equivalent to an output of 1000 tons weekly. The blowing engine is to be erected in the place of one of the old furnaces, and as the new cupola and railway facilities will be all centred near, Tredegar will be as compact a works as any. Cyfarthfa will probably have six furnaces raised, and plant that will be equal to turn out 2000 tons of steel rails per week. There is a large contract closed for Bilbao ore, which I learn from Penarth is to be stocked there to a very large extent. Stoppage of ironworks seems to be the order of the day. Briton Ferry is now added to the long list, and I am daily expecting that another in the vicinity of Swansea will follow suit unless times improve.

The remainder of the Warlich fuel plant is to be cleared off by auction.

The Cardiff coalowners are tendering for 36,000 tons of coal to the Alta Italia railways, but as trade is good, I do not think that low prices will be sent in.

The imports of ore from Bilbao have again attained a respectable size. Last week 10,000 tons came in to Newport and 14,000 to Cardiff. The total quantity of iron and steel sent from Newport and Cardiff amounted to 11,700 tons.

Pitwood is depressed in price on account of the large imports.

A strike has been existing at Briton Ferry Tinplate Works for some time, but I am glad to hear on the eve of the dispatch of my parcel that it has been brought to a close, and this week work will be resumed.

A Welsh daily paper calls attention to the catastrophe of the Doterel, and points out that two of the witnesses depose to seeing a column of dense black smoke shooting into the air. This, says the writer, could not come from exploded gunpowder, nor from a boiler, but must have come from coals. I note the hint as a valuable one in tracing out the cause of the calamity.

The Messrs. Beddoe, of Llancaiach, have been again fortunate in their colliery speculations, having struck the Black Vein steam coal this week. This working is at Machen; the vein is 5ft. thick, and of the first quality.

Some little excitement was caused in the Swansea district this week by the announcement that the Queensland Government contract for steel rails had gone to Scotland. Prices of steel rails remain firm. For iron the demand is small.

There has been a stoppage in part at Treforest owing to breakage.

The articles in THE ENGINEER some time ago regarding the qualities of steel, and the almost utter impossibility of getting uniformity, have received an illustration by recent breakages, of piston rods, &c., in this district.

Nearly all the Cyfarthfa horses, 100 in number, were sold by auction this week. Some augur a restricted steel work from this, but I read a change for the better. Cyfarthfa has persistently kept to old-world customs, and horse power where locomotive would have been better and far cheaper has been maintained. We shall now see, I fully expect, small locomotives used freely, and if Ynysfach Works are again used, they will be indispensable.

OPENING OF A NEW RAILWAY.—The section of the Banbury and Cheltenham Railway between Cheltenham and Bourton-on-the-Water was opened for traffic on Wednesday, the 1st inst. The line is sixteen and a-half miles in length, and includes a long viaduct and tunnel. The line was constructed by the Banbury and Cheltenham Company, but is being worked by the Great Western Company. The other section of the railway between Chipping Norton Junction and Banbury is in progress.

THE NEW ATLANTIC CABLE.—The telegraph steamer Faraday, Captain Maypee, left Mount's Bay at 5 o'clock on Wednesday evening for Whitesand Bay, Land's-end, to lay the shore end of the new Atlantic cable. The weather had become much more moderate, and the sea was considerably calmer. By a quarter-past ten the shore end had been successfully landed. The Faraday will proceed to London for the remaining section of the cable, 900 miles of which have already been laid on the American side.

SOCIETY OF ARTS.—The Council of the Society of Arts gave a conversazione on Thursday night, the 2nd inst., at the South Kensington Museum, when considerably over 2000 guests were present. The company was received by Mr. F. J. Bramwell, F.R.S., and other members of the Council. A promenade concert was given by the string band of the Royal Engineers in the North Court, and in the picture gallery Madame Frickenhaus gave a pianoforte recital. Mr. Corney Grain, in the lecture hall, amused crowded audiences at intervals during the evening with an account of the efforts made in a country town to elevate the masses, by means of concerts and other entertainments, which he illustrated with some cleverness, vocally and instrumentally. The courts and corridors of the ground floor were open, as well as the galleries containing the Raphael cartoons, the Sheepshanks, Pryce Owen, and other collections.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

31st May, 1880.

2375. MAGNETO-ELECTRIC MACHINES, H. E. Newton.—(*C. A. Hussey and A. S. Dodd, New York.*)
2376. VALVE, C. Wenner, Switzerland.
2377. FININGS, E. J. T. Digby, London.
2378. FIRE-ARMS, W. Nokes, Birmingham.
2379. LAMPS, E. P. Alexander.—(*E. Gény, Paris.*)
2380. WETTING SCYTHES, M. Bauer.—(*T. Jacquot and J. Thirion, France.*)
2381. PRINTING PHOTOGRAPHS, H. A. Bonneville.—(*W. H. Guillebaud, Marion, U.S.*)
2382. SHUTTER-WORKERS, H. A. Bonneville.—(*F. D. Blake, New York, U.S.*)
2383. GRINDING, &c., SURFACES, F. M. Robertson and R. R. Gubbins, New-cross, London.
2384. STEAM ENGINES, H. J. Haddan.—(*J. H. Cain, U.S.*)
2385. VENTILATOR, H. J. Haddan.—(*R. Evans, Canada.*)
2386. DISPLAYING ADVERTISEMENTS, H. J. Haddan.—(*A. Anderson, Paris.*)
2387. GRINDING, H. Gibbons, Hungerford, Berks.
2388. EVAPORATING, W. R. Lake.—(*C. Lachaize and C. Tetevuide, Paris.*)
2389. PREVENTING SLIPPING, W. R. Lake.—(*E. Willms, A. Lequin and E. Le Gallois, Paris.*)
2390. PIANOFORTES, W. R. Lake.—(*A. K. Hebard, U.S.*)
2391. PHOSPHATE of LIME, E. Solvay, Brussels.
2392. IMPROVED HARROW, J. McKinley.—(*R. Cokerell, Melbourne.*)
2393. REVERSIBLE SLAB, B. Tomkys and W. Tattersall, Haslingden.
2394. ELECTRIC CIRCUITS, S. Pitt.—(*O. Lugo, U.S.*)
2395. WHEELED VEHICLES, S. Pitt.—(*P. Herdic, U.S.*)
2396. BED BOTTOMS, H. Orth.—(*C. H. Dunks and J. B. Ryan, New York, U.S.*)
2397. FURNACES, W. P. Thompson.—(*Messrs. F. and J. Pages, Paris.*)
2398. TELEPHONES, R. M. and W. van Lockwood, U.S.
2399. GRADUAL REDUCTION of GRAIN, W. P. Thompson.—(*W. D. Gray, Milwaukie.*
2400. BOTTLE STANDS, C. Farrow & R. Jackson, London.
2401. PLOUGHS, J. Cooke, Lincoln.
2402. ELECTRIC LAMPS, G. Hawkes, London, and R. Bowman, Ipswich.
2403. PAINT, D. Brown and R. Mitchell, Cornwall.
2404. AERATED WATER, R. Seager, Ipswich.
2405. ARMCHAIR, W. H. Beck.—(*E. Dubreil, France.*)
2405. CHIMNEY TOPS, W. Chrystal, London.
2407. FIRE-ARMS, A. M. Clark.—(*A. Hape and A. S. Oliver, Elberton, U.S.*)
2408. FORCING WATER, A. Clark, London.
2409. SPRING BALANCES, C. Maschwitz.—(*E. F. Grell, Hamburg.*)
2410. QUARRYING SLATE, &c., A. M. Clark.—(*A. R. Reese, Phillipsburg, U.S.*)

1st June, 1881.

2411. TRANSMITTING MOTIVE-POWER, J. Aylward, Birmingham.
2412. ORNAMENTAL SURFACES, J. Cowan and O. Stuart, Liverpool.
2413. GLOBE HOLDER, J. Chatwin and H. Shipway, Hay Mills.
2414. MILANAISE, J. A. Sparling, Highgate.
2415. FABRICS, J. Cocks, Upper Norwood.
2416. MAGNETO-ELECTRIC MACHINES, F. Wolff.—(*Prof. C. P. Jurgensen and Dr. L. V. Lorenz, Copenhagen.*)
2417. CUTTING GRASS, H. H. Duke, Westburg.
2418. METALLIC FENCING, E. Steer and J. Sheldon, Birmingham.
2419. DEFLECTION of SHOT, &c., F. Panzera, Harwich.
2420. FURNACES, J. Henderson.—(*J. Russell, Rangoon.*)
2421. ORGANS, W. Evans and R. Jarrett, London.
2422. FLUID METER, W. R. Lake.—(*L. Jacquet, Paris.*)
2423. AMMONIA W. L. Wisc.—(*H. Grouven, Saxony.*)

2nd June, 1881.

2424. SEWING MACHINES, G. F. Elder, Lochee.
2425. ORDNANCE, W. Palliser, London.
2426. LOOMS, R. L. Hattersley & D. Bailey, Yorkshire.
2427. WAGONS, J. C. Martin, Bengal, East Indies.
2428. CLEANING KNIVES, J. Hargrave, Burley.
2429. HAMMERING METALS, H. Mainwaring, Manchester.
2430. ALARM APPARATUS, F. Wirth.—(*J. Weber, Uster.*)
2431. RAILWAY SIGNALLING, T. M. Ford, London.
2432. PERAMBULATORS, T. G. Wells, Birmingham.
2333. POTATO DIGGERS, W. Dewar, Strathmartin.
2434. LOOMS, G. H. Smith, Manchester.
2435. SAFETY VALVES, W. Payne, Birmingham, and W. Fisher, Tipton.
2436. BREECH-LOADING RIFLES, R. Hibbert.—(*V. Saverbrey, Switzerland.*)
2437. METALLIC CIRCUITS, E. Edmonds.—(*G. M. Mowbray, U.S.*)
2438. CLEANING COTTON SEED, G. Welburn, Grovehill.
2439. MOSS PEAT, F. Versmann.—(*E. Meyer and Co., Brunswick, Germany.*)
2440. SILK STUFF, F. A. Arbenz, Switzerland.
2441. CALCULATING APPARATUS, H. H. Lake.—(*H. Beaucourt, France.*)

3rd June, 1881.

2442. TAPS, &c., J. Corbett and W. Lochhead, Glasgow.
2443. REGULATING FLOW of WATER, C. H. von Ullner, Euston-road, London.
2444. MIDDLINGS PURIFIERS, W. H. Dickey.—(*G. T. Smith, Jackson, U.S.*)
2445. SUPPORTING the NET in LAWN TENNIS, R. H. Edmondson, Manchester.
2446. SPIKES, &c., S. E. Mossberg, Sweden.
2447. COMBING COTTON, W. R. Moss, Bolton.
2448. SUBSTITUTE for MALT, E. Martin and R. Benns, London.
2449. MEASURING ELECTRICAL POWER, C. Boys, Wing.
2450. PERFORATING INSTRUMENTS, D. Gestetner, London.
2451. STYLOGRAPHIC FOUNTAIN PENS, J. Nadal, London.
2452. OPERATING FANS, E. J. C. Fear, Redland.
2453. ROADWAYS, &c., J. Herd, Birmingham.
2454. ROTARY PUMPS, S. Mellor, London.
2455. MECHANICAL FOGHORNS, J. Sturge and J. Grubb, Birmingham.

4th June, 1881.

2456. LOCOMOTIVES, J. Bottomley, Manchester.
2457. FEEDING PAPER to PRINTING MACHINES, J. H. R. Dinsmore, Liverpool, and F. Hoyer, Waterloo.
2458. ADVERTISEMENTS, H. H. Banyard.—(*J. I. Czettel, Vienna.*)
2459. AXLE PULLEYS, F. Ryland, West Bromwich.
2460. TIN, &c., PLATES, J. Spence, Walbrook.
2461. FINGER EXERCISES, F. H. F. Engel.—(*F. Moller, Hamburg.*)
2462. SOAP LEYS, C. Thomas, Bristol, and A. Domeier, London.
2463. DISINTEGRATING, C. E. Hall, Sheffield.
2464. TILES, J. Taylor, Clapham-road, London.
2465. HANDLES of KNIVES, W. R. Lake.—(*C. Couzon Grimaud, Paris.*)
2466. BORING BROOM STOCKS, S. Ludbrook, London.

6th June, 1881.

2467. FIXING WHEELS upon AXLES, R. Hansell, Sheffield.
2468. NECKTIES, W. R. Lake.—(*J. H. Fleisch, U.S.*)

Inventions Protected for Six Months on deposit of Complete Specifications.

2384. OSCILLATING STEAM ENGINES, H. J. Haddan, Strand, London.—A communication from J. S. Cain, Louisville, U.S.—*31st May*, 1881.
2394. ELECTRIC CIRCUITS, S. Pitt, Sutton.—A communication from O. Lugo, New York, U.S.—*31st May*, 1881.
2395. WHEELED VEHICLES, S. Pitt, Sutton.—A communication from P. Herdic, Philadelphia, U.S.—*31st May*, 1881.
2396. SWING WOVEN WIRE BED BOTTOMS, H. Orth, Washington, U.S.—A communication from C. H. Dunks and J. B. Ryan, New York, U.S.—*31st May*, 1881.
2369. TELEPHONES, &c., R. M. and W. van O. Lockwood, New York, U.S.—*31st May*, 1881.
2437. METALLIC CIRCUITS, E. Edmonds, Fleet-street, London.—A communication from G. M. Mowbray, North Adams, U.S.—*2nd June*, 1881.

