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RUSHWORTH'S VERTICAL ANGLE AND T-IRON BENDING MACHINE.

The accompanying engraving represents a machine designed for bending angle iron up to 6×6 , T-iron, and flat bars. The rollers project above the table, which is planed for the

The rollers project above the table, which is planed for the angle iron to rest on whilst going through the rolls when bend-ing small diameters. The iron is also supported by the brackets with rollers when bending large dia-meters, as shown in the illustration. Each roller is in two parts, the bottom part of roller going, say, 2in. below top of planed part of table, and pro-jects, say, $\frac{1}{2}$ in. above on top side, so that no friction is caused through the angle iron being pressed against the table. iron being pressed against the table. The top part of the rolls can be raised or The top part of the rolls can be raised or lowered by a screw which passes through the bridges on the top of the rolls to suit the different thicknesses of angle iron to be bent. This secures a great saving of time as compared with rolls which have to be lifted off and washers put in between for different thicknesses. The machine is very powerfully geared with spur and worm gear, having a purchase of 90 to 1. The table is made strong enough to be used as a levelling block when required, and the brackets can be moved in the T-slots endways or readily taken off so as to leave the table clear. Small rings can be rapidly bent by the machine, which is made by Messrs. Rushworth and Co., Sowerby hv Messrs. Rushworth and Co., Sowerby Bridge,

SUSPENSION BRIDGE AT ABERGELDIE.

ABERGELIDIE. THE engravings on page 102 illustrate a new bridge designed and erected by Messrs. Blaikie Brothers, of Aberdeen, at Abergeldie. Those who have made the journey from Ballater to Brae-mar have seen with interest the old castle or estate house of Aber-geldie, which has been held by Royalty for nearly forty years, and has latterly been the residence of the Prince and Princess of Wales during their autumn visits to the High-lands. Prominent in the foreground of the "nieture" in

lands. Prominent in the foreground of the "picture," in which the castle holds the chief place, was a massive rope stretching across the river, and sometimes there might have

been seen swung from it a cradle that served to carry letters and parcels, and occasionally men, from side to side, this method of transport being necessary in the absence of a bridge. Now the rope has been removed, and the suspension bridge we illus-trate supplies its place. The bridge has a main span of 145ft. Sin., and its roadway is about 4ft. in width. At each end rise to a height of 25ft. two lattice-work steel pillars, these being founded on concrete of considerable depth. The pillars have

bridge is attached. The upper of these ropes is 5in, in circum-ference, and the lower is half that size. These ropes are attached by clips and bolts to the suspension rods of $\frac{1}{2}$ in. iron, and to these rods are hung the Zore beams, between which is laid the timber flooring. Under the flooring the bridge is strengthened by wind bracings. It is estimated that the bridge would bear a weight of 60 tons. On the north the bridge is approached by a stair about 7ft in height. On the south the

out 7t in negat. On the solution the roadway terminates on the sloping bank, a few steps above which is the entrance to the Castle garden. The new bridge, it may be mentioned, will save a walk of four miles between Ballater and Abergeldie, unless the transler chocess to use the somewhat traveller chooses to use the somewhat rough and hilly road on the south side of the Dee. From Ballater to side of the Dee. From Ballater to Abergeldie the distance is about six miles, and between these points there is no bridge spanning the river. Two miles farther up is an old suspension bridge, in line with the road passing the manse of Crathie, and a short distance beyond is the fine, substan-tial iron bridge erected by the late Prince Consort to give access to Bal-moral. The Crathie suspension bridge, it may be mentioned, was erected early in the century by a Dundee black-smith named Justice, who also put up a similar structure over the Southesk, a similar structure over the Southesk, near the Kirkton of Clova. Only this year the Crathie bridge was almost entirely renewed by Messrs. Blaikie Brothers, at the expense of the Queen, who also ordered the construc-tion of the Abergeldie bridge.

THE IRON TRADES EM-PLOYERS ASSOCIATION.

THE annual report of this Association, which has just been issued to the members, deals specially with two matters which are just now of exceptional importance, as they affect the interests of the engineering trades

RUSHWORTH'S ANGLE AND TEE-BENDING MACHINE.

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two oriels of light wrought ironwork between them over the gateways and gates. Behind the piers are the anchor plates, which are bedded in the rock and secured by masses of concrete and rubble on each side of the Dee, weighing about 40 tons. From anchor to anchor, over the tops of the piers, as shown in detail, pass the steel wire ropes to which the roadway of the

and still continues, in all our great national industries has during the past year been specially trying in every branch of the mechanical engineering and iron shipbuilding trades throughout the United Kingdom. In view of this state of things, a thoroughly comprehensive and searching inquiry has been made by the Iron Trades Employers' Association, with the object of obtaining reliable data as to the actual condition of trade, especially in the mechanical engineering, ironfounding, and shipbuilding branches, and the results of this inquiry are carefully summarised in the report. From the employers the reports have shown an increasing strain in their efforts to find work, by which their establishments might be kept going and their skilled artisans and labourers held together until the dawn of better times, with the result that the pressure of competition has brought down prices to a point where profits for employers were either reaching a minimum or had disappeared altogether. Equally cheerless are the reports from the workmen's side, and in regard to the depressed condition of the labour market they are all but unanimous, so that it is clearly shown that only by the extra-ordinary efforts of the employers have the skilled hands and labourers in the iron trade been saved from a calamity which threatens to assume wider proportions, unless some improvement comes to the aid of masters and workmen before the winter sets in, as not only is the capital of employers decreasing, but the provident resources of every trades union in the kingdom are diminishing under the exceptional strain to which they are at present being subjected. In carrying out the inquiry made by the Association as to the condition of trade, over 700 returns have been carefully dealt with, and these returns represent a direct employment in the engineering, moulding, steam boiler making, and iron shipbuilding trades of over 118,000 hands. The general result shows that trade is declared good only upon returns employing under 2500 hands, moderate upon those covering 25,000 hands, and bad or very bad over the remaining area covering an employment of 90,500 men. Subdividing the preceding figures, the committee have found the following to be the condition of the separate districts to which they have

directed their inquiry. In London and the valley of the Thames, from Hammersmith to Erith, it appears that in the trades under consideration, the data supplied covers an employment of 13,000 hands, in regard to which trade is declared good in returns covering 2000 hands, moderate in returns representing 4000, and bad in respect of the remaining 7000 hands dealt with in this investigation. It should be added to the foregoing, in respect of this district, that the localities where trade is active are confined solely to the Government War Departments, or to establishments distinctly influenced by naval or military requirements. As will be seen upon inspection of other details in this statement, trade is not declared good in any other part of the kingdom.

should be added to the foregoing, in respect of this district, that the localities where trade is active are confined solely to the Government War Departments, or to establishments distinctly influenced by naval or military requirements. As will be seen upon inspection of other details in this statement, trade is not declared good in any other part of the kingdom. In the Lancashire district, including Liverpool and Birkenhead, with three other places in Cheshire, the collected data show an employment of 39,000 men; and a detailed inspection of the returns shows that trade is given as moderate only upon figures dealing with 4000 men, and bad over the remaining districts in the county giving employment to 35,000 hands. In no single instance is it declared good in Lancashire and Cheshire. In Yorkshire, Durham, and along the north-east coast, from Hull to Newcastle-upon-Tyne, the figures taken from the returns received show a gross employment of 32,000 men in the engi-

In Yorkshire, Durham, and along the north-east coast, from Hull to Newcastle-upon-Tyne, the figures taken from the returns received show a gross employment of 32,000 men in the engineering and iron shipbuilding trades. Over this important area trade is in no instance declared good. It is moderate only in districts and establishments giving employment to 5000 men; and bad in the remaining districts, giving employment to 27,000 hands.

In selecting London, Lancashire and Cheshire, Yorkshire, Durham, and the north-east coast, the chief seats of the engineering and shipbuilding industries in England have been selected, as affording the safest tests as to the condition of trade. The inquiry has, however, been carried further, and returns have been dealt with which show the state of trade in Scotland and Ireland, thus making the present investigation as complete as possible.

Complete as possible. Glasgow and the Clyde district are obviously the most important centres of the engineering and shipluilding trades in Scotland, but in the following analysis the whole of North Britain is taken into account, with the following results:—The several districts in Scotland embraced in this inquiry give employment in the engineering and shipbuilding trades to 21,000 men, of which the iron shipbuilding trade finds work for rather more than half the number. An inspection of the tables giving the data under consideration brings out the fact that trade is moderate in districts or centres finding employment for 2000 men, and bad over an area finding employment under ordinary conditions for 19,000 hands.

In Ireland the returns examined show an employment in round numbers of 4000 hands. In centres employing not more than 400 men, trade is declared moderately active. In the remaining districts, covering an employment of 3600 men, it is found to be bad to a degree hitherto unknown.

found to be bad to a degree hitherto unknown. For the first time since the Association was formed, the committee have felt bound to give prominence to this subject; not from a desire to excite undue apprehensions, but from a conviction that the figures now given will be read with interest all over the kingdom. Accompanying the data upon which the preceding statements rest, the committee have unvarying testimony as to the rapidly falling prices for the work to hand. Nor is this experience confined to the mechanical engineering and shipbuilding trades simply. Producers in the iron-making trades have the same conditions to contend with, and unless an unusual stimulus is given to these industries in the near future, the consequences may assume serious proportions alike to employers and workmen. It forms no part of the duties of the committee presenting this report to deal directly with any industrial operations beyond the limits of the engineering and iron trades; and hence, other industries are not referred to in the above statements. It is, however, evident that in every department of British industry the same depression is being experienced as that which is now paralysing all mechanical engineering and iron shipbuilding operations.