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

2197. POTATO PLANTING, G. W. Murray, Banff, and T. Ferguson, Kinnochtry.—*1st June*, 1878.
2176. STEAM BOILERS, J. Horrocks, Ainsworth.—*31st May*, 1878.
2181. SCREW PROPELLERS, H. Puller, Perth.—*31st May*, 1878.
2191. RADIATING AXLES, J. MacLachlan, Glasgow.—*1st June*, 1878.
2209. CUTTING, &c., FIREWOOD, F. Kingston, Greenwich.—*1st June*, 1878.
2233. EXHAUSTING GASEOUS BODIES, W. E. Newton, London.—*9th June*, 1878.
2247. SHEEP SHEARS, T. Brown, Sheffield.—*5th June*, 1878.
2260. BLAST FURNACES, W. Ferrie, Lanarkshire.—*6th June*, 1878.
2283. WATCHES, D. A. A. Buck, Worcester, U.S.—*7th June*, 1878.
1945. FINISHING PRINTED SHEETS, H. J. Gill, Dublin.—*4th June*, 1878.
2206. THRASHING MACHINES, W. R. Lake, London.—*1st June*, 1878.
2211. REFINING SUGAR, H. H. Murdoch, London.—*1st June*, 1878.
2232. STONE-BREAKING MACHINERY, W. Lister, Minera.—*4th June*, 1878.
2264. REPRODUCTION of OIL PAINTINGS, H. Bogaerts, Holland.—*6th June*, 1878.
2286. CUTTING SHEET METAL, M. W. Johnson, Limehouse.—*7th June*, 1878.
2309. MARKING LAWN TENNIS COURTS, J. Constable, Cirencester.—*8th June*, 1878.
2541. ROLLING UP PAPER, &c., E. Dangoise, Brussels.—*25th June*, 1878.
3151. TREATMENT of DATE FRUIT, &c., T. F. Henley, London.—*9th August*, 1878.
2217. CAMPHOR TABLETS, &c., W. R. Lake, London.—*3rd June*, 1878.
2290. VENTILATORS, H. M. Williams, London.—*7th June*, 1878.
2307. HYDRAULIC PRESSES, J. Watson, Glasgow.—*8th June*, 1878.
2497. HEATING and DRYING, F. Hocking, London.—*22nd June*, 1878.
2934. CONDENSERS, F. Hocking, London.—*24th July*, 1878.
2240. PRINTING WOVEN FABRICS, J. Christie and G. Izatt, Alexandria, N.B.—*5th June*, 1878.
2245. PROTECTING CANISTERS, C. Cheswright, London.—*5th June*, 1878.
2256. THERMOMETERS, W. D. Bowkett, Leeds.—*6th June*, 1878.
2227. STEAM STEERING APPARATUS, J. Watson and L. Watson, Sunderland.—*4th June*, 1878.
2250. CLARET JUGS, &c., H. W. Dee, London.—*5th June*, 1878.
2253. LOCOMOTIVES without FURNACES, L. Francq, Paris.—*6th June*, 1878.
2279. BRAKE APPARATUS, G. Westinghouse, jun., London.—*7th June*, 1878.
2291. MULTIPLYING POWER, A. M. Clark, London.—*7th June*, 1878.
2315. SUBSTITUTE for CHILD'S CHAIR, &c., A. Browne, London.—*8th June*, 1878.
3017. REVOLVING CANNONS, W. Morgan-Brown, London.—*30th July*, 1878.

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

1945. FINISHING PRINTED SHEETS, H. J. Gill, Dublin.—*4th June*, 1874.
1920. LOOMS for WEAVING, C. Catlow, Burnley.—*2nd June*, 1874.
1923. STOPPERING BOTTLES, J. Lamont, Glasgow.—*2nd June*, 1874.
1915. PHOSPHATES of LIME, B. Tanner, Dublin.—*2nd June*, 1874.
1968. PAVEMENTS, S. Hawksworth, Doncaster.—*6th June*, 1874.
1931. PAPER, &c., BOXES, B. J. B. Mills, London.—*3rd May*, 1874.
1988. MALTING, H. B. Barlow, Manchester.—*8th June*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 24th June, 1881.

215. BORING, &c., ARTICLES of METAL, B. Sutcliffe, Halifax.—*17th January*, 1881.
384. TOBACCO PIPES, C. M. P. H. Triscott, King-street, London.—*28th January*, 1881.
401. FASTENINGS for BRACELETS, &c., E. Atkins, Birmingham.—*29th January*, 1881.
432. GRINDING, &c., RAZOR BLADES, H. H. Lake, London.—Com. from J. D. Frary.—*1st February*, 1881.
435. DRESSING MILL-STONES, E. Scholes, Ashton-under-Lyne.—*2nd February*, 1881.
458. HEATING LIQUIDS, B. W. Maughan, Cheapside, London.—*2nd February*, 1881.
441. PIPE JOINT, J. S. Fairfax, London.—Partly a com. from W. Painter.—*2nd February*, 1881.
446. METAL TUBES, J. R. Cassels and T. Norton, Glasgow.—*2nd February*, 1881.
453. HURDLES, &c., J. Sheldon, Birmingham.—*3rd February*, 1881.
456. MUFF-BAG, &c., I. Pick, Queen Victoria-street, London.—*3rd February*, 1881.
469. PERMANENT WAY, R. Long, Clayton-square, Liverpool.—*4th February*, 1881.
473. CONVEYING, &c., MONEY, &c., E. P. Alexander, London.—A communication from J. C. White and H. H. Hayden.—*4th February*, 1881.
496. VALVES, A. Beldam, Gracechurch-street, London.—*5th February*, 1881.
500. SEWING, &c., MACHINES, W. E. Gedge, Wellington-street, London.—A communication from E. Cornely.—*5th February*, 1881.
503. FIXING RAILS, F. C. Glaser, Berlin.—Com. from J. A. J. Vautherin.—*5th February*, 1881.
525. BREECH-LOADING SMALL-ARMS, J. F. Swinburn, Birmingham.—*7th February*, 1881.
627. STEAM ENGINES, W. F. Goodwin, Stelton, U.S.—*14th February*, 1881.
635. STEAM BOILERS, &c., W. Tulley, Kennington Park, London.—*15th February*, 1881.
665. SECURING the TEETH of RAKES, P. Pierce, Wexford, Ireland.—*16th February*, 1881.

738. STEEL and LIGHTING-GAS, P. Aube, Paris.—21st *February*, 1881.
1384. ELECTRIC LIGHTING, W. R. Lake, London.—Com. from A. G. Holcombe.—29th *March*, 1881.
1390. SPINNING FRAME TRAVELLER RINGS, C. A. Snow, Washington, U.S.—A communication from J. Y. Anthony and W. K. Evans.—29th *March*, 1881.
1523. VARIABLE EXPANSION VALVE GEAR, J. McFarlane and T. T. M. Lumsden, Edinburgh.—7th *April*, 1881.
1624. ELECTRIC TELEGRAPHS, A. Muirhead and H. A. C. Saunders, London.—13th *April*, 1881.
1757. SAFETY-VALVE PLUGS, A. M. Taylor, Lenzie.—23rd *April*, 1881.
1775. MINERS' SAFETY LAMPS, J. Fyfe, Glasgow.—25th *April*, 1881.
1919. SELF-ACTING LATHES, G. W. von Nawrocki, Berlin.—A communication from the Werkzeug und Maschinenfabrik Oerlikon.—3rd *May*, 1881.
1977. TILLING LAND, F. H. P. P. Oram, St. Paul's-road, London.—6th *May*, 1881.
2101. SECURING RAILWAY RAILS in their CHAIRS, W. H. Nevill, Ferryside, South Wales.—13th *May*, 1881.
2111. CROPPING or CLIPPING MACHINES, W. W. Urquhart and J. Lindsay, Dundee.—14th *May*, 1881.
2115. CURLING, &c., HAIR, J. Careless, Birmingham.—14th *May*, 1881.
2169. DISTILLING SHALE, &c., G. T. Beilby, Mid-Calder.—18th *May*, 1881.
2295. TREATING REFUSE MATTER, A. B. von Podewils, Munich, Bavaria.—25th *May*, 1881.
2384. OSCILLATING STEAM ENGINES, H. J. Haddan, London.—Com. from J. S. Cain.—31st *May*, 1881.

Last day for filing opposition, 28th *June*, 1881.

451. TUBE EXPANDER, G. Allix, Fleet-street, London.—2nd *February*, 1881.
452. BLACKSMITHS' HEARTHS, R. R. Gubbins, Newcross, London.—2nd *February*, 1881.
454. TAPS and VALVES, E. J. Collis, Stourbridge, and J. D. Ready, Wolverhampton.—3rd *February*, 1881.
458. BREWING, A. Manbré, South-street, London.—3rd *February*, 1881.
462. SPINNING, &c., MACHINERY, T. Craven and J. Crabtree, Keighley.—3rd *February*, 1881.
475. CLEANING, &c., CARPETS, P. Jensen, London.—A communication from Messrs. Mayer, Langfelder, and Hammerschlag.—4th *February*, 1881.
477. FILTER, T. Dunlevie, Station-street, Burton-on-Trent.—4th *February*, 1881.
488. MAKING the JOINTS of MOULDS, C. J. Allport, London.—4th *February*, 1881.
489. NAILING BARREL HOOPS, W. Morgan-Brown, London.—Com. from E. Cole.—5th *February*, 1881.
490. NAILING MACHINES, W. Morgan-Brown, London.—Com. from J. H. Foster.—5th *February*, 1881.
491. SECURING SCARF PINS, J. Foxlow, Manchester.—5th *February*, 1881.
499. HAMMERLESS BREECH-LOADING FIRE-ARMS, H. A. A. Thorn, London.—5th *February*, 1881.
503. SKATE, J. P. Becker, jun., Remscheid, Prussia.—5th *February*, 1881.
505. CHIMNEYS, J. Rowan, Ryde, Isle of Wight.—5th *February*, 1881.
508. CUBES of SUGAR, &c., M. Bauer, Paris.—A communication from H. Tietz, J. Selwig, and B. Lange.—7th *February*, 1881.
533. BICYCLES, &c., W. Mickelwright and A. G. Gladwyn, London.—8th *February*, 1881.
538. CUTTING, &c., TEA, D. White, Glasgow.—8th *February*, 1881.
673. SAFETY VALVES, J. D. Adams, Marshall-street, London.—16th *February*, 1881.
633. BOATS or VESSELS, T. Nordenfelt, St. Swithin's-lane, London.—17th *February*, 1881.
698. FOUNTAIN PEN-HOLDERS, M. Benson, London.—Com. from W. W. Stewart.—17th *February*, 1881.
720. NAILS, A. Burton, Leeds.—19th *February*, 1881.
744. DOOR CHAINS &c., H. Skerrett, Sparkbrook, near Birmingham.—21st *February*, 1881.
789. DRAWING GAS RETORTS, J. West, Manchester.—24th *February*, 1881.
863. CALCULATING INSTRUMENTS, J. B. Fearnley, Castleford.—1st *March*, 1881.
910. METALLIC PENS, M. Turnor, Birmingham.—3rd *March*, 1881
1070. RAILWAY SIGNALS, J. Snowball and C. Warren, London.—12th *March*, 1881.
1294. PURIFICATION of GASES, C. F. Lawton, A. W. Lawton, and A. L. Lawton, Rochester, U.S.—23rd *March*, 1881.
1295. PRESERVING ORGANIC SUBSTANCES by GAS, C. F. Lawton, A. W. Lawton, and A. L. Lawton, Rochester, U.S.—23rd *March*, 1881.
1301. TOBACCO POUCHES, H. A. Fleuss, London.—23rd *March*, 1881.
1492. LOOMS for WEAVING, H. A. Foster, Queensbury.—5th *April*, 1881.
1650. STEAM PUMPS, T. H. Ward, Tipton.—14th *April*, 1881.
1750. STEEL CASTINGS, I. Beardmore, Parkhead.—23rd *March*, 1881.
1856. RAILWAYS, A. W. L. Reddie, London.—A communication from J. Hunebelle.—29th *April*, 1881.
1988. SPINNING CARDED WOOL, A. Munzinger, Switzerland.—7th *May*, 1881.
2072. TREATMENT of DATE FRUIT, T. F. Henley, London.—12th *May*, 1881.
2179. METAOXYBENZALDEHYDE, J. A. Dixon, Glasgow.—Com. from Dr. K. Koenig.—18th *May*, 1881.
2256. SUPPORTING STRUCTURES, W. R. Lake, London.—Com. from W. C. Allison.—24th *May*, 1881.
2277. SEWING BOOKS, D. McC. Smith, Hartford, U.S.—24th *May*, 1881.

Patents Sealed

(*List of Letters Patent which passed the Great Seal on the 3rd June*, 1881.)