The report adds that the condition of the engineering and iron shipbuilding trades, as shown above, seems not unlikely to influence the wages question, unless improvement comes to the aid of employers at an early date. In some districts reductions have been effected during the past year both in weekly wages and in piece work prices. The movement, however, has not been general, and practically wages may be taken as standing as they did last year, with the uncomfortable conviction that unless the desired improvement in trade is felt within a short time the necessities of employers will force them to take this matter into consideration. No very serious matters have during the past year disturbed the ordinary good feeling existing between the members of the Association and their workmen. Steady progress was being made in the extension of piece work in different parts of the country, and during the past year gratifying results had been attained in the efforts put forward by the Association to establish a system of employment of non-

unionist foremen, the preference for whom over men whose actions were directed by the orders of a trades' union was obvious. The other matter of special importance dealt with in the vertex is the article of machinery and the whole question is

THE ENGINEER.

report is the rating of machinery, and the whole question is going into in detail. With regard to this matter the following extract from the report will be of interest:—

The report presented at the last annual general meeting of our members dealt with the question of the liability of engineers and other users of machines to be rated for the relief the poor, and for other purposes in respect of machines on their premises; and both in the body of the report presented in July, 1884, and in the interesting addresses of the president and of the chairman of our Parliamentary Committee, it was made clear that the committee then about to be elected would have to continue the labours of their predecessors, with the view of placing the question of rating machines upon a clearer and more equitable basis. To-day your committee feel gratified in being able to report that they lost no time in taking up the work handed over to them when they assumed office, and that during the official year now closing the subject has made remarkable progress, both in the Legislature and before the public. It has, in a word, become a national question. The president of the Association, and the chairman and members of president of the Association, and the charman and memoers of our Parliamentary Committee, have opened up important rela-tionships with the United Chambers of Commerce of the king-dom, who have in a general conference declared in favour of legislative enactments for the protection of engineers and other legislative enactments for the protection of engineers and other users of machinery. The National Association of Factory and Workshop Occupiers, the National Association of Master Builders, the Railway Carriage and Wagon Builders' Associa-tion, the Railway Locomotive Manufacturers' Association, the Agricultural Engineers' Association, the Nottingham Factory Owners' Association, and other kindred bodies of employers using machinery—all deeply interested in the question as one seriously affecting the great national industries of the country have made common cause with this Association ; and in view of the important issues involved, the committee have felt justified in getting a Bill drawn by counsel and introduced to be House of Commons by Mr. Norwood, M.P. for Hull, and president of the United Chambers of Commerce of the kingdom. In addition to the valuable support and advocacy of Mr. Norwood, the Bill has also been endorsed by Mr. Slagg, M.P. for Manchester, Mr. Jackson, M.P. for Leeds, and Mr. Brinton, M.P. for Kidder-minster. The several railway corporations of the kingdom have likewise recognised the value of the measure proposed, and are prepared to give it their valuable support when before the Legislature. The disturbed political conditions of the Legislature have diverted the attention of Parlia-ment from an adequate consideration of the measure. The Bill was read the first time, and ordered to be printed on the 15th of Armi last and its accord was find for the 15th of April last, and its second reading was fixed for Wednesday, the 8th inst. The condition of public business however, did not enable Mr. Norwood to bring it forward, and it is therefore lost for the present session. But although the Bill has not been passed into an Act of Parliament, the members of this Association may rest assured that the principles involved therein have made great progress. A general interest in the subject has been effectively started into life. The preceding list of associations of employers using machinery who have peti-tioned in favour of our Bill shows that attention is now being directed to the question, and that it is felt to be one of the highest importance. In several of the chief centres of the machinel and accessing and shiphyliding trades the members of mechanical engineering and shipbuilding trades, the members of our Association have, upon local grounds, joined with other users of machines to resist claims which are now being frequently put forward by overseers of the poor to rate machines which have hitherto been declared exempt from such liability. Pending the settlement of the question by the Legislature, our members in Leeds have, for mutual protection, made common cause with users of machines in industries distinct from the iron trades. In Newsubscribed the funds required for taking the case of the Tyne Boiler Works Company, Limited, on appeal from Quarter Sessions, to the higher Courts, and, if necessary, to the House of Lords. In Manchester the firm of Sir Joseph Whitworth and Co. have been placed under a revaluation of their works by order of the overseers, and have been called upon to pay rates upon light machines and tools hitherto held to be clear of such liability, and our Manchester members have, as in Leeds and Newcastle-on-Tyne, made common cause with employers in other industries carried on in the township, and have agreed to raise the funds with which to try the case at Quarter Sessions, and, if required, to proceed as in the Newcastle case, till a final judgment has been given in the House of Lords. It is evident therefore, that the question of rating machinery for the relief of the poor, and for other rating purposes, is growing in import ance, and is claiming attention all over the manufacturing centres of the kingdom. The committee about to be appointed to administer the affairs of this Association for the ensuing year will therefore, in this respect, have to carry forward the work from the point at which it will now be consigned to their hands, every reasonable prospect of success during the next but with session of Parliament."

JOINT ENGINEERING AND THE VYRNWY WATERWORKS FOR LIVERPOOL.

An unusual state of things in connection with the water supply of Liverpool draws attention to a remarkable squabble, followed by awkward consequences, between two civil eigeneers of eminence in the profession. The Corporation of Liverpool have lately realised that their capacity for supplying the town with water is limited, that severe measures of economy must be adopted, and that with all their economies their present re-sources will very soon be exhausted. For example, it is found that their reservoirs at Rivington show a yearly diminishing store. In June, 1884, the amount of water in stock was 2802 million In June, 1884, the amount of water in stock was 2002 infinite gallons: and this, in spite of economical precautions, fell to 1543 million gallons by the month of October. The quantity in hand a week or so ago was still less, viz., 1135 million gallons, and it is argued that according to past experience by October next the reservoirs will be dry unless some very vigorous steps are taken to reduce consumption or a heavy rainfall takes place. Taking the latter alternative first, it is calculated from the analogy of previous years that only a low rainfall can be expected for certainly more than a year; therefore, no solid help can be hoped for from that direction. A substantial diminution in consumption is thus the only practical course now. The average weekly consumption of water for all purposes may be put at about 1264 million gallons, and while the population is steadily increasing there is a natural tendency to a larger consumption for trade and manufactures. Of the total quantity consumed, something like three million gallons are used per week for watering the streets. This, under such circumstances, is rather a startling discovery, however important it may be to have streets cool and free from dust; and, to make a long story short, the Corporation have resolved to use salt water for the streets and to effect further economies by means of improved appliances.

This preliminary account of what is going on in a city stand-ing upon one of the finest rivers in the world was necessary to bring out in full force the difficulty between engineers to which we have referred. Most of our readers will probably recollect Parliament, after a stiff fight, a great engineering scheme for drawing a new water supply from lake Vyrnwy and its district. Mr. Hawksley was appointed engineer in chief to the works; Mr. Deacon, the Corporation water-engineer, assuming the post of joint engineer, or resident engineer. Sir Frederick Bramwell assisted to some extent in the preparation of estimates and plans. With such a combination it might be supposed that nothing could go very wrong in the undertaking; but it would now seem that there was too much talent engaged, not to put the matter in a rougher way. The Bill having been passed, the construction of the new system has progressed more or less rapidly, but just at the time when, as the facts we have related show, speed is of all things necessary, a grave and disturbing discovery has been made. Owing to fears in certain quarters, Mr. Hawksley and Mr. Deacon were a few months ago requested to prepare reports as to the progress and cost of the works up to the end of last year, and the probable total cost. The total estimate presented to Parliament was $\pounds 1,500,000$ —that being Expenditure will be, according to Mr. Hawksley, $\pounds 21,500,000$ —that being $\pounds 2250,000$ more than Mr. Deacon originally calculated—but it now appears that, judging from what has been done, the total expenditure will be, according to Mr. Hawksley, $\pounds 2,183,750$, and according to Mr. Deacon $\pounds 1,773,508$. That is to say, Mr. Hawksley, whose experience in such work is of the first order, exceeds Mr. Decemperative her $\pounds 100,810$ method. exceeds Mr. Deacon's new estimate by $\pounds 410,242$; while Mr. Deacon estimates $\pounds 520,000$ more than he did at first, or, in round figures, a quarter of a million more than the estimate approved by Parliament.

by Parliament. Discrepancies such as these naturally created a sensation, and ever since they were disclosed the matter has kept up a commotion in the Town Council and in Liverpool generally, while a controversy, perhaps unavoidable, but certainly unfortunate and not edifying, has been proceeding between the two engineers and the Corporation. The serious water-famine threatened in the town gives peculiar force to the dispute at this moment. Each of the two gentlemen most concerned has presented an explanation and vindication, and we understand that as no other solution has been arrived at, Mr. Hawksley has refused to be further associated with the Vyrnwy scheme on the footing of joint engineer. It is easy to understand that engineers, like doctors, will sometimes disagree, and it may occasionally happen that their disagreement is the public gain; but it is a great pity that in connection with one of the greatest water undertakings in the country, this *impasse* should have arisen. Upon the merits of the dispute we do not propose to pronounce, but we will briefly glance at the contentions on either side. Mr. Deacon, starting with the assertion that the original estimates were abundantly ample, and quoting Sir Frederick Bramwell to the same effect, attributes the great excess first to the fact that during the progress of the Bill the promoters undertook to give compensation water not only far beyond the amount contemplated at first, but to an extent absolutely unprecedented in the history of waterworks undertakings in this country. The second leading cause, he says, was the substitution of a masonry embankment for one of earth; and then he sets forth with more or less prominence these further circumstances; the necessity of raising the whole of the embankment at Vyrnwy ; alterations in the gradients and in the size of the pipes ; filter beds not included in the estimate; special works for the discharge of compensation water, and sundry other operations, resulting from the agreement as to compensation ; and an

In the one of a great articles to interpose, but it is not the question at the moment. Mr. Hawksley, for his part, warmly repudiates any responsibility for the discrepancy which has arisen and its causes. He calculates that half-a-million of the excess is due to the substitution of a stone embankment, about which he was not consulted, and he declares that his advice was not asked upon several other alterations which have increased the expenditure —these variations, it may be taken, being other than those which Mr. Deacon says were adopted on Mr. Hawksley's suggestion. If Mr. Hawksley be accurate, it would seem that the "joint engineer" had, or assumed, independent authority, and Mr. Hawskley could hardly be expected to accept responsibility for what he knew nothing of. This is the view he takes, and it cannot be matter of surprise that he should decline to continue even nominally or jointly connected with the scheme. It does not appear that this singular occurrence has delayed the construction of the works, but any distinct change in respect to the engineers of the works might easily do so, and that would, at any rate, be unfortunate for Liverpool.

TENDER.

Innes and Wood, Birmingham		 	1941 15	3	
J. W. Pickthall, Yardley		 	1800 0	0	
G. Moss, Oxford and Liverpool-accepted		 	1799 14	11	
Cowdery and Sons, Newent		 	1795 3	5	
Bell and Sons, Saffron Walden		 	1770 0	0	
Engineer's estimate		 	1778 0	0	
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LONDON WATER SUPPLY.—Mr. W. Crookes, F.R.S., and Drs. W. Odling and C. Meymott Tidy, reporting to Colonel Sir Francis Bolton, water examiner for the metropolis, on the composition and quality of daily samples of the water supplied to London during last month, state that they have analysed 182 samples collected by them from the mains of the seven metropolitan water companies deriving their supply from the Thames and Lea, and they found the whole of those samples to be "perfectly clear, bright, and well filtered." They add :—"In contrariety to what is usually observed in the month of June, and probably as an effect of the occasional stormy rainfall occurring in the early part of the month, there was a slight increase in the proportion of organic matter present in the water-supply of last month, beyond the very small proportion met with in the preceding month ; but the freedom of the water from colour and turbidity remained unaffected. During the past six months we have examined and reported on 1049 samples of the water supplied to the metropolis; and with the exception of two samples the whole were found to be well filtered, clear, and bright.

RAILWAY MATTERS.

THE half-yearly report of the London, Chatham, and Dover Railway Company gives the number of miles worked by the com-pany as 192.68 miles, and the mileage made by the company's engines, 1,435,410 passenger, 248,450 goods. The locomotive power cost £66,362 14s.; coal and coke for locomotives, £22,595 8s.

cost $\pm 00,002$ 145) could have control for the before the Belfast Accomposed to the half-yearly report to be read before the Belfast and Northern Counties Railway Company next Monday, the mileage during the half-year was 2175 miles; the train miles, 322,017 pas-senger and 153,464 goods. Locomotive power cost £14,526 13s.; coal for locomotives, £5763 6s.; maintenance of way and works, £15,214; carriages and wagons, £4363 18s.

The Great North of Scotland Railway Company is alive to some of the dangers possible from the continued use of old cast iron bridges. Fourteen new mild steel bridges are to be erected between Banchory and Aboyne, on the Deeside section of the company's railway. These new structures give a much larger margin of strength in the same space. Messrs. Blaikie Brothers, Aberdeen, have secured the contract for their erection.

have secured the contract for their erection. THE Public Works Committee of the Birmingham Town Council have not yet decided upon the description of tramway to be laid down in place of the existing lines. Their inquiries as to the cable tramways have been made in New Zealand, San Francisco, and other distant places where such tramways have been laid for a considerable time, and the information obtained has been submitted to an eminent engineer with whom the committee are in consulta-tion. They hope to be able to come to some decision before long.

THE new line of railway which will give the London, Chatham, The new line of railway which will give the London, Chatham, and Dover Railway Company direct access to Gravesend will be shortly opened for traffic. The railway leaves the main line at a point between the Farningham-road and Fawkham stations, about twelve miles from Rochester, passing for a considerable distance through a chalk cutting, the remaining portion of the line to Gravesend being, for the most part, on embankment. There are three stations on the line, namely, Southfleet, Rosherville, and the terminal station at Gravesend.

In reply to a question in the House last week on the Quetta Railway, Lord R. Churchill said : "The continuation of the rail-way from Quetta has been sanctioned to extend thirty miles in a north-westerly direction to a place called Shebo. I have no knowledge of any further intention to continue the railway beyond that point at present, but I may tell the hon. member that a very large accumulation of railway material is being contemplated at Quetta, so that if commercial and political interests should appear at any time to be favourable, the line might be continued without great delay in the direction of Candahar."

great delay in the direction of Candahar." A FATAL collision occurred on the 31st July at Binegar station, on the Somerset and Dorset Railway. The up fast passenger train leaving Shepton Mallet at 1.44 p.m. left the points on reaching Binegar at two o'clock, and came into collision with a goods train standing on another line. The carriages were telescoped by the force of the collision, and several of the trucks forced off the line into the roadway. One passenger, supposed to be a Mrs. Charles, on her way to join her husband, a coastguardsman at Cork, was killed, four others were seriously injured, including Beakes, the guard, who had both legs taken off. It appears that a new double portion of the line was opened for the first time on that day between Binegar and Chilcompton. It was inspected by Colonel Rich, the Board of Trade inspector, who passed the line, but required some alterations to be made in the points, and while these alterations were in progress the accident happened. The signal fitters had taken off the locks in the signal-box. Beakes, who was the oldest guard on the line, leaves a widow and five children. ONE day last week a train carrying the president and directors of

the oldest guard on the line, leaves a widow and five children. ONE day last week a train carrying the president and directors of the Delaware, Lackawanna, and Western Co. made the trip over the Morris and Essex Division from Hoboken to Washington, N. J., 67 miles in 1 hour 24 min., being at the rate of 47.9 miles per hour for the entire distance, including two stops for drawbridges and slow running required at other points. The *Railroad Gazette* says :--The fastest time made was on the 4.6 miles between Port Morris and Waterloo, which was run in 4min., or at the rate of 69 miles per hour. The 20 miles from Port Morris to Washington was run in 19 min., or at the rate of 63.2 miles per hour. The train consisted of three cars, and was drawn by engine No. 134, which has 18in. by 24in. cylinders and 5ft. 6in. driving wheels. The fast train on the West Shore Road on June 4th last made the run from Newark, N.Y., to East Buffalo (94 miles) in 119 min. Of this time 13 min. is deducted for stops, leaving the actual running time 106 min., being at the rate of 53.2 miles per hour. The actual running time from Frankfort to East Buffalo (202 miles) with six cars was 254 min. On June 17th, the same train with seven cars ran from Newark to East Buffalo in 105 min., and from Frankfort to East Buffalo in 247 min., or at the rate of 49.1 miles per hour.

A NEW form of wheel for tramcars, designed with the object of overcoming the severe friction of the ordinary rigid wheels in pass-ing round short curves, has been under trial at Northampton. The wheel has a loose steel tire, working on ball rollers round an inner wheel, which is fixed to the axles in the ordinary way. This loose tire can revolve faster or slower than the inner wheel, thus giving freedom to the wheel which has to travel the outer or longer sweep of the curve. About a dozen gentlemen accompanied Mr. Elliott, the manager of the Tramways Company, to witness the experiment, and all agreed in approving the marked difference felt in the movement of the car round curves, and noticed with pleasure the ease with which the horses took corners that have hitherto been a great strain upon them. The wheels were tested as to the brake power that could be applied. Three men pushed a car out of the Northampton Tramway Company's depôt round the awkward curves; with the old wheels six men are required for the purpose. A great saving is anticipated from the fact that only the steel tires will require renewing, and that these can, it is said, be attached in five minutes. The wheel is the invention of Mr. F. G. Myers, and is being made by Messrs. Hy. Mobbs and Co., North-ampton. A NEW form of wheel for tramcars, designed with the object of ampton.

ampton. IN an article on the Inventions Exhibition, the American Railway Review remarks that "in selecting titles for the first locomotives engineers had wandered far and wide, from the undignified in Puffing Billy, to the loyal in the Royal George, and to the heavens for the Planet, whilst suggestions of vast speed and power were intended to strike the beholder on seeing the Rocket, the Arrow, the Sanspareil, or the Novelty. To those who have watched the erratic motions of the Firefly, the name of that lively little insect would hardly seem appropriate for the steadiness and regularity required from a locomotive, but this was the name of one of the errate motions of the Firefly, the name of that lively little insect would hardly seem appropriate for the steadiness and regularity required from a locomotive, but this was the name of one of the early railway engines. For many years, mythology supplied a fruitful source of locomotive nomenclature, and Vulcans, Furies, Vestal Virgins, and the whole army of gods and goddesses, from Jupiter to Satyrs, and from Juno to Dryads, rushed about the country from Land's End to John o'Groats. Lempriere being exhausted, Milton's fallen angels appeared on the scene, and one engine was, it is said, to have been called by the common synonym of his Satanic Majesty, but ultimately received the title of his great lieutenant, Beelzebub. In relation to this change of name it is stated that one driver was overheard asking another if he would like to run an engine named after the arch-fiend, and the reply, to the effect ' that he wouldn't, as such an engine would never run straight on an '' up'' track, but would always be wanting to run on the ''down'' to h-----,' suggested, at any rate, an acquaintance with the elements of the orthodox doctrine of the origin of evil. The Miltonic list exhausted, botany and entomology books were ransacked for names, 'bees' gathered honey for the shareholders, and 'lilies' and 'daffodils' could be seen at ourgreat stations in all seasons and all weathers. In these prosaic days numbers have, on most lines, taken the place of names.''

NOTES AND MEMORANDA.

THERE are now 1045'5 miles of water mains within the metropolitan area that are under constant pressure.

THE deaths registered in twenty-eight great towns of England and Wales during the week ending 25th July corresponded to an annual rate of 19.5 per 1000 of their aggregate population, which is estimated at 8,906,446 persons in the middle of this year.

ACCORDING to a paper communicated to the Institution of Civil Engineers on the pollution of the river Thames, the circulation or renewal of the sea water was nearly three times as rapid in November, 1882, when the river was in high flood, as in August and September, 1884, a time of unusually prolonged drought.

IT is said that a dam is to be constructed in Brazil, under the direction of French engineers, the main portion of which will be 940ft. long by 58ft. high, and two smaller ones will close side depressions. It is calculated that this work will back the water over some 1500 acres, and retain 14,000,000 cubic metres of water.

DR. SEPTIMUS GIBBON, medical officer of health to the Holborn District Board of Works, in his report for the year ending Lady-day last, states that the death rate was 23 15 per 1000 for 1884. In the central districts, of which Holborn forms a part, the rate of mortality was 23's against 23'2 in the previous year. Thus, it appeared that the Holborn death rate was 2'85 above the general death rate of the whole of London, and 0'65 below that of the mean rate of all the central districts for 1884.

SOME groups of spots have lately developed themselves on the upper portion of the sun's surface. The largest of them measures superficially about 20,000 geographical miles in length by from 6000 to 7000 miles in width. This spot is towards the right of the upper surface, and can be easily made out through a darkened glass. In 1882 sun spots much less than these caused the very cold very wet summer. This year they are a failure in that respect. They have not made it a bit wet, and are not acknowledged by their inventors.