4474. STEEL TOOTHED WHEELS, J. A. Vickers and E. B. Burr, London.—2nd *November*, 1880.
5057. REGULATING the PASSAGE of AIR, J. F. Hoyne, London.—4th *December*, 1880.
5071. LIGHT-PRESERVING COMPOSITION, N. Chevalier, London.—6th *December*, 1880.
5079. CALIPERS, A. Scott, City-road, London.—6th *December*, 1880.
5084. HOLDING DRILLS, J. McCulloch, Camborne.—6th *December*, 1880.
5087. SEPARATING MATERIALS, G. Wilson, London.—7th *December*, 1880.
5094. VEGETABLE FIBRES, P. M. Justice, London.—7th *December*, 1880.
5097. HYDROCARBON LAMPS, D. P. Wright, Birmingham.—7th *December*, 1880.
5099. MEASURING FLOW of LIQUIDS, W. Stead, Northallerton.—7th *December*, 1880.
5104. PULVERISING MINERALS, W. R. Lake, London.—7th *December*, 1880.
5114. FASTENING RAILS, H. A. Houllier, Rouen, France.—8th *December*, 1880.
5116. WATER METERS, R. Schloesser, Manchester.—8th *December*, 1880.
5118. HOBBY-HORSES, &c., A. Waddington, Bradford.—8th *December*, 1880.
5119. SKATES, H. Bezer, Smithfield, London.—8th *December*, 1880.
5130. GAS MOTOR ENGINES, J. Livesey, London.—8th *December*, 1880.
5135. HOLDERS or ATTACHMENTS, A. M. Clark, London.—8th *December*, 1880.
5155. MEASURING WATER, S. Toy, Birmingham.—10th *December*, 1880.
5175. PERFORATING DOCUMENTS, A. H. Robinson, Dublin.—10th *December*, 1880.
5176. TURN-TABLE, J. P. Clarke, Bury St. Edmunds.—10th *December*, 1880.
5267. FASTENINGS for NECKTIES, E. de Pass, London.—15th *December*, 1880.
5276. WINDLASSES, G. D. Davis, London.—16th *December*, 1880.
5344. MOULDING MACHINES, H. Wren and J. Hopkinson.—20th *December*, 1880.
5457. BLOW-PIPE REVOLVING FURNACE, B. J. B. Mills, London.—28th *December*, 1880.
545. CORKING BOTTLES, W. H. Beck, Cannon-street, London.—9th *February*, 1881.
557. DRAW-OFF TAPS, J. Davidson, Auchmill.—9th *February*, 1881.
559. DECORATING BUTTONS, J. H. Johnson, London.—9th *February*, 1881.
890. AIR-PUMP BUCKETS, J. Musgrave, Bolton.—2nd *March*, 1881.
1051. HYDROCARBON STOVES, F. Arnold, Birmingham.—11th *March*, 1881.
1356. CONDENSING, &c., GAS, T. N. Kirkham, T. Hersey, D. Hulett, S. Chandler, sen., J. Chandler, and S. Chandler, jun., London.—26th *March*, 1881.

(*List of Letters Patent which passed the Great Seal on the 7th June*, 1881.)

5123. TURKISH, &c., BATHS, H. Jones, Adam-street, London.—8th *December*, 1880.
5123. PRODUCING WRITING on PAPER, A. Ford, Regent's Park, London.—8th *December*, 1880,
5134. PRODUCING LIGHT and HEAT, F. Wilkins, London.—8th *December*, 1880.
5142. BOBBINS, W. and J. Dixon, Steeton.—9th *December*, 1880.
5144. NON-INTOXICATING COMPOUNDS, T. H. Larmuth, London.—9th *December*, 1880.
5146. OBTAINING USEFUL PRODUCTS from the RESIDUE of SULPHURIC ACID, W. Weldon, Rede Hall, Burstow.—9th *December*, 1880.
5150. PREPARING MOULDS for CASTING, H. Gibbons, Hungerford.—9th *December*, 1880.
5161. MAKING BOTTLES, E. Breffit, Castleford.—10th *December*, 1880.
5164. DRAIN PIPES, E. Brooke, Huddersfield.—10th *December*, 1880.
5166. STANDS for BOTTLES, &c., J. E. Bingham, Sheffield.—10th *December*, 1880.
5188. PAINT, P. M. Justice, Southampton-buildings, London.—11th *December*, 1880.
5206. STEAM GENERATORS, H. J. Allison, Southampton-buildings, London.—13th *December*, 1880.
5213. LIQUOR STANDS, J. Burley, Birmingham.—13th *December*, 1880.
5228. STRIKING, &c., SKINS, E. Wilson, Exeter.—14th *December*, 1880.
5231. SUGAR, H. Stokes, Liverpool.—14th *December*, 1880.
5246. DISCHARGE, &c., of CARGOES, H. Adams, London.—14th *December*, 1880.
5251. BOWS, &c., for WATCHES, W. R. Lake, London.—14th *December*, 1880.
5284. SUPPLYING FRESH or PURE AIR, O. Seydel, Birmingham.—16th *December*, 1880.
5320. CLEANING IMITATION CARVING, A. Guattari, Paris.—18th *December*, 1880.
5365. BASIC FIRE-BRICKS, A. M. Clark, Chancery-lane, London.—21st *December*, 1880.
5371. VALVES, &c., J. B. Denans, Paris.—22nd *December*, 1880.
5424. MOULDING BRICKS, &c., H. Johnson and B. Stuart, Keymoor Junction.—24th *December*, 1880.
5438. TREATING LIQUID, W. R. Lake, Southampton-buildings, London.—24th *December*, 1880.
5443. AIR-COMPRESSING ENGINES, F. E. B. Beaumont, London, and D. Greig, Leeds.—27th *December*, 1880.
47. LASTING BOOTS and SHOES, A. M. Clark, Chancery-lane, London.—4th *January*, 1881.
48. GENERATING, &c., ELECTRICITY, W. R. Lake, London.—4th *January*, 1881.
517. LETTER LOCKS, E. Allebos, Brussels.—7th *February*, 1881.
542. TELEPHONIC APPARATUS, J. Sax, Great Russell-street, London.—8th *February*, 1881.
727. FLUSHING, &c., DRAINS, S. H. Adams, Leeds.—19th *February*, 1881.
833. STEAM PUMPS, J. Shanks and J. G. Lyon, Arbroath.—26th *February*, 1881.
930. PREPARING SHIPS for PAINTING, &c., A. C. Kirk, Glasgow, and R. Sim, London.—4th *March*, 1881.
1060. TUBULAR BOILERS and FURNACES, R. and F. Garrett, Leiston.—11th *January*, 1881.
1279. PREPARING FIBRES, I. Holden, Bradford.—23rd *March*, 1881.
1283. MIXTURE for CHOLERA, &c., W. Williams, Hampden-street, London.—23rd *March*, 1881.
1315. VALVES and PORTS, J. Snelling, Gilbert-road, London.—24th *March*, 1881.
1336. FINISHING, &c., PILLS J. G. F. Richardson, Leicester.—25th *March*, 1881.
1358. ELECTRIC LAMPS, R. Harrison and C. Blagburn, Newcastle-on-Tyne.—26th *March*, 1881.
1423. FEEDING ROLLER MILLS, &c., J. H. Carter, Marklane, London.—31st *March*, 1881.
1426. HARVESTING, &c., APPARATUS, J. Hornsby, J. Innocent, and G. T. Rutter, Grantham.—31st *March*, 1881.
1496. PREVENTING RACING in MARINE ENGINES, T. Mudd, Hartlepool.—6th *April*, 1881.
1599. LACING HOOKS, W. R. Lake, Southampton-buildings, London.—12th *April*, 1881.

List of Specifications published during the week ending June 4th, 1881.

5112*, 4d.; 1564*, 4d.; 2328, 2d.; 3722, 2d.; 3738, 2d.; 2226, 6d.; 3176, 10d.; 3683, 6d.; 3708, 6d.; 3722, 2d.; 3786, 2d.; 3796, 2d.; 3799, 2d.; 3819, 4d.; 3865, 6d.; 3963, 2d.; 3994, 6d.; 4054, 4d.; 4098, 1s. 2d.; 4099, 2d.; 4112, 6d.; 4143, 6d.; 4178, 2d.; 4208, 2d.; 4227, 4d.; 4266, 2d.; 4268, 6d.; 4272, 2d.; 4287, 6d.; 4280, 6d.; 4286, 6d.; 4288, 6d.; 4296, 6d.; 4298, 8d.; 4299, 6d.; 4301, 6d.; 4308, 8d.; 4309, 6d.; 4314, 10d.; 4318, 4d.; 4319, 6d.; 4322, 6d.; 4323, 6d.; 4326, 6d.; 4330, 6d.; 4336, 8d.; 4338, 6d.; 4340, 6d.; 4344, 8d.; 4348, 6d.; 4351, 6d.; 4358, 4d.; 4362, 6d.; 4363, 6d.; 4365, 6d.; 4367, 6d.; 4369, 6d.; 4370, 6d.; 4373, 6d.; 4377, 6d.; 4378, 6d.; 4383, 6d.; 4384, 6d; 4386, 8d.; 4388, 4d.; 4389, 4d.; 4390, 4d.; 4391, 6d.; 4394, 10d.; 4395, 6d.; 4397, 6d.; 4403, 6d.; 4404, 8d.; 4411, 6d.; 4415, 6d.; 4420, 4d.; 4421, 6d.; 4424, 6d.; 4426, 6d.; 4429, 6d.; 4430, 6d.; 4434, 6d.; 4435, 8d.; 4436, 4d.; 4443, 4d.; 4444, 6d.; 4446, 6d.; 4447, 4d.; 4452, 6d.; 4458, 6d.; 4459, 8d.; 4461, 8d.; 4464, 2d.; 4465, 4d.; 4467, 2d.; 4470, 2d.; 4471, 2d.; 4478, 2d.; 4480, 2d.; 4483, 6d.; 4487, 6d.; 4488, 2d.; 4490, 2d.; 4493, 6d.; 4495, 6d.; 4497, 2d.; 4499, 2d.; 4500, 2d.; 4501, 2d.; 4502, 4d.; 4503, 2d.; 4505, 2d.; 4506, 2d.; 4508, 2d.; 4509, 6d.; 4510, 6d.; 4511, 10d.; 4514, 4d.; 4515, 2d.; 4518, 6d.; 4520, 2d.; 4521, 2d.; 4522, 4d.; 4523, 8d.; 4525, 6d.; 4527, 2d.; 4528, 2d.; 4530, 2d.; 4532, 2d.; 4533, 2d.; 4534, 6d.; 4535, 2d.; 4537, 2d.; 4538, 2d.; 4543, 4d.; 4547, 2d.; 4550, 2d.; 4551, 2d.; 4552, 2d.; 4554, 6d.; 4557, 2d.; 4558, 2d.; 4563, 2d.; 4564, 2d.; 4569, 2d.; 4572, 2d.; 4573, 2d.; 4574, 2d.; 4575, 2d.; 4576, 4d.; 4577, 2d.; 4578, 2d.; 4579, 2d.; 4591, 2d.; 5044, 6d.; 136, 6d.; 842, 6d.; 901, 8d.

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

ABSTRACTS OF SPECIFICATIONS.

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

2398. JUGS AND CUPS, *D. Moulton.—Dated 17th June*, 1879.—(*Not proceeded with.*) 2*d.*

This consists in inserting in the side of the jug or cup a plate on which is stamped the Government measure.

3722. STAND FOR CASKS, &c., *J. M. Matthews and E. B. Burr.—Dated 17th September*, 1879.—(*Not proceeded with.*) 2*d.*

This relates to means whereby the vessel containing the liquid is automatically tilted as the liquor is withdrawn

3738. STOPPERS FOR BOTTLES, *N. Robertson.—Dated 17th September*, 1879.—(*Not proceeded with.*) 2*d.*

The stopper consists of a tapered plug of cork weighted at the small end, or a plug of cork tapered and weighted at both ends. The bottle neck is tapered to correspond with the taper of the stopper.

2226 BEARINGS FOR BICYCLES, &c., *R. Green.—Dated 1st June*, 1880. 6*d.*

This consists of a divided or split ring having in its inner face a concave groove either curved or angular, which groove partly encloses the balls or spheres of the bearing, the said divided ring being capable of expanding and contracting so as to increase or decrease its diameter, the outer edge of the divided ring being conical and seating itself in the conical interior of the cap or box of the bearing, the adjustment of the parts of the bearing being effected by forcing the divided ring more or less into the cap or box.

3176. ENGINES, &c., FOR PRODUCING MOTIVE POWER, *W. B. Northcott.—Dated 3rd August*, 1880. 10*d.*

In one form of gas engine, air and gas in explosive proportions are drawn through a valve and port into a long or tall cylinder by the movement of a piston actuated by a crank pin. This piston is itself formed as a cylinder, closed at the ends, but furnished with a port or passage at each end. A second piston, with a trunk piston-rod, is arranged to work in the first piston, and this trunk piston is connected to the crank pin. The first piston is not itself connected to the crank pin except indirectly through the second piston.

3683. JACQUARD APPARATUS, *J. Bywater, C. Bedford, and T. Kershaw.—Dated 10th September*, 1880. 6*d.*

This relates, First, to the Jacquard needles, and consists in a means of preventing the enlargement of the slot lengthwise and avoid "jack drops" and improper working of the jack hooks. The Second part consists in a means of dispensing with the use of the spiral springs at present employed for operating the Jacquard needles after they have been pegged by the pegging cylinder.

3708. SELF-ACTING CASK TILTERS, *J. and H. J. Brookes and F. Mason.—Dated 11th September*, 1880. 6*d.*

The cask is tilted gradually as the contents diminish by means of spiral springs working in suitable slides.

3722. COMBINED MUFF AND HOOD, *W. Hyman.—Dated 13th September*, 1880.—(*Provisional protection not allowed.*) 2*d.*

This relates to means of obtaining an economy of material.

3786. PRESERVING AND PREPARING MUSSELS AND COCKLES FOR BAIT, *C. W. Harding.—Dated 18th September*, 1880.—(*Provisional protection not allowed.*) 2*d.*

The mussels and cockles are first boiled, then taken from their shells and placed in a brine solution.

3796. ALPHABETICAL PUZZLE, *C. R. Hall.—Dated 18th September*, 1880.—(*Provisional protection not allowed.*) 2*d.*

This consists in an arrangement whereby simple words formed by the combination of detachable or loose letters can be displayed so as to attract the attention of children.

3799. LAMPS, *A. Mackay.—Dated 18th September*, 1880.—(*Provisional protection not allowed.*) 2*d.*

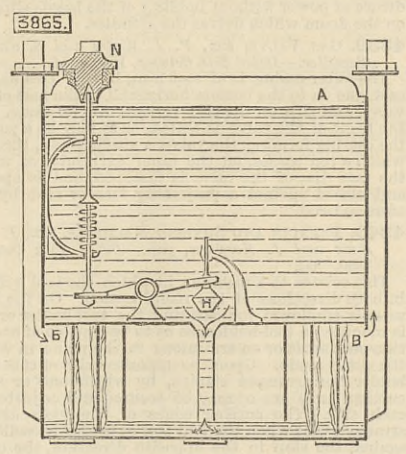
The oil is by means of this lamp brought into combination with the full proportion of atmospheric air it is capable of taking up or amalgamating with.