DURING the first half of 1885 the production of pig iron in the United States has amounted to 2,150,816 tons, against 2,267,021 in the similar period of 1884. The stock in the hands of the makers on June 30th was 692,916 tons, showing an increase of 100,000. The product of Bessemer steel ingots has been 763,344 tons, an increase of 39,694 tons, which indicates a new demand by the railmakers. The product of Bessemer steel rails was 452,446 tons, a decrease of 140,924 tons compared with the similar period of 1884.

a decrease of 140,924 tons compared with the similar period of 1884. WRITING in the Chemical News, Mr. P. T. Austen and F. A. Wilber strongly advocate the use of alum for the purification of water, alleging that it not only clarifies but also removes disease germs and ptomaines. By adding 2 grams of alum to 60 litres of a rather turbid drinking water, a precipitate settled, and perfectly clear water was obtained after forty-eight hours. The dried pre-cipitate contained per cent, C 16:50, H 2:02, N 0:77, ash 59:28, the latter consisting of small amounts of silica and alumina, large amounts of iron oxide, and considerable quantities of phosphoric acid. The clear water contained the merest trace of aluminum, and a further addition of alum caused no precipitation in it. IN London 2423 bitths and 1636 deaths were registered during

IN London 2423 births and 1636 deaths were registered during IN London 2423 births and 1636 deaths were registered during the week ending the 25th July. The annual death rate per 1000 from all causes, which had steadily increased in the four preceding weeks from 16°3 to 20°6, further rose to 20°9. During the first three weeks of the current quarter the mean death rate was 19°8, against 21°3 in the corresponding periods of the nine years 1876-84. In Greater London, during the week ending 18th July, 3109 births and 1935 deaths were registered, corresponding to annual rates of 31°2 and 19°4 per 1000 of the population. During the week ending 25th July, 3116 births and 2013 deaths were registered, correspond-ing to annual rates of 31°3 and 20°2 per 1000 of the population.

A SUCCESSFUL attempt was made last year in Leipsic to remove by chemical means the incrustation that coated the interior of the force main from the pumping station to the reservoir. The main is 390 millimetres wide—about 153in.—and 4.55 kilometres long, and the incrustation was from 13 to 24 millimetres thick, and in places thicker still. The operations lasted from the 7th of March to the 11th of May, and during that period at intervals the pipe was filled with dilute hydrochloric acid eight times, with soda solution three times, and with a solution of chloride of lime once, being washed out thoroughly with water between the successive applications. It was stated that the incrustation was entirely removed, and the practical effect of the cleaning was indicated by the pressure gauge, there being a decrease of from 1'8 to 2 atmothe pressure gauge, there being a decrease of from 1'8 to 2 atmospheres pressure at the pumps.

DR. WEDDING gives the following figures to show the reduction in cost of production of steel rails in Germany. The figures were found in 1879 by a Government inquiry. Exclusive of interest and sinking fund, the cost of rails at different German works was as follows during that year :--

Works		Mate	rials,	Wages,	Ma	terial,	Total,
	HOLES.	ma	rks.	marks.	m	arks.	marks.
	Koenigs und Laura Hu	iette 12	1.70	3.80]	7.50	143.00
	Union Dortmund .	8	7.96	9.12]	2.67	109.75
	Bochum	8	5.85	9.43	5	25.63	122.00
	Phœnix	11	4.54	7.90		8.56	126.00
	Max Huette	12	3.20	10.40		6.40	140.00
1	t the same period,	Dr. We	edding	asserts,	, the	cost in	n English
V	orks was not more	than fro	om 120	to 125	man	ks, and	in some
2	uses only 102 marks.	Now th	he cost	at all t	he G	erman y	works has

fallen to about 90 marks, while in the Cleveland district, England, it is 34'70 marks.

At a recent meeting of the Geological Society, a supplementary note on the deep boring at Richmond, Surrey, was read by Professor John W. Judd, F.R.S., and Mr. Collett Homersham, F.G.S. Since the author's former communication to the Society on the subject, this boring had to be abandoned, after reaching a total depth of 1447ft. boring had to be abandoned, after reaching a total depth of 1447/it. from the surface. This depth is 145ft. greater than that of any other well in the London Basin, and, reckoning from Ordnance datum, reaches a lower level by 312ft. than any other well in the district. Before the termination of the work temperature observations were obtained, which generally confirm those previously arrived at. The strata in which the boring terminated consisted of the red and variegated sandstones and marks previously desoribed, which were proved to the depth of 208ft. Although it was demon-strated that these beds have a dip of about 30 deg., complicated in places by much false bedding, no conclusive evidence could be obtained concerning their geological age. They may be referred either to some part of the Poikilitic series, or to the Carboniferous series at Gayton, near Northampton—or they may be regarded as of Old Red Sandstone age.

of Old Red Sandstone age. In a paper read before the Royal Society, Dr. Percy Frank-land gives the results of a number of experiments he has performed on the removal of micro-organisms from water. Contrary to the general opinion and what might be expected, he discovered that the largest number of organisms was found in the upper layers of a water which had been standing for some time; instead of there being any tendency for the upper layers of water to become deprived of organisms by subsidence, the tendency is for the number to increase very rapidly. Of the various filtering materials experimented with, only green sand, coke, animal charcoal, and spongy iron were found to wholly remove the micro-organisms from water filtering through them; but this power was in every case lost after the filters had been in operation for one month, but even then a considerable proportion of the organisms continued to be removed. By agitating water with coke it was found that the organisms were completely removed. It was always found that Clark's process of softening water by lime greatly reduces the number of suspended organisms. A further curious result of Dr. Frankland's researches was to show that the complete removal of the micro-organisms in a water had but a very trifling influence upon its chemical composition.

MISCELLANEA.

THE offices of the National Agricultural Hall Company are now at 25 and 26, St. Margaret's-offices, Victoria-street, Westminster. MR. ALEXANDER DICK has been awarded a gold medal at the present International Exhibition, Antwerp, for Delta metal.

ON Tuesday a committee of Elder Brethren of the Trinity House left London in the Galatea, to visit and report upon the proposa for more lighthouses in the Shetland and Orkney Islands.

THE Francesco Morsini, ironclad, was successfully launched on the 30th ult. at Venice. The benediction was given by the Cardinal Patriarch, and the ship was baptised by the Queen.

THE Anglo-American Brush Electric Light Corporation directors have published their half-yearly report. They think the profit that has been made had better not be used for an interim dividend. THE directors of the South Staffordshire Waterworks Company has male a profit upon the past half-year, including the balance brought forward of £12,000, out of which the directors recommend the declaration of an ordinary dividend at the rate of 5 per cent. per annum, carrying forward a balance of £682.

MR. J. W. HAMMER, of the Edison Electric Company in New York, has devised means of completing electric circuit in a model of the Bartholdi statue of Liberty lighting the world, by dropping a quarter dollar into a suitable opening. This coin causes temporary illumination of the lamp in Liberty's hand. This is done with a view to subscriptions to the Liberty statue.

At the Crystal Palace, on Saturday, July 25th, a dinner was given by Messrs. Hobbs, Hart, and Co., to which the whole of the staff (327) were invited. During the proceedings it was stated that in seven years 1,734,000 locks, 3,876,000 keys, 8,483,000 screws and stumps for the various locks, and 6,700,000 riveting stumps for inside work, were made in the factories at Arlington-street, N.

A COMMENT on the condition of business in Austria is the fact that one of the largest spinning mills in Bohemia—that of Theresienau—has had to stop work. Several other mills have reduced their working time to three or four days a week. At present foreign buyers are afraid to give large orders lest there should be some alteration in the tariffs before they can be exe-ented cuted.

At arrival of recent mail the New South Wales Government had concluded a contract with Hudson, Bros., and Co. to bring in a supply of water to Sydney from Pheasant's Nest, at the head of the main stream. By the completion of this work, from 2,500,000 gallons to 3,000,000 gallons daily would be made available for Sydney. The Minister for Works had decided to invite tenders for the supply of 850,000 wood pavement blocks for the Circular Ouax. Quay.

Quay. THERE is now being constructed at Mr. Skelton's yard, Millwall, a small yacht, which will be propelled by electrical power. The boat is 36ft. in length by 7ft. in breadth. It is constructed of galvanised steel, lined inside with wood and lead. The accumu-lators are placed below the floor of the boat, so that with the exception of a small compartment aft for the dynamos, the whole of the space is available for passengers. Two masts and a full suit of sails are also fitted for use when required. In the course of a few days it is intended to take the yacht on a trial trip from Dover to Calais, when it is fully anticipated that a good speed will be obtained. obtained.

Too much of a good thing is causing trouble in the States. The legal papers in a nuisance suit against the Penn Fuel Gas Com-pany, the largest natural gas company of this locality, has been filed by residents of Cliff-street and Fulton-street, Philadelphia. For several weeks this gas company has been blowing off its surplus gas on the hill overlooking the Union depôt. At night the gas is lit, and the roaring, together with the light and heat, has so annoyed the neighbouring residents that they will ask the courts to declare it a nuisance. They say that they cannot sleep, and the glare from the light is intolerable. The company answers that it must have an escape for the gas.

THOSE interested in the manufacture and erection of iron structures Those interested in the manufacture and erection of iron structures can at present see such work being carried out in a somewhat novel manner. Messrs. Ed. and E. B. Ellis, architects, of Fenchurch-street, are having a large block of offices and warehouses put up in Eastcheap. These buildings, which are immediately over the Metropolitan District Railway, running between Monument and Mark-lane Stations, are carried by very massive wrought iron girders. The contractors for the ironwork, the Darlington Wagon and Engineer-ing Company are delivering the girders in the form of lose allotse ing Company, are delivering the girders in the form of loose plates, bars, &c., and are rivetting the mupon the site by portable hydraulic rivetters, the power for working these machines being taken from the mains of the London Hydraulic Power Company.

The progress of the works of the London Hydraule Power Company. THE progress of the works of Herr Krupp at Essen may be said to be one of the marvels of modern industry. The most recent and authentic data show that in 1860 the total number of workmen employed by Herr Krupp was 1764. In 1870 they had increased to 7084. At the present time-I885-the total number employed in all the establishments of Herr Krupp exceeds 20,000. If we add the wives and children dependent upon the workmen, the total number of persons supported by the Krupp works is not less than 65,381. Of this number fully 29,000 dwell in cottages built by Herr Krupp, and belonging to his works. There are eight separate and distinct departments belonging to this enormous concern. In the first place, we have the vast extent of workshops at Essen ; secondly, three coal mines at Essen and Bochum ; thirdly, no fewer than 547 iron ore mines in various parts of Germany ; fourthly, several iron mines near Bilbao, in Spain ; fifthly, an extensive series of smelting furnaces ; and sixthly, the ranges at Meppen for the testing of the Krupp guns. Besides the eleven smelting fur-naces, there are 1542 puddling and heating furnaces. The number of steam boilers employed on Herr Krupp's works is 439, and the total horse-power of the 450 steam engines in use is 185,000. There are thirty-seven miles of railway in the works, on which the traffic is performed by eighty-eight locomotive engines, and a park of 833 luggage wagons. There are no fewer than thirty-five tele-graph stations, with forty miles of telegraph wire and fifty-five Morse apparatus in operation on the works. SOME amusement has been afforded the New York newspapers by the reflues of an electric light customer there to pay his bill, on the THE progress of the works of Herr Krupp at Essen may be said

SOME amusement has been afforded the New York newspapers by the refusal of an electric light customer there to pay his bill, on the ground that he had not used any lamps. The Edison meter showed, or was said to show that he had taken so much current, and he was therefore charged such and such a sum for it. One facetious journalist says :— "I t would be interesting to know if the particular electric meter which made a false charge of 9:29 dols. had ever been associated with a case meter. If it had spent any time in a cellar Joint has a system of the other theorem of the theorem associated with a gas meter. If it had spent any time in a cellar in the society of a gas meter. If it had spent any time in a cellar in the society of a gas meter it was quite possible that it was corrupted by the vicious influence and degrading example of the latter. That the gas meter does exert a most demoralising influence upon those who associate with it is sufficiently proved by the character of the managers of gas companies, not one of whom ever declines to profit by the false testimony of meters. Persons using the electric light cannot be too careful to remove their gas meters from the cellar before introducing the electric meter. The proba-bility is that the electric meter is honest when left to itself, but that it is weak and casily led away by had companions. If, on the other hand, it should turn out that the electric meter is as inherently vicious as the gas meter, the electric light will become as unpopular as gaslight, and the public will burn nothing but oil and candles." The desideratum of which we spoke last January—a simple self-registering meter that will show the suspicious consumer at any time the amount of light, or current, that he has used—has yet to be registering meter that will show the suspicious consumer at any time the amount of light, or current, that he has used—has yet to be supplied. Though the meters in use may conform to the require-ments of scientific principles and are accurate in their work, they remain under the control and manipulation of the lighting company; and after years of sad experience with that successful example of perpetual motion, the gas meter, the consumer has become sceptical as to every other form of measurement of light.

INVENTIONS EXHIBITION - ROBEY AND CO.'S ENGINE, WITH PROEL'S VALVE GEAR.



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TO CORRESPONDENTS.

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- * * We cannot undertake to return drawings or manuscripts; we must therefore request correspondents to keep copies.
 ** 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 Id. 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.
 W. L.—The somitary inspector appears to be right.
- W. L.—The sanitary inspector appears to be right. SUBSCRIBER.—You do not give data which will enable us to answer your question. The serve should not be less than bin, diameter. In calculating the speed, allow 20 per cent. for slip. The pitch cannot well be more than DO

- Restrict and the series should not be tess than the internet of the more than hole.
 P. O. S. T. -You will probably find it necessary to apply to the firms in whose employ you have already been, or to owners of similar boats. You would have to study very hard to pass any Board of Trade examination for better berths in English vessels.
 R. L. If the machine for which patent has been obtained is, as you say, line for line the same as that published in the paper mentioned, the patent cannot be upheld unless it can be shown that patente and public had not been able to see the publication referred to.
 Econn-As you give no details, we cannot say whether your invention is patentable or not. In principle it seems to be old. Pitcher's governor, patented many years ago, and used with much success, consist, to use your orn words, of a "pump and valves." You will find it described and illustrated in Board's treatise "On the Steam English.
 N APPENTICE. If the avere an hour, then the engine made 5000 + 00 = 60 recolutions prime.
 R. T. -- Underground houses have been found most unsatigatory. A blick in such success the chamber with a cover with a canet of with a cover build will seed with a cover build will be added by the engine in any period of time you like to take. Suppose the counter stands at , say, 1815 at the time you bearve it, and at, say, 5415 at the end of a m hour, you then know that the engine has made 5415 1815 = 3600 revolutions in the time. If that were an hour, then the engine made 2600 + 00 = 60 recolutions per minute.
 R. T. -- Underground houses have been found most unsatigatory. A blick in ender and built being made. Sometimes the chamber is lined with wood, the space between wood and britch being filled with savedust. Care should be taken that no air currents may in any way pass through the chamber.

BARNES' BOILER FEEDER.

(To the Editor of The Enginee.) SIB,—Can any correspondent tell me the name of the maker of Barnes donkey boiler feeders? London, August 1st. J. S. C.

(To the Editor of The Engineer.) (To the Editor of The Engineer.) SIR,—Having a number of brass liners to shrink on propeller shafts of from Sin. to 12in. diameter, I shruld be glad if any of your able corre-spondents would kindly give me particulars of the most approved method of doing so. London, July 81st.

COMPOUND ENGINES.

(To the Editor of The Engineer.) (To the Editor of The Engineer.) SIR,—We shall be much obliged if you would correct a misprint which appeared in your issue of 21st ult. The words, "With two of high-pressure and two 174in. low-pressure cylinders," should read, "With two 7in. high-pressure and two 174in. low-pressure cylinders. Dartmouth, August 4th.

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

DEATHS.

On the 31st July, at Southsea, HERBERT CHAPMAN, M.I.C.E., aged 48. On the 31st July, ROBERT FRANCIS, FAIRLIE, C.E., of Woodlands, Ch and Palace-chambers, Victoria-street, Westminster, aged 54 years.

THE ENGINEER.

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AUGUST 7, 1885.

THE BRITISH NAVY AND SIR N. BARNABY, K.C.B. ALL who are interested in naval affairs must feel con-cerned at the announcement that Sir Nathaniel Barnaby's present state of health has induced him to apply to the Board of Admiralty for release from his duties as Director of Naval Construction. We believe the response from their lordships consists in a prolonged leave of absence, in the hope that by a period of rest Sir Nathaniel may recover his health. How far this arrangement will need the needed his health. How far this arrangement will meet the neces-sities of the case remains to be seen ; but we may safely

of so eminent a naval architect, whose long career is so closely identified with the history of the ironclad era. The view which Sir N. Barnaby takes of his position is probably somewhat different from that which is entertained by those who know and appreciate his high scientific abilities. It is no secret that he looks upon himself simply as the head of a highly efficient staff, for whom there must needs be a leader, which post he feels it an honour to hold. Even his recent knighthood he accepted as conferred not merely for his own sake, but as bestowed in recognition of the merit vested in the staff of which he is the chief. To others it may appear that Sir Nathaniel stands out with more distinct as the staff of which he is the chief. more distinctness than he is willing to allow, while at the same time it is satisfactory to know that there is talent existing at the Admiralty, such as will meet any exigency that is likely to arise. As closely associated with the Director in the design and construction of our ships of war, we may make mention of Mr. James Wright, Engineer-in-Chief, and Mr. F. K. Barnes, the Surveyor of Dockyards. It is a remarkable fact that Sir N. Barnaby and the two authorities just named have been jointly concerned in the meducation of all one section. production of all our seagoing fighting ships, whether armoured or otherwise, excepting three that were pur-chased from foreign Governments. When Sir Nathaniel retires from active duty, he may look back on a long and honourable career; and certainly it must be no small matter for one individual to feel that he has taken a leading part in the design and construction of the most power-ful fleet in the world. It is a lesser matter, but still worthy of note, that not only in this way has Sir N. Barnaby served the State, but he is distinguished as one of the four original founders of the Institution of Naval Architects.

Speaking of the departure of Sir N. Barnaby from Whitehall as an event apparently near at hand, though we trust it may be somewhat postponed, we seem to have reached an epoch from which we may review some of the more salient points that have marked the progress of naval architecture since the period of the Russian war. Sir N. Barnaby was at the Admiralty then, though not in the same advanced capacity that he subsequently enjoyed. In the Crimean War we seem to trace the germs of those great changes which afterwards came over the entire art of naval warfare. Three shells fired from one of the sea forts of Sebastopol, and bursting between decks, served to dis-organise the crew of one of our finest ships of the line. The event was pregnant with important issues, as demonstrating the hopelessness of sending unarmoured wooden ships to encounter horizontal shell fire. The French recognised the value of armour, and produced the Gloire, to which England responded with the Warrior. The terrible fate of the Congress under the fire of the Merrimac hastened the general adoption of armour, and showed still further the danger of employing wood in the construction of ships. The early notions concerning ship armour differ widely from those which now prevail. Thus, after numerous experiments had been made, it was considered that, "for all practical purposes," armour of 41 in. was sufficient. Ideas have changed vastly since then, and the perpetual progress has made increasing demands on the skill and the resources has made increasing demands on the skill and the resources of the naval architect. Criticism has always been busy, and has never been fully satisfied. In a pamphlet pub-lished some few years ago, and supposed to have been written by the Duke of Somerset, there was a shrewd remark that "the mind of man does not go back to the time when the management of the Navy by the Admiralty was not a subject of dissatisfaction." The comment has lost none of its force since the data when it was written was not a subject of dissatisfaction." The comment has lost none of its force since the date when it was written, and into whatever period we look we find Englishmen lamenting that their Navy is in a condition to invite disaster and defeat. As for the remedy, the critics are never agreed. In 1873 Mr. Goschen was bewildered with the multitude of counsellors. There were advocates for masted turret ships, for turret ships without masts, and for broadside ironclads. Some proposed the entire abandonment of armour; others the use of armour to protect the vitals of the ship; some considered the guns to be everything, while others had peculiar faith in the defensive element, concerning which again there was a dispute as to whether a ship should have a continuous belt or should dis-pense with it at the extremities. About the same time Sir Spencer Robinson declared, in regard to the splendid display which had taken place at Spithead, that nothing was so remarkable "as the absence of what ought to have been there." Still, the Admiralty have managed to make progress, and if sometimes the progress has seemed rather slow, it has been possible to find a reason for it. Mr. Goschen, in his day, considered England so strong in the matter of ironclads, that although we could not altogether matter of ironciaus, that athough we could not altogener suspend shipbuilding, we could yet afford to proceed with judgment and calmess; and, above all, we could "avoid the fatal mistake of deciding too soon." This has been the usual style, except at periods of panic, when there has been a grand rush, and a sort of golden avalanche has come down upon the Admiralty. As for the risk of "deciding too soon," certainly there have been some odd decisions in the past, though at the time when they were arrived at they may have seemed very prudent and arrived at they may have seemed very prudent and proper. Breech-loading guns were introduced into the Navy at a time when the Admiralty had not learned the right use of gunpowder. More than two millions were spent on the guns, and very soon they were rejected. Two years later a committee of officers reported unanimously in favour of the muzzle-loading system. Under the circum-stances which then prevailed the committee were probably right. This was in 1866. Five years later came the first of the "Woolwich Infants," weighing 35 tons. A cry then arose that the torpedo was displacing heavy guns and armour. But the guns asserted themselves, and in 1873 it was proposed that one of 60 tons should be provided for the Navy, an idea which was soon merged in the gun of 80 tons. In 1874 Mr. Ward Hunt made a statement as to the strength of the fleet, which provoked Sir John Hay to say it was discreditable that the late Board should have allowed such a state of things to arise. He declared it was the business of the naval officers at the Board to