3819. CLOTH, *J. Cook and J. Turner.—Dated 21st September*, 1880. 4*d.*

This consists in the use of net, lace, and leno, either separately or combined, in combination with suitable borders, for the manufacture of dhooties.

3865. INCREASING THE ILLUMINATING POWER OF COAL GAS, *F. Weston.—Dated 24th September*, 1880. 6*d.*

This relates to improvements on patent No. 3301, A.D. 1875, and consists in so constructing the carburetting chamber in which the gas becomes charged with hydrocarbon fluid so that its efficiency is increased. This is effected by dividing the chamber B into



passages lined on either or both sides with sponge, so that the gas passing through it is cleansed and becomes charged. The reservoir A containing the hydrocarbon is fitted with a valve H actuated through a nut N acting on a suitable lever so as to open or close the valve, and thus open or cut off the supply of hydrocarbon to the carburetting chamber.

3963. POCKET KNIVES, *W. R. Lake.—Dated 30th September*, 1880.—(*A communication from D. Peres.*)—(*Void.*) 2*d.*

The springs are covered by a back-piece formed in one piece with the side plates. The side plates are made in one piece with the back of the handle.

3994. GASSING YARNS OR THREADS, *W. T. Stubbs and J. Corrigan.—Dated 2nd October*, 1880. 6*d.*

This consists, First, in the use of one row of drums, by which the yarn or thread is wound upon the bobbins after being gassed or singed, each of such drums acting upon two or more bobbins for winding the yarn thereon. Secondly, in an arrangement for acting upon the gas burner and upon the bobbin, upon which the gassed yarn is wound, for putting them in and out of action. Thirdly, in using a bracket with two projecting arms, which carry the two rollers or bowls. Fourthly, in mounting the pulleys or bowls upon bushes turning on studs or pins. Fifthly, in forming a flange around one end of each of the guide pulleys and a projecting part upon their supporting bracket.

4054. DRAIN PIPES, *T. H. Baker.—Dated 6th October*, 1880.—(*Not proceeded with.*) 4*d.*

The section of the drain is founded on an equilateral triangle, the corners being rounded off.

4098. FURNACES FOR THE MANUFACTURE OF COKE, *G. A. Dick.—Dated 9th October*, 1880. 1*s.* 2*d.*

The furnace consists of one or more chambers constructed in one piece or built up of fire-brick or other suitable material, according to the nature of the substance to be treated, and arranged horizontally, or in any convenient position. These chambers are surrounded by a number of flues or channels of fire-brick for the circulation of the heating medium. The outer ends of the said chambers are provided with hoppers and screws, or other contrivances, for the purpose of mechanically effecting and regulating a continuous supply of the material to be treated, and the inner ends open into a chamber provided for the reception of the gases, coke, or other substances, after the completion of the process of distillation or sublimation.

4099. RAILWAY POINTS, *H. Whitehead, R. Hodgson, and T. Dodd.—Dated 9th October*, 1880.—(*Void.*) 2*d.*

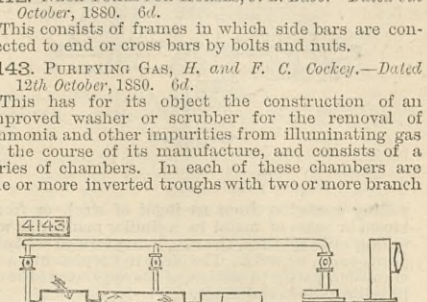
Four special cast iron chairs are provided, two of which are employed to secure two short rails and to keep them in close proximity to the main rails. The other two chairs are employed to secure the heel of the points, and to prevent them from moving in any way other than the required one. At the same time the four cast iron chairs are also so arranged as to secure the main rails, and thus it is impossible for either main rails or points to move or to be moved out of position other than by the lever provided for the purpose.

4112. NECK YOKES FOR HORSES, *J. L. Babb.—Dated 9th October*, 1880. 6*d.*

This consists of frames in which side bars are connected to end or cross bars by bolts and nuts.

4143. PURIFYING GAS, *H. and F. C. Cockey.—Dated 12th October*, 1880. 6*d.*

This has for its object the construction of an improved washer or scrubber for the removal of ammonia and other impurities from illuminating gas in the course of its manufacture, and consists of a series of chambers. In each of these chambers are one or more inverted troughs with two or more branch



flange pipes attached to them. With these pipes the inverted troughs are connected to the top plates of the chambers. In the top plates of each chamber holes are cast to match the branch pipes on the inverted troughs, and through these pipes and troughs the gas passes into the chamber through the liquor which is in them. There are also holes of the same area cast in the top plates of each chamber, and over each series of holes an iron box or cover is fixed, thus forming a communication to the adjoining chamber; the inverted troughs are cast with a flange round the bottom edge, and to this flange are fastened plates or breakers, the lower edges of which are serrated; these dip slightly into the liquor with which each compartment is charged, so that the gas in its passage between the teeth and through the liquor is broken up into small particles or fine streams. The drawing is partly a longitudinal vertical section and partly a side elevation of the apparatus.

4178. CEMENT AND BRICKS, *F. Parker.—Dated 14th October*, 1880.—(*Provisional protection not allowed.*) 2*d.*

This relates to the utilisation of a calcareous marl containing over 60 per cent. and under 75 per cent. of carbonate of lime.

4208. URINALS, &c., *H. Phillips.—Dated 15th October*, 1880. 2*d.*

The urinal is constructed so that the discharge pipe from the urinal basin is led down to a receptacle containing dry earth or other dry powdered deodorising material, and is caused to discharge below the surface of such material and near to the bottom of the receptacle.

4227. PREVENTING ACCIDENTS IN COAL MINES, &c., *A. Budenberg.—Dated 16th October*, 1880.—(*A communication from C. F. Budenberg and B. A. Schäffer.*)—(*Provisional protection not allowed.*) 4*d.*

The First part, which may also be arranged to indicate the presence of carbonic acid or other gases in wells, &c., consists in utilising different densities of various gases.

4266. MULTIPLICATION OF COPIES PRINTED BY TYPE PRINTING MACHINES, *G. H. Jones.*—(*Provisional protection not allowed.*) 2*d.*

This consists of a thin sheet of gelatine or a coating of gelatine or albumen, or other similar substance being applied to a sheet of paper or linen, and used in the same way, but instead of paper in the use of type printing machines; Secondly, in the use of a dye or prepared ink, instead of the use of ordinary ink now used in type printing machines.

4269. HYDRAULIC LIFTS, *E. B. Ellington.—Dated 20th October*, 1880. 6*d.*

This relates to means for dispensing with the counter balance weights, chains, and pulleys, and consists in the combination with the cylinder of a hydraulic lift, of a second cylinder provided with a trunk piston, and a third cylinder having its plunger attached to the said piston, and suitable cocks and valves.

4272. VENTILATORS, *J. Martin and W. A. Ward.—Dated 20th October*, 1880.—(*Not proceeded with.*) 2*d.*

This relates to ventilators for the rooms of dwelling houses, and consists principally of a vertical tube open at each end. At the top of this tube is a cap or cover to prevent the admission of dust or other extraneous matter. The lower end is fitted into a screwed socket, into which may be screwed a rosette or other ornamental device, the rosette being beneath the ceiling, and the tube above the same, and between it and the floor above.

4277. ROLLERS AND BEAMS FOR LOOMS, *T. Reeder.—Dated 20th October*, 1880. 6*d.*

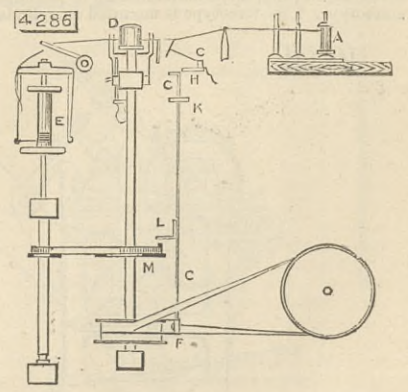
This consists, First, in making a cylindrical sheet metal roller by forcing a die through the roller when it is held in a cylindrical tube; Secondly, filling a sheet metal roller to render it solid; Thirdly, in the machinery for finishing and filling sheet metal rollers.

4280. SECURING SHIPS' CABLES, HAWSERS, &c., *F. Archer, jun.—Dated 20th October*, 1880. 6*d.*

This consists in the arrangement and construction of a nipper for securing ships' cables, hawser, or other ropes and chains bearing a pulling strain.

4286. PREPARATORY STOP MOTION DOUBLING FRAMES, *J. Briggs, jun.—Dated 21st October*, 1880. 6*d.*

A is the bobbin containing the yarn in single



thread, of which there would be two, three, or more, and from it thread is carried forward through a hole in the detector C to the vertical rollers D, and thence to the take-up bobbin E. Under the front end of the detectors is a series of driving band guards F fixed to bars G carried in suspension upon the shoulder K. When any of the single threads break the front end of the detector drops between the fixed

bar H and the top of the rocking bar G, which is pushed off the shoulder and drops, thus shifting the strap, and at the same time the arm L comes in contact with stops on the pulley M, thus stopping the particular section of the machine.

4288. STEAM GENERATORS, &c., *J. Windle.—Dated 21st October*, 1880. 6*d*.

To avoid the ordinary longitudinal seams, the shells of the generator are formed by connecting together a number of rings of metal, each ring being formed by a

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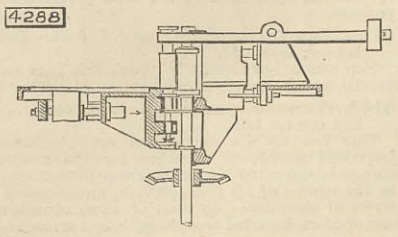

rolling operation from an ingot of steel, or from a bloom or mass of metal in a similar manner as when rolling railway tires, the ring being formed without a joint, seam, or weld. The drawing represents a side elevation, partly in section, of the apparatus to be used in rolling the metal rings.

4295. RAISING WINDOW SASHES, *P. Langridge.—Dated 21st October*, 1880. 6*d*.

This consists in a means of raising window sashes by the application of coiled springs.

4298. PROPELLING NAVIGABLE VESSELS, *J. Gibbons.—Dated 21st October*, 1880. 8*d*.

A screw aperture A is formed in the dead working or dead wood in the run of the vessel, of less height and greater length than usual, and through it passes the propeller shaft B. On it are mounted the pro-

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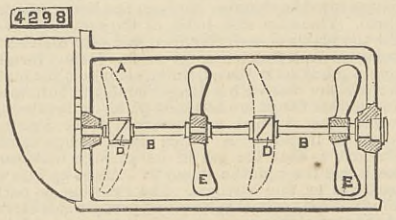

pellers consisting of a combination of different or contrasting shaped blades, the propellers D having the greatest surface at the root of their blades, and the propellers E at the extremity. The former taper from the root to the extremity, and the latter from the extremity to the root.

4299. FOLDING AND EYELETTING LABELS, *E. A. Pallister.—Dated 21st October*, 1880. 6*d*.

The labels are cut to the required size and then placed on to a "he" swing templet and caused to close into a "she" templet, thereby causing the corners of the first or side folds to rise. The punching operation for the holes is produced by an ordinary punch actuated by suitable mechanism, and after the punching is completed the supports carrying the punch are opened to allow a die carrying the eyelet, and another which compresses or closes the eyelet, to meet at the same centre or point at which the hole has been punched.

4301. PRINTING MACHINERY, *F. Payne—Dated 21st October*, 1880. 5*d*.

This relates to means for stopping the rotary motion of the cylinder of Wharfedale machines, and also the motion of the grippers and feeding board, from time to time, and this is accomplished by the use of a horizontal sliding bar caused to slide backward and forward by means of a cam on the crank shaft. One end of this sliding bar is made taper or V-shaped, and it is set opposite to a horizontal lever also having one

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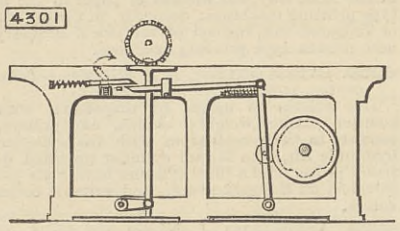

end taper or V-shaped, and the two are so arranged that when the cylinders and grippers and feeding board are required to be in motion the horizontal bar slides under the taper lever, but when the cylinder and grippers and board are required to be stationary the attendant operates a handle which brings into position a small cam, allowing a spiral spring to lift up the taper lever into such a position that on the return traverse of the sliding bar it is caused to slide up the incline of the lever, by which means the taper end of the sliding bar is raised, lifting up the ordinary vertical rod, which disconnects the parts employed in operating the cylinder grippers and feeding board.

4308. INCUBATORS, &c., *A. M. Clark.—Dated 22nd October*, 1880.—(*A communication from O. Martin.*) 8*d*.

This relates to an incubator provided with apparatus whereby the eggs may be turned without opening the incubator, and heated by means of a circulating apparatus termed a thermo-syphon, the water in which is heated either by a lamp, a hot spring, hot bed, or other source of heat.

4314. PREPARING STEREOTYPE PLATES FOR THE PRINTING MACHINE, *A. M. Clarke.—Dated 22nd October*, 1880.—(*A communication from A. H. Marinoni.*) 10*d*.

This relates to apparatus for cutting, trimming, bevelling, routing, and countersinking or piercing the stereotype. The stereotype is mounted on cylinder A,

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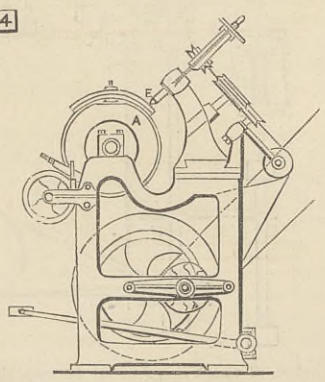

having longitudinal and circumferential grooves to clear the point of the tool, and capable of being revolved so as to cause the plate to be acted upon by the revolving cutter E mounted in a slide rest, along which it can be moved when required to cut longitudinally, in which case the cylinder A remains stationary. The cutter E is shaped so as to produce a bevel if required. By the rotation of the cylinder and the movement of the cutter along its slide ways the plate can be cut in any desired direction. The cylinder may be replaced by a flat table when required to cut flat plates.

4309. STOPPERS FOR BOTTLES, &c., *J. Davies and P. Humphreys.—Dated 22nd October*, 1880. 6*d*.

This consists in the application to a bottle neck of a cap or stopper containing a valve spindle and valve with india-rubber or other suitable elastic disc for keeping the valve in its normal position against its seat and forming a gas-tight joint between spindle and cap, said elastic disc when compressed allowing the spindle to descend and the valve to open for liquid to escape by a nozzle or aperture which is also used for filling.

4318. BICYCLES, *J. F. R. Wood.—Dated 22nd October*, 1880. 4*d*.

The end of the back fork terminates in C springs, which are curved outward, upward, and around, and the ends terminate with bearings for the axle of the back wheel. The back bone is provided at about midway of its height with a roller, against which the main wheel tire may bear if from vibration these should approach each other.

4319. PAINT BRUSHES, *E. Wright.—Dated 22nd October*, 1880. 6*d*.

This relates to improvements on patent No. 1930, dated 11th May, 1880, and consists, First, in the employment in a paint brush of a clasp for the knot of bristles; Secondly, in the employment of metal strips, clips, or caps, or flanged rings for binding the bristles round the core.

4322. FASTENINGS FOR BOOTS, SHOES, &c., *J. F. Fryer.—Dated 23rd October*, 1880. 6*d*.

This consists mainly of a series of laces or thongs united at one end, or the series may be formed by being cut out of a single piece of material, say, leather, by stopping the cuts between them a short distance from one end, the latter being provided with eyelet holes, so that it can be fastened by one of said holes taking over a stud or pin on the garment to be fastened.

4323. PURIFICATION OF GAS, *A. Ford.—Dated 23rd October*, 1880. 6*d*.

This consists in the employment in gas washing or purifying apparatus of concentric tubes fastened to fixed and movable plates, or to two movable plates, so as to admit of being more or less inserted into one another for the purpose of varying the scrubbing surface.

4326. HORSESHOES, *L. A. Groth.—Dated 23rd October*, 1880.—(*A communication from Baron G. Luchaire.*) 6*d*.

This relates to the production of a horseshoe which will permit of the free development of the tender parts of the hoof, and also enable the horse to touch the ground not only with the side, but also with the frog of the hoof.

4330. MACHINES FOR WASHING, RINSING, AND CHURNING, *T. Bradford.—Dated 23rd October*, 1880. 6*d*.

This consists partly in the construction of the washing vessel of a washing machine, with, and the application thereto, and use therein, of a partition constructed as or with a series of louvres or parallel slats or boards arranged obliquely with reference to the plane of their edges, and so as to overlap each other, and parallel with the axis of the washing vessel.

4336. SPINNING MACHINE SPINDLES, *W. R. Lake.—Dated 23rd October*, 1880.—(*A communication from C. H. Chapman.*) 8*d*.

One part relates to improvements in spindles, whereby a sliding of such spindles longitudinally on their standards (as in the operation of doffing the bobbins) will, by a pump-like action, cause an upward flow of oil from a reservoir to lubricate the bearing surfaces of the spindle and the fixed standard on which it rotates. Another part relates to improvements whereby the spindle can be loosely bounded, and therefore run lightly, or with the minimum expenditure of power without liability of the bands slipping on the drum which drives the spindles.

4338. GAS VALVE, &c., *P. J Wates and S. and J. Chandler.—Dated 25th October*, 1880. 6*d*.

The outer casing is of cast iron, having two flanges cast, one on to the bottom horizontal to the face of the valve, and that on the side vertical to the same. On the front of the valve is bolted, or it may be a part of the casting forming the valve, a stuffing-box, through which a rod passes, on the inner extremity of which the face disc of the valve is fastened, and is opened and closed against a projecting face or seat by the aforesaid rod.

4340. PLANING AND SHAPING MACHINES, &c., *J. Kershaw and J. Kershaw, jun.—Dated 25th October*, 1880. 6*d*.

This relates to a machine in which the tool will cut in both directions of the reciprocation. On the slide usually employed for carrying the tool-holder or box is mounted a tool-holder, so as to be capable of oscillation on a shaft or on trunnions in the plane in which the cut is made. Upon the opposite sides of this tool-holder are arranged clamps, by which one or more cutting tools are or may be secured and adjusted on each side. The cutting edges of the tools are so arranged that when the tool box or holder is oscillated against the stop in the opposite direction, the other cutter or cutters on the other side are brought into position and are ready to act to cut in the opposite direction.

4344. AUTOMATICALLY LIGHTING AND EXTINGUISHING STREET LAMPS, &c., *G. P. Ganster.—Dated 25th October*, 1880. 8*d*.

A small flame is carefully shielded from being extinguished by accident during the entire day or such period as the light is not required, and at a stated hour the cock or valve is opened and allows gas or gaseous combustible to flow out from the main burner. The jet being ignited from the small flame yields a broad light until the proper time arrives when the mechanism shall cut off the flow from the main burner again.

4348. EXCLUDING AIR FROM EMPTY CASKS, *F. Baxter.—Dated 25th October*, 1880. 6*d*.

This consists of a stopper attached at the tap hole or tap holes, ready to be applied at any moment to close it or them, and thereby exclude the air from the said cask.

4351. LIFE-SAVING RAFTS, *W. R. Lake.—Dated 25th October*, 1880.—(*A communication from T. B. Griffith.*) 6*d*.

This consists in the combination and arrangement of parallel, or substantially parallel, cross bars or portions of buoyant material, and longitudinal connecting lines carrying cork or other buoyant material forming compartments, each of which is adapted to receive a person.

4358. ANNEALING IRON AND STEEL WIRE, *W. Hewitt.—Dated 26th October*, 1880.—(*Complete.*)—(*Void.*) 4*d*.

This relates to the mode of utilising waste hydrogen gas generated in iron and steel cleaning and like processes, which consists in collecting the same and charging annealing pots therewith, to provide a non-oxidising medium for annealing wire and kindred articles.

4362. POTATO DIGGERS, *J. Wallace.—Dated 26th October*, 1880. 6*d*.

The rotating digging instrument, which is of the well-known Hanson kind, is carried on a frame mounted on three wheels, two being at the sides on the same axle, and the third being in front and on a lever jointed to the frame. On the axle of the two wheels there is placed a bevel wheel, which can be put into gear by means of a lever and clutch, and which gears with a bevel pinion on a short longitudinal shaft. This longitudinal shaft extends forward from the axle in a position near one of the side wheels, and the digging instrument, which is a radiating set of forks, is fixed on the front end of it.

4363. SUSPENDERS AND BRACES, *H. J. Haddan.—Dated 26th October*, 1880.—(*A communication from T. O. Potter.*) 6*d*.

This consists in the combination of shoulder straps or webbing, provided at their ends with pulleys, with independent cords, provided with button-holes.

4365. BATHS, *W. T. Sugg.—Dated 26th November*, 1880. 6*d*.

This consists in the combination, with a bath in which the water is heated while in the bath, of a conductor or cover for directing the gases of combustion on to the surface of the water, whereby they are more or less absorbed.

4367. FASTENING TUBULAR HANDLES TO CULINARY VESSELS, &c., *F. Ryland.—Dated 26th October*, 1880. 6*d*.

This consists in casting a socket of special form upon the vessel to receive the tubular handle within it, and formed with the inside of the socket tapering to correspond with the taper of the tubular handle. This socket being made of a slightly less diameter than the tubular handles, and with the butting edges of the handles not quite meeting, the tendency of the handle, after it has been forced into the socket, will be to expand or open at the joint, and will thus be held tightly in its position.

4369. HORSESHOES, *W. R. Lake.—Dated 26th October*, 1880.—(*A communication from J. D. Billings.*) 6*d*.

This consists in providing machine-made horseshoes and blanks therefor composed of either an iron or steel bar in the form of a T-shaped rail in transverse section, the central rib of which forms a continuous projection or caulk extending around the shoe from heel to heel, when the same is bent by machinery into the required curvilinear form of a horseshoe.

4370. WATER-CLOSETS, *J. W. Holland.—Dated 26th October*, 1880. 6*d*.

This consists in the construction of closets in which the outward and exposed parts are practically disconnected with the soil pipe and other parts in which exist or are generated poisonous or injurious gases.

4373. STEERING APPARATUS, *J. N. Holliday.—Dated 26th October*, 1880. 6*d*.

This relates to economising space and so arranging the steam and hand steering apparatus that either can be at once worked without any locking being required,

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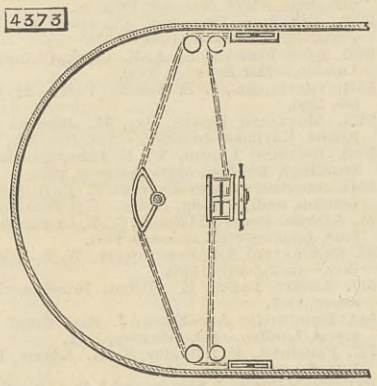

for which purpose the steam steering apparatus is placed amidships apart from the hand steering gear which can be placed aft, the two being connected by an arrangement of rods or chains.

4377. FACILITATING REPAIRS OF DOCK WALLS, SHIPS, &c., *J. T. Parlour.—Dated 27th October*, 1880. 6*d*.

This relates mainly to an extending frame of tube or other form, and telescopic or not, terminated at its lower end with an enlarged portion, within which men can work. If desired, this enlarged end supports upon its side one or more ball-and-socket or other jointed tubes or bulbs, on the outer ends of which are projecting tubes, which serve as connections to other tubes, whose outer ends are provided with india-rubber flexible caps. The ball-and-socket tube is provided with a head-piece, in which a glass or other sight-hole is arranged, to enable the workmen to examine the structure to be operated upon when the apparatus is let down or submerged to the desired depth.

4378. MULTITUBULAR FIRE-ARMS, *G. Pace.—Dated 27th October*, 1880. 6*d*.

This consists in the combination in combined revolving multitubular and magazine fire-arms of a recessed cartridge receiver, which revolves with a series of removable slides, and occupying a relatively fixed position, the cartridges in the intermittent revolution of the receiver being gradually pushed into the opposite barrels until they reach the firing position by a stationary cam, and being singly exploded, and when discharged being gradually withdrawn by means of extractors engaging with and worked by the said cam, and with a needle container and hammer.

4383. ABDOMINAL BELTS FOR THE PREVENTION OF SEA-SICKNESS, *P. W. G. Nunn.—Dated 27th October*, 1880. 6*d*.

The belt is adapted to be strapped on to the body around the abdomen. On the inner side of the belt air pads are provided in such positions that when inflated they may support the solar plexus and those branches of the sympathetic nerve which control and envelope the superior and inferior mesenteric, gastric, and splenic arteries, and so acting through the sympathetic nervous system prevent or alleviate sea-sickness.

4384. SELF-LEVELLING TABLES, CATTLE PENS, &c., *B. J. B. Mills.—Dated 27th October*, 1880.—(*A communication from J. F. Dobson.*) 6*d*.

This relates to improvements in dining tables upon ocean steamers and navigable vessels, and it consists in a novel arrangement and construction whereby the tables and the chairs connected with the same will remain in a horizontal position, unaffected by the rolling or pitching of the vessel.

4386. COWL, *J. R. Dry.—Dated 27th October*, 1880. 8*d*.

A hood fits over and is secured to the brickwork, terminating in a short neck, the whole serving to lead the smoke and gases from the mouths of the chimneys to the cowl proper, which is pivotted and can turn freely on a stem or rod, the latter being well steadied by a cross-bar and firmly fixed at its base on the brickwork. The cowl has a bell mouth and a cone inserted in its centre, with a narrow aperture around the base of the said cone, and an opening opposite to it, the bell mouth and cone being made to face the wind by the influence of a vane on the top.

4388. COMBINED ADJUSTABLE SEATS AND SCHOOL-DESKS, *P. M. Justice.—Dated 27th October*, 1880.—(*A communication from A. E. J. Damman and A. Cassard.*) 4*d*.

From a base or platform rise three hollow cast iron columns, within which slide in a vertical manner a corresponding number of iron rods. Upon the top of two of these rods are secured iron plates or tables which are secured to and support the desk. The third hollow column is provided with a sliding rod carrying its superimposed platform, upon which is secured the seat. The supporting rods are secured in position by set screws passing through the columns.

4389. DREDGER OR CASTER FOR TABLE USE, &c., *A. M. Clarke.—Dated 27th October*, 1880.—(*A communication from A. C. D. Pochez fils.*)—(*Not proceeded with.*) 4*d*.

The dredger is provided with a valve to regulate the discharge of the contents.

4390. ENVELOPE LETTER PAPER, *A. M. Clarke. Dated 27th October*, 1880.—(*A communication from E. Clement.*)—(*Not proceeded with.*) 4*d*.

This relates to an envelope letter paper designed to prevent the letter being surreptitiously opened without detection.

4391. IMPROVEMENTS IN MEANS FOR MEASURING THE AMOUNT OF ELECTRICAL CURRENT FLOWING THROUGH A CIRCUIT, *P. Jensen.—Dated 27th October*, 1880.—(*A communication from T. A. Edison.*) 6*d*.