assume that every effort will be made to retain the services have resigned rather than to have countenanced a policy resulting in so much mischief. Bad as things were, Mr. Ward Hunt proposed to do so little that Sir Edward Reed regarded the estimates as a practical abandonment of the position of this country in Europe. He laid down the prin-ciple, so persistently violated, that the Government should regulate the expenditure of the nation by its requirements and necessities, and by no lesser consideration. It was, he said, the practice of successive Governments to proceed upon the plan of fixing an aggregate amount which might be spent by the Board of Admiralty, whether needed or not, but which must not be exceeded, however necessary. In this system is found the source of all the weakness of which complaint is notice the source of all the weathers of which complaint is made as to the magnitude and efficiency of the British Navy. With regard to the guns, there is, however, another difficulty, and that is the awkward relationship which exists between the Admiralty and the War-office.

The muzzle-loaders are now the relics of a past era, and the Navy is receiving breech-loaders. If we take the the Navy is receiving breech-loaders. If we take the fighting ship of the present day, and compare her with the earlier type of the ironclad, we find almost everything changed. The two creations are wholly distinct. A per-sistent principle may sometimes be traced, but little else. Wooden ships with plated sides are gone. We have long built our armoured ships of iron, and now we are entering on the age of steel. The armour is not mere iron, but iron with a steel face. The guns have grown in size, and the breech-loaders have grown enormously in length. We have learned what kind of powder to use, and it is to be hoped we are getting the right projectiles. Underlying hoped we are getting the right projectiles. Underlying all there is the horrible torpedo, which cares nothing for belts or citadels, and against which the most uncouth devices have to be adopted. There is the machine gun, with its ceaseless shower of bullets, to riddle and wreck the torpedo boats, and there is the electric light to reveal width the devices of the single the time to reveal amidst the darkness of the night the tiny craft which comes fraught with the messenger of destruction. In the use of armour there is a wide departure from the earlier methods. Armour is made which can really fulfil the original demand for something to "keep out the shells." But where is the ship that can do this? The armour can-not be everywhere on a vessel's hull. Some part must be left penetrable; and as heavier armour is demanded to cope with guns of increased power, so the area covered by the armour must, be reduced, or some other device cope with gins of increased power, so the area covered by the armour must be reduced, or some other device be adopted by which protection can be secured within the limits of weight. An attempt has been made to show that our armour-clad ships are less secure than those of the French, because the armour belt stops short of the extremities of the hull. But the Franch chips for which such a preference has been expressed French ships for which such a preference has been expressed are in reality unarmoured ships in regard to all that part of the hull which is more than 3ft. above the water-line. The continuous belt need possess extraordinary virtue if it is to atone for the absence of armour elsewhere. The Italians have gone quite away from the French type, and while seeking to possess armoured ships of unexampled power, have abandoned the use of side armour. Speaking of the Italia and the Lepanto, Sir N. Barnaby said some time ago-"They are not ironclads; they are protected ships, and it cannot be denied that they are also armoured ships." That they carry armour is indisputable, although it is disposed in a manner entirely different from that which was at first adopted. They have an under-water deck of 3in. armour, weighing about 1200 tons, and about the same weight of armour of 18in. to 27in. protecting their internal vital parts. Much of the armour is vertical, but it is not on the sides of the ship. Mr. King, of the United States Navy, has remarked in reference to these vessels, that it appears as "a bold defiance" of the principles laid down by Sir Edward Reed in the Inflexible controversy," to abandon side armour altogether as a means of preserving stability when the ship is pierced at the water-line." The skilful arrangement of armour is a matter of vital consequence in the design of war ships, and a mere blind adherence to the continuous belt affords no guarantee that the weight of armour carried is used in the most effectual manner. Sir N. Barnaby has applied the principle of the underwater armoured deck very extensively, and if ever the test comes to be applied, we may expect that the results will show the wisdom of this plan. Associated with the use of coal-armour, the under-water armoured deck gives great defensive quality to ships which are not ranked as armour-clads. Vessels of this description are likely to play an important part in any naval war of the future.

There are many sides to the Navy question in the present day, and of Sir N. Barnaby it may be said that he has exercised a large influence outside the immediate sphere of the Admiralty. A most important feature in his career has been the extent to which he has introduced steel for the purposes of shipbuilding. Persuaded that this metal was of especial value in the construction of ships, Sir N. Barnaby exercised all the influence he possessed to encourage the manufacturers in producing steel of suitable quality. The innovation took effect commencing. Of the enormous benefit conferred on the mercantile marine by the introduction of steel for ship construction, it is scarcely possible to speak too emphatically. A good authority has said that the differ-ence between the finest iron and the worst is a mere trifle compared with the difference between the finest iron that is made and the steel that is now generally used in ship-building. Admitting that steel is dearer per ton than iron, a ship built of steel is cheaper than one of iron, estimated according to the dead weight. Another point of great moment is that which relates to the use of water-tight compartments. While the big ocean steamers were building the Admiralty were seeking to develope the plan

which are very widely appreciated. Shipbuilding, where the vessels are of considerable size, is now a very different matter from what it was when Sir N. Barnaby Shipbuilding, first became known to the public. The stability of ships was a problem which until a few years back was looked upon as altogether out of the range of an ordinary shipbuilder. How many merchant steamers were lost through the prevailing ignorance on this subject it would be hard to say, but it is feared that several thus perished. Even in the Royal Navy, at one time, there were several dis-asters evidently owing to the deficient stability of certain ships. The 10-gun brigs were doubtless victims to this defect, and their ill-repute was lamentably justified. Times are altered now, and although the catastrophe of the Captain is not very remote, while that of the Eurydice is still nearer, the conditions of safety are now too well understood for these disasters to repeat themselves, and there is an improvement in the science of shipbuilding throughout the private yards of the kingdom which may be largely-though not exclusively-traced to the leading and teaching emanating from the Admiralty. In all that appertains to the science of naval architecture, Sir N Barnaby has toiled conscientiously, and to his boldness and breadth of view may be attributed much of the improvement which now appears in the mercantile marine. Seeing that in the years to come the mercantile fleet will stand in a very intimate relationship to the Royal Navy, this kind of side issue is one of signal value. In the domain which appertains to war ships alone, Sir N. Barnaby has achieved grand results amid peculiar difficulties. Criticism, of course, will not slumber; but if the British Navy is less powerful than it ought to be, the fault rests with those who hold the purse-strings rather than with those who design and build the ships.

THE TOWER BRIDGE.

THE Bill promoted by the Corporation of the City of London for the new bridge at the Tower having now been sanctioned by Parliament, it may be expected that the works will proceed without delay. The Bill has, however, been altered in some important particulars since it was first presented. The making of an opening span for the passage of masted vessels was deemed by the promoters a sufficient concession to those interested in sea-going traffic, and, therefore, to neutralise their claim to compensation. The Commons' Committee thought otherwise, and decided that a merely occasional opening of the bridge was not sufficient, and that the navigation must have precedence of road traffic to the extent of having the bridge open for vessels two hours at each time of high water. This decision greatly lessens the advantages hoped for in relieving the crowded approaches to London Bridge, and confirms the opinion we have always held, that a low-level non-opening bridge is the only proper solution of the difficulty, and that London can afford to pay compensation to those injured by such a bridge. But a further alteration was made in the Bill by the Lords' Committee, who did not consider that the above alteration was sufficient protection to the interests of the wharfingers between the Tower and London Bridge, and therefore required as a condition of their assent a clause in the Act giving the wharfingers a right to such compensation as may be awarded them by arbitration, limited, however, in each case to a maximum amount equal to two years' assessed value of the premises affected, these premises being again limited to 200ft, back from the river front. Moreover the claims are not to be made till the bridge has been opened for traffic four years, so that the question hitherto so much disputed, as to whether damage will accrue or not, can be settled by the evidence of actual facts.