The inventor uses balanced plates in a depositing cell, so arranged that the deposition of metal upon one plate overbalances it, and so operates the registering devices. A depositing cell is used (see figure), in which the plates are suspended, but insulated from a balanced arm, to which is attached a lever arm D, on which is an adjustable weight. This cell is placed in a branch circuit. As the weight of one plate is increased by the deposit of, say copper, from the solution, it will

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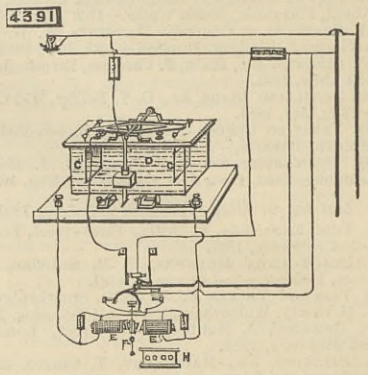

tip the balanced arm whenever the weight of the increase becomes sufficient to overbalance the weight on the lever arm. The movement of the lever arm causes a movement of the registering apparatus. Suppose the parts to be in the position shown in the figure, and the current flowing through the cell, so that C is the anode and C^1 the cathode. As metal is deposited on C^1 it overbalances C, swings D out of perpendicular until it takes against the screw shown in figure, wherein circuit through E^1 is closed, E^1 attracts F, causing it to operate the register H. The inventor calls this apparatus the "vebermeter."

4394. MACHINERY FOR MANUFACTURING SPOOL TUBES, *W. Ambler.—Dated 27th October*, 1880. 10*d*.

This relates, First, to the apparatus for cutting the lengths of paper from which a tube is to be made; Secondly, of apparatus for supplying ink to the tube-marking type; Thirdly, to the manufacture of two tubes in one machine.

4395. GAS STOVES, *C. A. Brodribb.—Dated 27th October*, 1880. 6*d*.

This consists of a gas stove which has the burner or burners placed just above the apex or top of a conical

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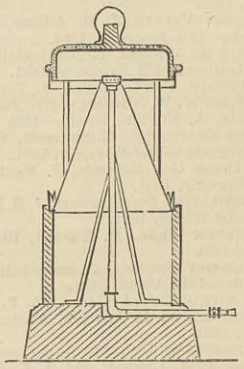

reflector, and immediately below and within a cover or top of porous material, which is perforated with holes, whose number and area are properly proportioned to the capacity of the burner.

4397. PACKING CASES FOR THE CONVEYANCE OF PICTURES, &c., *W. and A. H. Dawes.—Dated 28th October*, 1880. 6*d*.

This consists, First, in the application and use of permanent sliding or otherwise adjustable grippers or holders, with or without leather or webbing cross bands and loose sliding frames or boards, as attachments or appendages to packing cases, for receiving and securely holding pictures, frames, or other articles without requiring the use of a tool; and Secondly, of an angle iron or other combined rectangular metallic brackets and screws for securing the lids of packing cases.

4403. MASHING MALT, &c., *G. G. Cave.—Dated 28th October*, 1880. 6*d*.

This consists in the combination in an apparatus for mashing malt of a hollow plough or ploughs in communication with a hollow shaft, into which ploughs a heating or cooling medium is passed.

4404. SEWING MACHINES, *G. Browning and S. Mort.—Dated 28th October*, 1880. 8*d*.

This relates to machines for producing zigzag stitching, and one of the objects achieved by the machine is the production not only of zigzag stitches of various lengths, but also of zigzag stitches in combination with horizontal stitches between them.

4411. CISTERNS OR FLUSHING APPARATUS FOR WATER-CLOSETS, &c., *U. Bromley, G. Crowe, and W. James.—Dated 28th October*, 1880. 6*d*.

The cistern has a syphon cast or fixed therein, and by means of an adjustable cock, which can be regulated to admit sufficient water to fill the syphon and flush at any fixed interval of time, the periodical flushing is effected.

4415. STOPPERS FOR BOTTLES, &c., *H. J. West.—Dated 28th October*, 1880. 6*d*.

This relates to the construction of valve stoppers.

4420. WEAVING REVERSIBLE FABRICS, *A. and C. H. Rothwell.—Dated 29th October*, 1880. 4*d*.

The weft is floated alternately over and under three or more threads, missing one warp end in each succeeding pick.

4421. PRIME MOVERS ACTUATED BY STEAM, &c., *G. Wilkinson.—Dated 29th October*, 1880. 6*d*.

Two pistons are fitted to work in one oscillating

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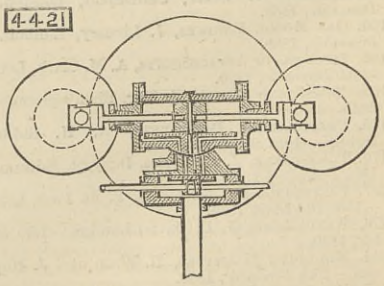

cylinder, and so acting that the moving parts balance each other in their various positions. The said

cylinder is provided with a cover at each end, and each of the two piston-rods work in one of the said covers. Each piston-rod takes hold of a separate crank, or of the pin of a crank, and the two crank shafts are provided with pinions, which gear with a central wheel which is secured to a main shaft. The said crank shaft may also be provided with fly-wheels. The said central wheels maintain the relation of the two sets of moving parts to each other in all their movements, so that the two pistons move outwardly and inwardly in unison.

4424. VALVE GEAR FOR STEAM ENGINES, &c., *J. and R. Crighton and P. Chell.—Dated 29th October*, 1880. 6*d*.

This relates to the valve gear wherein the valve is opened by the excentric and closed by a spring to effect the "cut-off," the time of opening and closing the "cut-off" valve being regulated by the action of the governor. A is the excentric rod, B the valve rod, C the rod from the governor, and D the spring box. The rod A is connected to a sliding plate E, and rod B, to another sliding plate F resting upon the former and having a vertical slide or die G capable of rising

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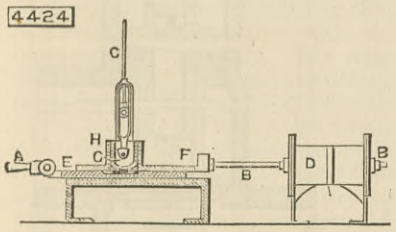

and falling in an open box H. The top of plate E and the bottom of the vertical slide are provided with slightly projecting plates, so arranged that when the slide G is in its lowest position the plates are in contact and the movement of the rod A is communicated to the valve rod B, but when the slide is raised the plates are released, and the spring connected with the valve rod closes the valve. The slide G is operated from the governor.

4426. BEARING SPRINGS, *I. A. Timmis.—Dated 29th October*, 1880. 6*d*.

This consists in the use of bearing springs under railway carriages and trucks made from bars of steel, which in cross section are of unequal shape, and consequently of unequal temper, or the shape of a parallelogram, or nearly a parallelogram, and coiled in a helical or spiral form, and working in compression or in tension.

4429. COILING AND BUNDLING IRON AND STEEL RODS, &c., *B. Talbot.—Dated 29th October*, 1880. 6*d*.

On one end of the framing of the machine is a winder, on which is placed the loose coil of wire rod or wire to be coiled or bundled. At the opposite end of the machine is a reel on which the coiling and bundling are effected. The said reel is connected to its shaft by a clutch, by which it can be thrown into and out of gear with the driving shaft.

4430. SEWING MACHINES, *S. and A. Keats.—Dated 29th October*, 1880. 6*d*.

This consists mainly in a novel form of looper, which ensures the unfailing placing of the hook thread in he hook of the needle.

4435. STOVES, *C. M. Westmacott.—Dated 30th October*, 1880. 8*d*.

This relates to the construction of stoves by which the heat generated by the combustion of fuel is utilised to a greater extent than heretofore.

4434. IMPROVEMENTS IN TELEGRAPHIC RECORDING APPARATUS, *T. M Foote.—Dated 30th October*, 1880. 6*d*.

This invention relates to apparatus for recording messages transmitted by electricity, and consists of various improvements for causing the letters, &c., to be automatically impressed in consecutive lines. A sheet of paper is fed forward beneath a type wheel and drawn back to its starting position by a roller actuated so as to bring the paper into proper position for commencement of another line. An electro-magnetic escapement turns the type wheel, to which movement is given by a weight or spring barel through a train of clockwork, so as to present the desired letter for impression, after which a second electro-magnet acts

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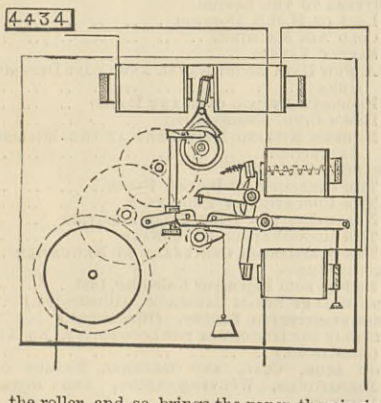

upon the roller, and so brings the paper therein into contact with the type wheel, thereby producing the impression. After one line of letters has been printed the roller is returned by means of a third electro-magnet to its starting position; simultaneously with this the type wheel is liberated, and turns so that the zero point is presented at the place where the impression takes place, all the instruments in the circuit being then in unison. The figure is a side elevation partly in section of the apparatus in question.

4436. LOOMS, *I. Bradshaw.—Dated 30th October*, 1880. 4*d*.

This refers to an improved arrangement of the swell, whereby the operation of arresting the progress of the shuttle may be more gradually and effectively

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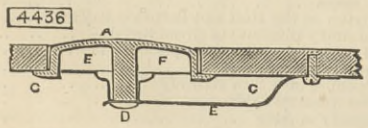

performed than heretofore. A is the swell or curve supported centrally in slotted guide bearings, in which pins or arms, one on each side of the central block D, are free to slide; E is the back spring; F the groove in the side of the shuttle box in which the swell or curve A fits easily, and G are the stops (answering as fulcra or points of resistance) formed upon each end of the swell.

4444. IMPROVEMENTS IN ELECTRIC GAS-LIGHTING APPARATUS, *H. H. Lake —Dated 30th October*, 1880.—(*A communication from W. Pelton.*) 6*d*.

The inventor opens and closes the gas cock by electric action on a mechanical device, and employs in combination with the burner a stationary metallic arm terminating in a platinum point near to the orifice of said burner, this electrode being fixed to, but insulated from the burner and connected to one pole of a battery and a movable electrode which is connected to the other pole of the battery, and pivotted to the burner, so that when it vibrates it makes and breaks circuit, and so produces a spark which lights the gas. In the apparatus shown in the figure, the inventor employs two electro-magnets and a vertically arranged vibrating armature connected with the gas cock, and arranged between the magnets in combination with a movable and a fixed electrode, the latter being secured rigidly to and insulated from the body of the burner and connected with a button joined by a wire to a battery, while the burner itself is connected with a magnet and a battery by a button, thereby making connection with the movable electrode, the whole being so arranged

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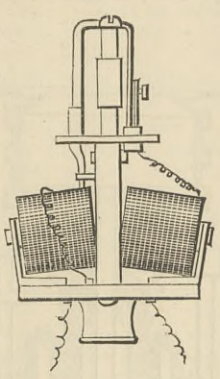

that the movement of the armature, when attracted to one magnet, which is charged from the battery by pressure on its button, serves to open the gas cock, and when attracted to the opposite magnet by depolarising the first and charging the second by pressure upon its button, the cock is closed, while as long as the first magnet remains charged by the pressure upon its knob, the movable electrode vibrates with rapid intermissions, and certain lighting of the gas is ensured.

4443. MILLING CUTTERS, REAMERS, &c., *A. Muir.—Dated 30th October*, 1880. 4*d*.

The teeth on the cutter are formed in the usual way, and then spiral grooves are made round it, thus dividing the faces of the cutting edges. When the

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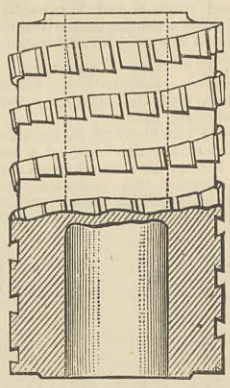

groove is made there is only clearance at one side of it, and sufficient clearance is then cut out at the other side of the groove, so as to give clearance at both sides of the cutting edges.

4446. DENOTING TIME BY BURNING OILS, &c., *R. H. Ridout.—Dated 30th October*, 1880. 6*d*.

This relates to denoting the passage of time by the burning of oils, tallow, and other like substances, so that the act of consumption or dispersion of the substance by burning puts into motion the apparatus denoting the passage of time on a graduated dial or other such device.

4447. VELOCIPEDES, *T. F. Best.—Dated 30th October*, 1880. 4*d*.

This velocipede consists of three or more wheels, propelled either by foot or hand, applied independently or simultaneouly. A fly-wheel is fitted to the axle, with or without a weight, as found most desirable, or with a bar and weight, by which means the driving power is stored up, thereby either increasing the speed of the machine or the power to ascend inclines.

4452. WRITING INSTRUMENTS, *A. P. Hansen.—Dated 1st November*, 1880. 6*d*.

The instrument consists essentially of the following parts, viz., a hollow tube or holder, a writing point or piston stop, a rod, and a cap or cover.

4458. METAL WHEELS AND PULLEYS, *R. R. Gubbins.—Dated 1st November*, 1880. 6*d*.

This consists in the swaging of the spokes from a centre to form the end of such spokes at true radial distances from the centre to receive the flange, periphery, or tire.

4459. FELTED THREAD, *W. A. Barlow.—Dated 1st November*, 1880.—(*A communication from A. Monchablon.*) 8*d*.

A cylinder is placed in a trough, which said cylinder is provided with a felt, on which is fixed a sheet, and the surface of the cylinder is embraced to considerable extent by the sides of the trough, which is also furnished interiorily with a felt and a sheet, and the cylinder is capable of two movements, one of longitudinal frictional action, the other of rotation on itself. The roving to be felted is introduced between the cylinder and the trough, and consequently it is drawn between them, and by the backward and forward action of the cylinder the felting is effected.