Of the engineering merits of the scheme as it is now to be carried out we have already expressed our views, and will only say now that we have no doubt the eminent engineers, Mr. J. W. Barry and Mr. Brunel, who have the matter in hand, will give as stable and efficient a bridge as the ill-chosen and unfortunate design of the City Architect will allow; and while in the interests of Eastern London this unsatisfactory solution of a much-vexed question may be deemed better than none, yet even to the Common Councilmen who have such pleasing faith in the ability of their architect it may dimly occur to ask, when they see the Flemish towers of Mr. Horace Jones rising from the river bed, whether such huge structures do necessarily pertain to bridges, and whether some less valuable site than the middle of London's greatest tho-roughfare might not have been found for displaying them. Looking back on the various schemes propounded during the last twenty years for crossing the river below London Bridge, and on the great expenditure of time and money which has taken place regarding them, one more example is afforded of how ill-adapted the present government of London is for the carrying out of public works; and we commend it to Mr. Firth, M.P., and other would-be advocates of municipal reform, as an additional argument in favour of their views. Certainly the City Architect is fortunate in getting legislative sanction to his scheme now, for he would not get it either from the coming Parliament, in which Londoners will for the first time have a proportionate voice, or from a municipality elected by the ratepayers in the manner prevailing in other cities of the kingdom. We may safely say that in no other capital in Europe would a work so important have been authorised as this has been; and in view of the incon-veniences that will arise in the future from the course now adopted, and of the criticisms that may be expected from foreign engineers and others capable of judging, we think it desirable to record the circumstances under which the present design has been adopted. The Metropolitan Board of Works tried several times to supply the need of a crossing-place, and full particulars of the bridge and tunnel schemes have appeared on each occasion in THE ENGINEER. All the proposals failed, and in each case from the same two main causes; firstly, the half-heartedness from the same two main causes; firstly, the half-heartedness of the promoters, and secondly, the opposition of the Cor-poration. Much as a bridge was wanted by Eastern London, whose population forms half the total of the metropolis, there was no articulate voice to give expression

to their wants, for the vestrymen who compose the Metropolitan Board have no direct constituents to stimulate them. When, therefore, the Corporation, led in this matter by the same party that opposes the removal of Billingsgate, and other City obstructions, decided to oppose the building of any kind of bridge, there was no public body to ventilate the question thoroughly, and bring the force of opinion of those interested to bear. The power with which the City can still oppose reforms was mani-fested so strongly that a Committee of Parliament decided that a bridge could be built only by allowing the Cor-poration to do it, even though outside the City boundaries, and the Bill which has just passed into law embodies

the scheme which the City accordingly presented. When it is considered how during the last fifty years the Government of the day has invariably, in regard to public works, endeavoured to obtain the best design from the best sources; how for the London main drainage, the Thames Embankment, the Law Courts, the new War-office, and other works, suggestions from all competent persons were considered, it might have been expected, especially under the peculiar difficulties of the case, that some such course would have been pursued for the Tower Bridge; or, at any rate, the City Engineer might have been consulted. But by some fiction difficult to be understood outside the Corporation, the City Engineer, although he has his office in the Guildhall, and although he built the Holborn Viaduct with its Farringdon-street bridge, is not deemed to be an engineer when a river bridge is in question, City etiquette demanding that such structures shall be designed by the architect; and although the architect, when he had made his design, did wisely in obtaining outside aid to keep him safe, this was apparently considered unnecessary by his clients, the Bridge Committee, one of whom in giving evidence in the Commons, said that this aid was in no way required by the Corporation, but was a personal matter of the architect.

It should be clearly understood that though the project, as now to be carried out, has passed through Committees of both Houses of Parliament, no investigation has been made as to whether the design is the best or not for the murpose. The Corporation having ample means at com-mand, called numerous engineer witnesses to confirm the fact that the bridge could be built; that it was strong enough for its purpose; and that it could be made to open and shut as proposed. The opposition to the bridge came only from the wharfingers and others who wanted no bridge at all, and whose interests therefore did not lie in the direction of showing that a more appropriate design could be provided. It was the duty of the Corporation, the scheme having been placed in their hands, to take all necessary steps to obtain the best design. This duty they have entirely neglected ; their entrusting so important a matter to the City Architect, who by his own showing had had no previous experience in such work, is, to say the least, ill-judged; the bridge as it is to be built is in no way an expression of the best engineering talent available; and it is against this course that we desire, in the interests of the profession and of the metropolis generally, to record our protest.

COLLIERY OFFICIALS AND THE GOVERNMENT INSPECTORS.

Two significant instances of the vigilance exercised by her Majesty's Inspectors of Mines call for special notice this week in view of the complaints frequently made by Union officials and others against these officers. At the instance of Mr. F. N. Wardle, the Government Inspector, the Treasury prosecuted in here areas. In the first Thornas Laboras undervision at the In the first, Thomas Johnson, underviewer at the both cases. In the first, Thomas Johnson, underviewer at the Monk Bretton Colliery, was charged with infringing the sixth special rule in use at the pit, by neglecting to see that the "sump" at the bottom of the drawing shaft was sufficiently covered with a scaffold. On the 18th ult. a train of corves was being taken out of the pit bottom, when the horses ran away. The corves came back, and striking other corves, a youth named Smith was knocked into the sump, which was partly uncovered, and lost his life. It was not alleged that the lad was killed by falling into the sump, for he might have been killed by being struck by the corves ; but it was urged that there was a dereliction of duty in the defendants' allowing the sump to be partly uncovered. The both cases. defendants' allowing the sump to be partly uncovered. The bench inflicted the full penalty of $\pounds 2$ and costs. Mr. William Tate, certificated manager at the same colliery, was charged with an offence against the Mines Inspection Act, in not with an orience against the Mines Inspection Act, in not seeing that the special rules were enforced respecting the covering of the sump. In this prosecution it was ex-plained that by a section of the Act if any workman was found guilty of a breach of the rules the manager was liable to be fined, unless he could prove he had done all he could to carry out the rules. The defendant was fined $\pounds 5$. These two cases, the latter having just a touch of hardship in it, show pretty conclusively the hollowness of the agitators' cry that the colliery officials are not virilantly watched in the that the colliery officials are not vigilantly watched in the exercise of their perilous calling.

REGISTRY AMALGAMATION.

THE amalgamation is announced as "nearly complete" of the Liverpool Underwriters' Registry with Lloyd's. The event is of importance in shipbuilding and shipowning circles, though it has been for some time looked upon as inevitable. The Liverpool Registry is younger than Lloyd's, and it had not the same large area of influence, but it had served a useful part in discus sions as to the relative dimensions, scantlings, &c., of iron vessels, and it is probable that its institution has in the end led to the outports obtaining better representation at Lloyd's than they had previously, or than they would have had. The details of the amalgamation have not as yet been published, but it is certain that not only the influence but the power of Lloyd's will grow. On the whole, the shipowning community has confidence grow. On the whole, the shipowning community has community in Lloyd's—confidence which fifty years of work have justified. There will be for the future one British registry of shipping, and there may be a gain in the concentration of power there. But the matter will be perhaps best discussed when the details of the work of the combined registries are published.

BIRMINGHAM AND ITS PUMPING ENGINES.

sided. The opposers have satisfied themselves that the expend ture is wise, and they have admitted as much. But, at the same time, certain of them adhere to a strong opinion previously expressed, that the Committee would have adopted a cheaper expressed, that the committee would have adopted a chapter system if, instead of ordering beam engines, they had pur-chased horizontal engines similar to those employed by, for instance, the Newcastle-on-Tyne Corporation. The Committee, however, urge that a very slow moving, well-balanced, beam engine is the best engine that can be for this special purpose, and they defend their action in having gone to a Leeds firm, whose tender was lower than that of Messrs. James Watt and other Birmingham engineers. The Committee have this week other Birmingham engineers. The Committee have this weak been authorised by the Council to make the purchase, the engine and works costing ± 5000 ; the boilers, ± 1135 ; and the buildings, ± 1887 . When the new plant has been laid down, all the Birmingham pumping-stations will be supplied with duplicate power. At Aston, which is one of the three main pumping-stations, there are eight large engines, seven of which are at present at work.

FOUL AIR IN PARIS AND IN LONDON.

THE smells must be rather bad in Paris just now, for the The smells must be rather bad in Paris just now, for the municipal councillors are complaining of them. At a meeting of the council on the 30th ult, one member called attention to a scavenger's yard, which spoils the enjoyment of the Bois de Vincennes, another to tanneries and other malodorous factories on the west of Paris, and a third to a factory of sulphate of ammonia within the walls, which forces the neighbours to keep their windows closed. A fourth member, however, a doctor, whose nose seems to be under proper subjection, and well trained in selecting the things it will smell and those it will not, declared these complaints to be exaggerated, and contended that the inconveniences of factories giving employment to large numbers must be submitted to. The Prefect of Police promised that the inspection should be more rigorous, and stated that the Vincennes depôt had already been closed for a time for non-observance of the terms of the licence. In England we grumble a great deal about smells, but the sacred rights of property in a stinking trade are recognised as sufficient excuse for poisoning the air and people over a considerable area near the Borough-road Station of people over a considerable area hear the Borough-road Station of the London, Chatham, and Dover Railway. The stink from the hide dressing establishment near this place is enough to stiffe all the passengers on the railway, and then leave a lot to poison wayfarers in the district. The vestry of the district has near the same spot a garbage sorting establishment, which helps to make the district air reek with foulness.

NUNEATON WATERWORKS.

THE East Warwickshire Waterworks Company, which obtained an Act a session or two ago for the supplying of Nuneaton and the surrounding districts, has been for some time past sinking a well in the Permian formation near that town, and water has now been found. The site of the well is within the basin of the Warwichching activity of the context of the surrounder the second Warwickshire coalfield, the coal measures being overlaid by a considerable thickness of Permian marls and sandstone, the strata of which are conformable to those of the coal measures beneath, lying in the form of a trough with the axis north and south. In sinking the well about 50 yards of marls were passed through, and there being indications of the proximity of the ben carried a few yards when very hard beds of rock were met with containing springs, which being tapped, the water rose 60ft. from the water bearing stratum into the well, and now stands at that level. Further springs were met with by boring a little deeper, thus indicating the presence of a subterranean store proof arguing the presence of a subterranean store proof against the severe droughts of the past two years. The town of Nuneaton and the district around seem to be about as ill-provided with pure water as any district in the country-considering the amount of population—and the construction of waterworks must be of very great advantage to the neighbour-hood. The site of the well was selected by the engineer to the East Warwickshire Company, Mr. John Anstie, C.E., of West-minster, under whose direction the works have been carried out.

LITERATURE.

Handbuch der Elektrotechnik. By Dr. ERASMUS KITTLER. Stuttgart: Ferdinand Enke. 1885.