4461. STEAM ENGINES, &c., *A. M. Clark.—Dated 1st November*, 1880.—(*A communication from A. Johnson.*) 8*d*.

This invention is embodied mainly in an improved form and arrangement of friction clutches, whereby a

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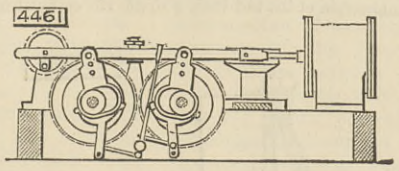

reciprocating motion may be converted into a continuous rotary motion, or whereby a continuous rotary motion may be transmitted from one shaft to another. It also consists in an improved form of balanced slide valve and in details of construction and modifications. The drawing represents a sectional side elevation of the mechanism applied to a steam engine for changing the reciprocating motion of the piston into a continuous rotary motion of the driving shaft.

4464. FOLDING FOOT MUFF OR VALISE, *G. B. Oyex.—Dated 2nd November*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in combining with a valise or portmanteau a fur or other soft lining for the reception of the feet.

4465. HAND TRUCK, *W. Cole.—Dated 2nd November*, 1880.—(*A communication from S. W. Sprague.*)—(*Not proceeded with.*) 4*d*.

This consists of a double hook hinged at the lower part of the truck frame so that it may be thrown up or open to rest upon the toe or end crossbar of the device, and operate in combination with a hook that slides on the central longitudinal bar of the truck to take hold of and hold a barrel, cask, or large box, the said double hook being so hinged that it can be turned or folded down.

4467. STEAM BOILERS, *J. Russell.—Dated 2nd November*, 1880.—(*Not proceeded with.*) 2*d*.

The boiler consists at both ends of a flat circular water space or chamber, which is mounted on hollow trunnions or journals supported in suitable bearings, in hollow vertical standards, or pillars. In each flat circular water space a steam box or chamber is provided, communicating with the hollow trunnions or journals, and with the parts of the standards or pillars above them, by which means the steam generated is allowed to pass into a steam chest supported above the boilers on the pillars or standards.

4470. FIRE-LIGHTERS, *E. Elford and A. Carr.—Dated 2nd November*, 1880.—(*Not proceeded with.*) 2*d*.

Sods of peat are cut as nearly as possible of uniform dimensions and dried in the air, when they are cut by circular saws to a suitable size. The pieces so cut are then exposed to a bath of dissolved resin, or an equivalent liquid combustible.

4471. LITHOGRAPHIC CYLINDER PRINTING MACHINES, *T. W. Woodhouse.—Dated 2nd November*, 1880. 2*d*.

This consists, First, in having the fingers immovable and fixed to the printing surface of the cylinder; Secondly, in an arrangement for damping the stone; Thirdly, in the construction of the framework.

4478. LOOMS, *W. and G. F. Holroyd.—Dated 2nd November*, 1880.—(*Not proceeded with.*) 2*d*

This consists in arranging the connections to the healds in such a manner that the tension on the heald and warp threads is reduced when the same are lifted, and the down healds are eased when the warp is being raised to the top.

4480. TRICYCLES, *W. E. Hart.—Dated 2nd November*, 1880.—(*Not proceeded with.*) 2*d*.

This consists, First, in providing against the danger incurred from the tendency of upsetting when going round a curve, owing to the pair of wheels on the one axle not being able to adjust themselves as the framing of the machine is inclined; and Secondly, in a means to allow of either or both of the pair of wheels on the one axle rising to pass over a stone or other irregularity without causing any severe jerk to the rider.

4483. SAFETY VALVES AND APPARATUS FOR STEAM GENERATORS, *S. Hallam.—Dated 3rd November*, 1880. 6*d*.

A is the stand pipe fitted to the generator, and in its upper end is fixed a seating B formed with a cross bar

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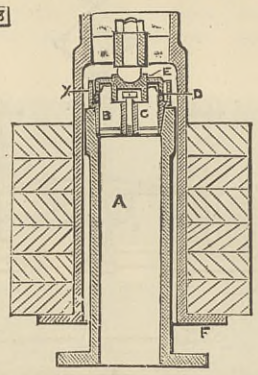

carrying a central stud C, and also having a flange on the wall X. On the seating is mounted a loose seating D, and on the latter is mounted the valve E sustaining the outer shell F loaded with weights.

4487. WELLS, DRINKING FOUNTAINS, &c., *T. Kennedy.—Dated 3rd November*, 1880. 6*d*.

The apparatus is made with a discharge spout and a handle at the upper part, whilst the valve or tap is situated at the bottom of a hollow foundation box, intended to be sunk in the ground. A self-acting valve is applied near the main valve to allow the water to escape from the pipe leading from the main valve to the spout when the main valve is closed.

4488. REGULATING THE SPEED OF MARINE ENGINES, &c., *E. P. Alexander.—Dated 3rd November*, 1880.—(*A communication from C. J. A. Ziegler.*)—(*Not proceeded with.*) 2*d*.

The chief feature of this invention is the construction of a hydro-pneumatic regulator, which is quite independent of the motion of the engines.

4490. GARTERS, *J. M. Richards.—Dated 3rd November*, 1880.—(*Not proceeded with.*) 2*d*.

This consists of a cotton or silk webbing provided with suitable fastenings and of a strip of metallic braid—for instance, gold braid—having at frequent intervals narrow strips of another metal, such as zinc, lapped round it, the braid with the zinc strips so applied being affixed to the inner surface of the garter.

4495. IMPROVEMENTS IN ELECTRIC-LIGHTING APPARATUS, *W. R. Lake.—Dated 3rd November*, 1880.—(*A communication from J. T. Nichols.*) 6*d*.

The inventor forms the base of the glass globe of his lamp, which is on the incandescent principle, or

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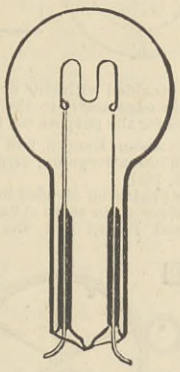

surrounds the conducting wires in the globe, with a cement, so as to avoid the tendency to the formation of cracks in the glass about the wires. The cement is composed of oxide of lead, silica, oxide of iron, oxide of copper, and potash or soda. The conducting wires are made of copper. The figure shows the cement tubes, which are fused and sealed to the wires at their upper ends and to the glass of the globe at their lower ends.

4510. BREAKING STONES, &c., *D. Stratton.—Dated 4th November*, 1880.—(*A communication from A. Hope.*) 6*d*.

This relates to machines having a fixed jaw, near which an inclined jaw works with a small vibratory motion, whilst the stones pass down between the jaws and become gradually broken. The vibrating jaw A is worked by a crank which gives a vertical reciprocating movement to a connecting bar B, forming the middle piece of a toggle combination acting horizontally between the back of the vibrating jaw and a stationary bolster C, which is adjustable by a wedge to set the vibrating jaw at a suitable distance from the fixed jaw. Toggle pieces or struts D and E are placed between the vibrating jaw and the middle piece, and between the latter and the bolster, such struts being formed with a single bearing part at one end, and two

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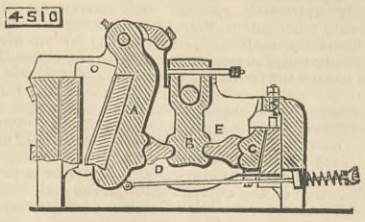

or three bearing parts at the other end, so as to obtain two or three strokes for one revolution of the crank shaft.

4515. IMPROVED CONSTRUCTION OF MOUTHPIECE LIP OR RIM FOR IMPARTING ELECTRIC CURRENTS TO FLUIDS WHILST PASSING INTO THE MOUTH, *J Dunbar and R. R. Harper.—Dated 4th November* 1880. 2*d*.

The inventors employ one or more opposite or negative and positive metals in conjunction with an insulating medium in connection with the rims of drinking vessels, &c., whereby an electric current is caused in the liquid.

4554. SHIPS' VENTILATORS, *J. W. Shepherd and G. Lines.—Dated 6th November*, 1880. 6*d*.

Into the vessel's side is fixed a small chamber or bent tube, which is open to the outer air and to the cabin or other part to be ventilated, the opening to the cabin or other part being placed a short distance above the opening to the outer air. In connection with this chamber is employed a sliding catcher, collector, or

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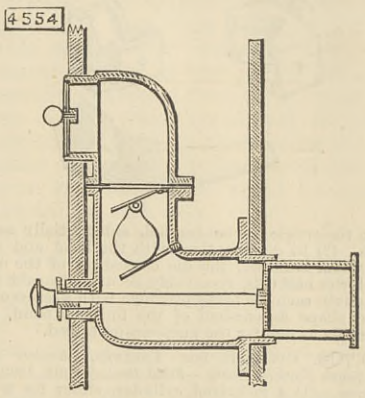

conductor, closed at its outer end, but partially or entirely open at its inner end and at one side. A rod from this catcher, collector, or conductor passes into the interior of the cabin or other part through a stuffing box, thereby permitting the said catcher, collector, or conductor to be protruded from the vessel's side when the ventilation is required, and to be partly or wholly drawn back within the tube as may be desired.

SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.

240,629. SWITCH AND SIGNAL APPARATUS, *George Westinghouse, jun., Pittsburg, Pa.—Filed January 8th*, 1881.

Brief.—Switches and their corresponding signals are actuated through hydraulic columns extending from one side of flexible diaphragms to the switch or signal operating mechanism, said columns being set in motion by compressed air acting upon the opposite

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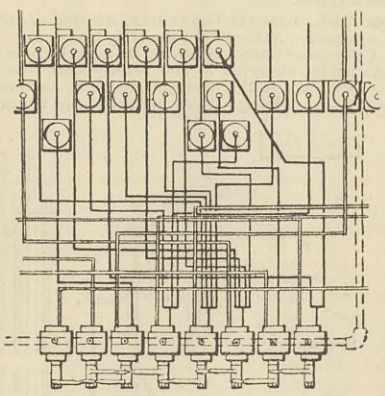

side of the diaphragms. Specially formed valves admit the air to the diaphragm, which actuate the switch columns first, and then to the corresponding signal-actuating diaphragms. Interlocking bars are employed in connection with the main line signal valve levers.

240,678. WEBERMETER, *Thomas A. Edison, Menlo Park, N.J.—Filed October 7th*, 1880.

Brief.—In a cell containing copper or other metal in

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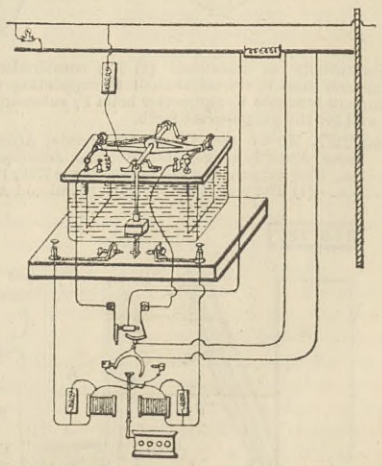


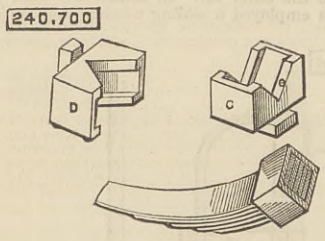
solution is placed a pair of balanced depositing plates. A proportional derived current is passed through the cell from one slate to the other until one becomes sufficiently loaded to move an arm connected with the balance lever, so as to effect a reversal of the current

whereby the loaded plate is freed from its burden and metal deposited upon the other with a like result. A registry apparatus records each movement of the reversing mechanism, thereby indicating the amount of electricity employed. *Claim.*—(1) In an electro-depositing cell, the combination, with the plates therein, of means for changing the anode and cathode relation of the plates, substantially as set forth. (2) The combination of a decomposing cell, balanced polar plates therein, and a registering apparatus controlled by the overloading of either plate, substantially as set forth. (3) The combination of a decomposing cell, balanced polar plates therein, and a reverser reversing the direction of the current through the cell, and controlled by the overloading of either plate, substantially as set forth. (4) The combination of a decomposing cell, balanced polar plates therein, and registering apparatus, and means for reversing the direction of the current through the cell, the register and reverser being controlled by the overloading of either plate, substantially as set forth. (5) The combination with a main circuit, of a shunt or branch circuit through which passes a definite portion of the current, a depositing cell containing balanced plates, a register, and a reversing apparatus, substantially as set forth.

240,700. DEVICE FOR BANDING ELLIPTIC SPRINGS, *Jas. Hale, Detroit, Mich.—Filed January 25th*, 1881.

Claim.—(1) The method herein described of forming and securing metallic bands, consisting of forging the same upon a manual in dies removably secured to the anvil and head of a steam hammer, and provided with recesses of the same shape as the finished band, and by means of the same dies swaging said bands

240.700

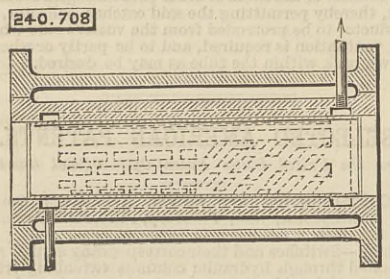


upon the article to be banded, substantially as set forth. (2) In combination, with the head and anvil of a steam hammer, the die consisting of the upper and lower half C D, removably secured to said head and anvil, each die being provided with a recess of the same shape as one-half of the finished band, substantially as and for the purposes described.

240,708. CYLINDER FOR ENGINES, *Ebenezer Hill, South Norfolk, Conn.—Filed December 9th*, 1880.

Claim.—(1) A jacketted cylinder, either for water, steam, air, or other gases, formed with ribs or studs in the jacketted space or spaces, and faced and covered with a thin sheet metal lining, rolled into proper posi-

240.708

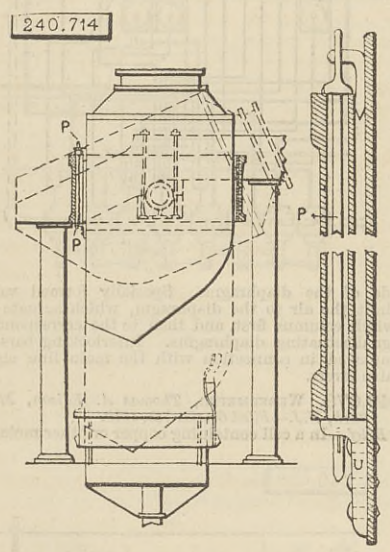


tion, as hereinbefore set forth. (2) The method of lining jacketted cylinders, consisting of forming bearing ribs or studs in the jacketted spaces, then filling the intervening grooves or spaces with an alloy or other hard bearing substance, then boring out the cylinder, and lastly rolling in a thin sheet metal lining, as hereinbefore set forth.

240,714. BESSEMER CONVERTER, *Alexander L. Holley, Brooklyn, N.J.—Filed June 17th*, 1880.

A Bessemer converter having its main body or shell detachably connected to and readily separable from the trunnions, so that the said shell may be removed for repair or relining without disturbing the trunnions,

240.714

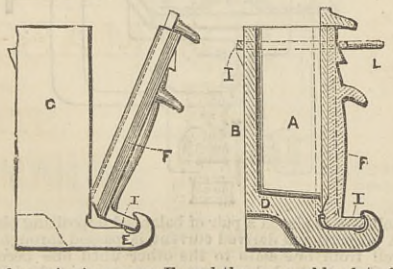


substantially as described. (2) The combination of trunnion band F, converter shell D, supporting ring, flange or brackets U, and cotter bolts P, substantially as and for the purposes set forth.

240,727. MOULD FOR COMPOUND INGOTS, *Alfred E. Jones, Newark, assignor to Spaulding, Jennings and Co., West Bergen, N. J.—Filed December 17th*, 1880.

Claim.—(1) The combination, with the mould A B C

240.727

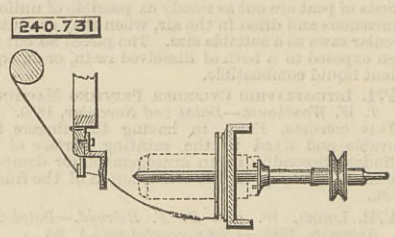


D, of a swinging cover F, and the removable plate G, for the purposes and as set forth. (2) The combination, with the mould A B C D, of the cover F, having the projection I, and the base E, forming an open hinge for the cover, substantially as set forth. (3) The combination, with a two-part mould capable of being opened and its removable rings, of a parallel plate or bar having a hook K, for retaining it in position against one side of the mould, which plate is liberated by opening the mould, and is removed after one metal has been cast, substantially as set forth.

240,731. RING SPINNING FRAME, *Chas. C. Kent, Laurel, Md.—Filed October 28th*, 1880.

Brief.—The auxiliary traveller ring, of much smaller diameter than the main ring, is placed below and in close proximity to the guide wire and attached to the same hinged rail or board, and serves to correct irregularities of tension in the yarn being spun, and also to throw twist into the yarn back past the guide wire to the rolls. *Claim.*—(1) In ring spinning frames, the combination, with the rolls, the guide wire, its hinged rail or board, and the main ring and traveller, of an

240.731

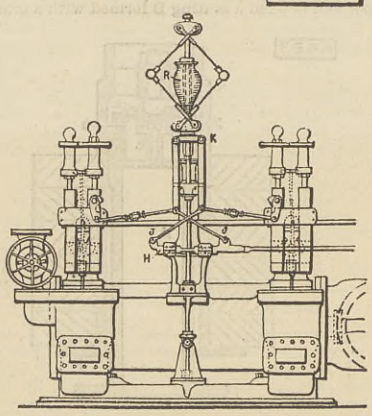


auxiliary traveller and travelling ring, attached to and carried by the hinged guide wire rail or board, and placed vertically above the spindle and below the guide wire, substantially as hereinbefore set forth. (2) The combination, with the rolls, the guide wire, its hinged rail or board, and the main ring and traveller, of the auxiliary or regulating traveller and ring adjustably secured to the guide wire rail, substantially as shown and set forth.

240,756. VALVE MOTION CUT-OFF, *Eugene O'Neill, San Francisco, Cal.—Filed September 27th*, 1880.

Claim.—(1) The arms J, having their lower ends pivotted to the slide H and approaching or crossing each other diagonally, their upper ends being connected with the ring or sleeve K of the governor, and with the valve tripping mechanism by the rods O, sub-

240.756

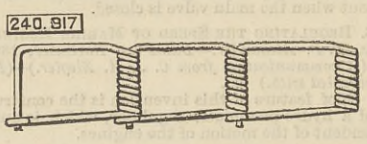


stantially as and for the purpose herein described. (2) The means for regulating the movement of the governor, consisting of the receptacle R, supported by the arms of the governor, in combination with the contained shot or other divided removable solid heavy material by which the action is adjusted and regulated, as described.

240,817. DRIVE CHAIN, *James M. Dodge, Chicago, Ill.—Filed February 17th*, 1881.

Claim.—A chain link made of a single piece of wire

240.817

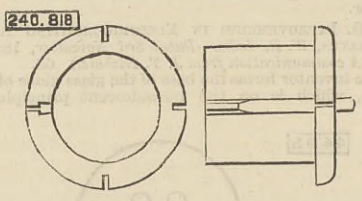


and having a tubular end bar, substantially such as and for the purpose set forth.

240,818. BOILER TUBE FERULE, *George W. Duval, Norfolk, Va.—Filed February 21st*, 1881.

Claim.—A ferule provided with one or more longitudinal slots for the reception of keys, and having an

240.818

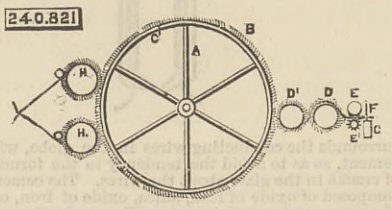


outer flange provided with slits or notches extending from the outer edge nearly to the inner edge of said flange, as and for the purpose set forth.

240,821. CARDING ENGINE FOR MAKING MOTTLED YARNS, *William Ferguson, Germantown, Pa.—Filed May 11th*, 1881.

Brief.—For producing clouded or mottled roving or yarn, the surface of the main cylinder is divided into circumferential rings, and the two doffers are

240.821

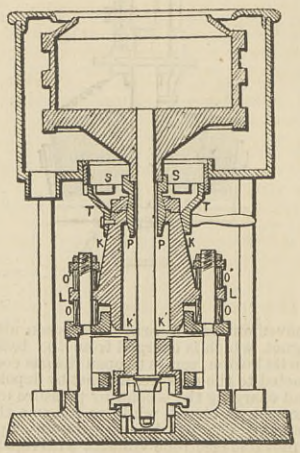


furnished with oblique or spiralled rings of card clothing, the rings on the upper doffer being over the spaces on the lower doffer. The different colours are removed in diamond-shaped sections. *Claim.*—(1) In a carding engine, the cylinder A, having its surface divided into circumferential rings B by leather or analogous bands C, which are pressed between the teeth, in combination with two doffers arranged one above the other, said doffers being furnished with oblique rings of cards and spaces of equal, or nearly equal, width, the rings on the upper doffer being over the spaces on the lower doffer, the whole constructed substantially as shown and described. (2) In a carding engine, the combination of support G, provided with guide pins F, feed wheels E E¹, cylinders D D¹, carding cylinder A, having its cards divided into circumferential rings B by leather bands C, and two doffers H H¹, arranged one above the other, and provided with rings of cards set obliquely thereon, substantially in the manner shown and described.

240,839. CENTRIFUGAL MACHINE, *Teile H. Müller, New York, assignor to Samuel S. Hepworth, Yonkers, and Joseph Colwell, New York, N.Y.—Filed December 6th*, 1880.

Claim.—(1) The combination of the oscillating sleeve K, having the joint K¹ in the fixed frame of the machine, and the flange L, with the bearing P, of the spindle, and the springs O O¹, substantially as described. (2) The combination of the fixed base plate J, the oscillating sleeve K, the ball and socket R, and the springs O O¹, to form an elastic or flexible

240.839

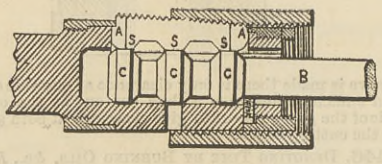


pedestal in a centrifugal machine, substantially as described. (3) The flexible sleeve K, provided with the ball joint K¹ at the bottom, and suitable springs to maintain its equilibrium, to serve as an elastic support for the upper bearing of the spindle of a centrifugal machine, substantially as described. (4) The notched rings S and T, operating as described, in combination with the oscillating sleeve K and the fixed frame of the machine, substantially as described.

240,917. TAP FOR THREADING SOCKETS, *John McCandless, assignor to himself and Spang, Chalfant, and Co., Allegheny County, Pa.—Filed November 4th*, 1880.

Claim.—(1) The mandril B, capable of a free endwise motion under the blow of a hammer, or otherwise, and having die seats thereon steeply bevelled on the sides toward the projecting stem or releasing device, in combination with threading dies A each having two or more lugs S, made with steep counter

240.917

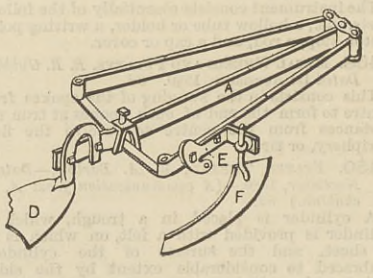


bevels, substantially as and for the purposes set forth. (2) The mandril B, capable of a free endwise motion, and die seats C thereon, bevelled on both sides, in combination with threading dies A, each having two or more lugs S, also bevelled at both ends, substantially as and for the purposes set forth.

240,945. CULTIVATOR, *Frank Bateman, Spring Mills, N.J., assignor of one-half to Edward S. Bateman, same place.—Filed November 22nd*, 1880.

Brief.—An adjustable sharp-edged plate, to press a ridge and perform the office of a roller. A wheel cutting knife, hung upon a bracket attached to a cultivator frame, and capable of three or more adjust-

240.945

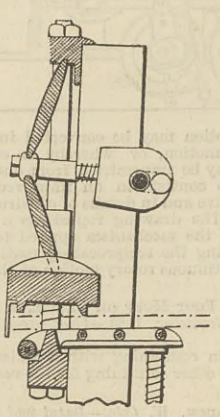


ments. *Claim.*—(1) The combination of the bar A of the frame, the presser plate D, and a U-shaped bar, having openings in both standards, and the bolts for confining the same as specified. (2) The combination of the side bar of the frame, the bent plate E, bolted to said bar, the cutting blade F, having a stem and a bolt, adapted to an opening in the laterally projecting portion of the plate E, and having an eye for the reception of the said stem of the blade, as set forth.

240,951. MACHINE FOR BREAKING PIG IRON, *Theodore A. Blake, New Haven, Conn.—Filed January 31st*, 1881.

Claim.—(1) In a machine for breaking pig iron, the combination of the bed with a single rib or breaking

240.951

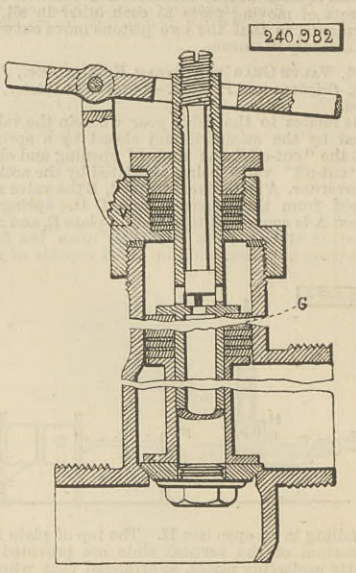


point, over which the pig is placed, and the reciprocating slide above, provided with two ribs or breaking points to bear upon the pig, one in front of and the other in the rear of the rib or breaking point below, substantially as described.

240,982. VALVE APPARATUS, *Chauncey N. Dutton, Washington, D.C., assignor of one-half to Thom s Wilson, same place.—Filed August 16th*, 1880.

Claim.—(1) A celluloid valve body formed by moulding upon mandrils or formers and then hardening and finishing, substantially as described. (2) The

240.982

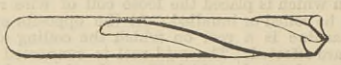


piston G, composed of alternate layers of metal and celluloid of different diameters, which respectively attract and repel water, so as to leave annular spaces U, substantially as described.

240,984. ART OF MANUFACTURING TWIST DRILLS, *Theodore P. Farmer, Worcester, assignor to the Farmer Lathe Drill and Tool Company, Leominster, Mass.—Filed September 9th*, 1880.

Claim.—As an improvement in the art of making twist drills, providing the stock with two symmetrical longitudinal grooves lying in parallel but not coinciding longitudinal planes cut from opposite sides of the stock, and passing by the centre on opposite sides thereof, and then cutting away each of the opposite

240.984



sides of the stock, from 7 to 8, to give proper relief, and then twisting said stock in such a manner and to such an extent as to render the grooves spiral, with a uniform twist, and also cause the opposite edges of each groove to approach each other to diminish the surface area of chips brought into contact with the sides of the hole being bored, substantially as and for the purpose set forth.

CONTENTS.

THE ENGINEER, June 10th, 1881.

ASHTON AND STALYBRIDGE TRAMWAYS.—Cars commenced running on this line last Saturday. The construction of the line from Ashton to Fairfield Wells, where it will join that already laid from Manchester, is being pushed on rapidly, and is to be, the *Contract Journal* says, completed by the 10th of July.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending June 4th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 11,994; mercantile marine, building materials, and other collections, 3439. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 1977; mercantile marine, building materials, and other collections, 349. Total, 17,759. Average of corresponding week in former years, 17,043. Total from the opening of the Museum, 20,000,973.