GERMANY'S contemporary literature on electrical subjects is, as a rule, not of a very high order, but the present manual is rather better than the ordinary run of books. It occupies a position midway between the theoretical treatises like Wiedemann's "Elektrizität" or Wüllner's "Experimental physic" and the so-called practical books of Hartleben's Electrical Library, and whilst much inferior in theory to the first-named standard works, it is certainly superior to the latter. The complete work will consist of two volumes, but at present only the first half of vol. i. has been published, the second half being promised by the end of this year. The present edition treats of the general theory of electro-magnetic induction, the principles of continuous current dynamos, and electrical measurements, whilst the description of special types of dynamos and their theory are reserved for the second part. Vol. ii., which is promised within a year from date, will contain arc lamps, incandescent lamps, installations, transmission of power, secondary generators and batteries, and electrochemistry; altogether, it must be granted, a wide pro-gramme. If any engineer was persevering enough to read all that has been as yet written about dynamos in England and Germany, we doubt very much whether from such reading alone he could design a successful machine. The art seems to be so jealously guarded by those who are in the trade that nothing like practical and useful informa-tion ever finds its way into books. Now, Dr. Kittler has been a member of the jury both at the Munich and at the Vienna Exhibitions, and we should therefore expect that his book would prove a perfect mine of practical knowledge to those interested in the con-struction of dynamos. This expectation, we regret to say, is not fulfilled. It may be that the coming volumes will make good the deficiency, but the present one con-tains very little that can guide the designer of dynamos. The explanation of the action of the Gramme ring, and of the Siemens armature, is, indeed, given at great length, and that part of the book which treats of electrical measurements, especially such as can be carried out in a

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lessen the internal resistance of the armature, both ends of each coil should not be brought out to the commutator and thus coupled, but should be united direct, and one wire only brought to the commutator. Now, if we cousider that the attempt to solder up the wires close to the surface of the armature would probably destroy, or at least impoverish, the insulation, and that the only advantage gained will be the resistance of an inch or two of wire in a coil which measures many yards, we must own that the author's recommendation does not seem very practical. When treating of field magnets, he advocates a number of when treamly of head highest, he advocates a function of circular bars placed side by side in lieu of one core of oblong section, but he mentions that there seem to be some objections to this on theoretical grounds. The reader has certainly a right to expect that the professor should tell him the why and the wherefore of these objections, and head the the the important mention is no achieved to the should treat this important matter in an exhaustive style. Instead of doing this he drops the subject, and in the next few lines he dismisses the equally important question of the proportion of magnets with the vague remark that at the present time the tendency seems to be towards the employment of short and thick magnets. The chapter dealing with the history of our modern dynamo is more satisfactory, and contains also a clear explanation of the different methods of exciting the field magnets. By far the best part of the book is, however, the latter half, which treats exclusively of electrical measurements. Here the professor has something of a positive and practical cha-racter to communicate to the reader, and he does it in very lucid language, and by the aid of numerous examples. The book is plentifully illustrated and well got up.

ROBERT FRANCIS FAIRLIE.

WE announce with much regret the death, at his residence, Woodlands, Clapham, of Mr. R. F. Fairlie, which took place on the 31st ult

the 31st uit. Mr. Fairlie's name is known all over the world. For many years he was the apostle of light railways, and invented an original type of locomotive specially intended for working them. Mr. Fairlie was born in Scotland, in March, 1831. His father was a civil engineer of some eminence. His education in loco-motive work took place at Crewe and Swindon. While at Swindon, a great strike among the drivers and firemen occurred. The heads of the departments took to the foot-plate, and Mr. Fairlie for some days drove an engine, while Lord Grosvenor Fairlie for some days drove an engine, while Lord Grosvenor fred for him. In 1853 Mr. Fairlie was locomotive superinten-dent and general manager of the works of the Londonderry and Coleraine Railway, and afterwards held a position of im-portance on the Bombay and Baroda Railway. He subsequently started in business for himself in Grace-church-street as consulting engineer and in 1864 Mr. Fairlie

church-street as consulting engineer, and in 1864 Mr. Fairlie patented his double bogie engine, which was described in THE ENGINEER for December 2nd in the same year. After over-ENGINEER for December 2nd in the same year. After over-coming much opposition, the Fairlie system fought its way to esteem, and engines of this type may now be found in every country which possesses a railway. They are in use on fifty-two railways, and have been built to every variety of gauge from 1ft. 10in. up. Among the last Mr. Fairlie designed were some for the Berber-Suakim Railway. These were actually con-structed, but are still in England. In 1873 Mr. Fairlie went to Venezuela, where he remained but three months. He got a bad sunstroke, followed by fever and blood poisoning, and returned to England more dead than

and blood poisoning, and returned to England more dead than alive. The natural strength of his constitution, however, asserted itself, and after a time he recovered to a large extent; but he never again enjoyed perfect health, and his death, almost in the prime of life, was beyond doubt an ultimate result of his South American trip.

Mr. Fairlie's genial temperament endeared him to many friends, and his loss will be felt throughout a wide circle.

THE MANCHESTER SHIP CANAL.

THE long-continued and strenuous battle over the Manchester Ship Canal Bill having at last been ended in favour of the scheme, it will be well to complete our numerous articles on the subject by showing exactly how the matter now stands, and what it is that Parliament has sanctioned. Introduced in Parliament first in 1883, the measure was referred to a specially constituted Committee of the House of Commons, of which Sir Learch Beiler mas chairmat, and often an inquire of thirty ning constituted Committee of the House of Commons, of which shi Joseph Bailey was chairman; and after an inquiry of thirty-nine days' duration it was passed, in the main. Passing to the Lords' it was dealt with and rejected in ten days by Lord Camper-down's Committee, and so failed for that year. In the following down's Committee, and so failed for that year. In the following session, however, it was initiated in the Upper House, and on that occasion agreed to by the Duke of Richmond's Committee, who occasion agreed to by the Duke of Richmond's Committee, who sat forty-one days; but oddly enough the Commons' Committee, with Mr. Sclater-Booth as chairman, threw the Bill out on the twentieth day. Thus each House had passed and rejected the Bill alternately; but, as though satisfied with this assertion of independence and impartiality, the Lords' Committee this year, presided over by Earl Cowper and sitting thirty days, and Mr. Forster's Committee—having met thirty-three times—have both come to the same conclusion, and approved the Bill; in the latter case unanimously. Altogether 173 sittings were held before this result was arrived at; but as the Lords' Committees, the number of working days occupied on the Commons' basis was 193, and to this must be added two days upon the clauses, the Bill not finally leaving the Committee till Monday last. Look-ing at these facts, this Bill may well take a prominent position ing at these facts, this Bill may well take a prominent position in the records of private Bill legislation.

In respect to the engineering considerations, Mr. Pember, in his closing speech, confined himself almost entirely to the question whether or not the scheme, as finally modified, would prevent the waters of the Weaver from flowing into the Mersey, prevent the waters of the Weaver from flowing into the Mersey, and so reduce the tidal capacity of the estuary. Answering an argument by Mr. Bidder, he contended that the diversion of the top layers of the Weaver would have no effect upon the fretting, and therefore would not reduce the water in that way. The canal would be a locked canal up to 14ft., and that being so the promoters would be able to deal with all the Weaver waters immediately the tide fell below 14ft. They would leave every other accentive such changes as they more effective. immediately the tide fell below 14ft. They would leave every other agency to contrive such changes as they were now effecting, and by sluices or over-weirs they would enable the Weaver water to do the same as soon as the tide had fallen below 14ft. The canal being like a closed box, the Weaver water would be found to pass through the canal, and there would be nothing to prevent it entering the canal, as there would be no wall on the Weaver side of the canal, and no obstruction at all to the flow of the water. It would pass through in the same quantity and with the same effects as at present. But even if their present proposal failed they could resort to other means such as the water to do the same as soon as the tide had fallen below 14ft. The canal being like a closed box, the Weaver water would be found to pass through the canal, and there would be nothing to prevent it entering the canal, as there would be no wall on the Weaver side of the canal, and no obstruction at all to the flow of the water. It would pass through in the same quantity and with the same effects as at present. But even if their present proposal failed, they could resort to other means, such as the

introduction of reversible gates across the Weaver some distance from the canal. In reply to Mr. Forster—the chairman—Mr. Pember stated that the canal could be carried inland until deep water was reached at Eastham, and so by not running through the estuary it would avoid the dangers of "coaxing"—as Mr. Pope had described it—the Lancashire channel away from Garston to the Cheshire side. The rest of Mr. Pember's speech was directed to the financial and com-mercial questions, with which we need not concern our-selves. On its conclusion, the Committee conferred for about an hour, and then the chairman announced that the Committee had unspinously acres to this conclusion. about an hour, and then the chairman announced that the Committee had unanimously come to this conclusion:— "We consider the preamble proved upon the following condi-tions:—First, that the limits of deviation should be so made use of that the canal shall come upon dry land after entering the lock at Eastham. This is what Mr. Pember has stated was possible to be done. The next is that the dredging shall be only 12ft. The modified plan proposes 15ft. We think the dredg-ing should be only 12ft. With regard to the capital, as men-tioned in Clause 38, Mr. Pember made a suggestion which was only carrying out what strongly occurred to each one of us, that this Clause about the $\pounds 5,000,000$ to be raised before operations are begun should be entirely independent of and in addition to are begun should be entirely independent of and in addition to the purchase of the Bridgewater Canal. We think the time in which this should be raised should be two years—the time fixed for the purchase of the Bridgewater Canal—instead of three years. We cannot consent to Clause 42 relative to the deposit. There is only one other matter we wish to state, and that is that a clause for the protection of Ellesmere Port should be fairly con-sidered. Clause 42, referred to by the chairman, proposed that on the application of the depositors by petition in a summary manner at any time after the passing of this Act, the Chancery Division may and shall order that the canal deposit fund and interests and dividends thereon shall be transferred to the depositors, on to any other person or persons whom the depositors may appoint on their behalf."

To make this decision clearer it may be explained that the first condition laid down by the Committee affects a length of about half a mile of the canal beginning at the lock at According to the original and modified plans of the Eastham. promoters the outer embankment of this portion of the canal would have been in the tideway, and the opponents alleged that this would lead up or coax the channel along the shore towards this would lead up or coax the channel along the shore towards Pool Hall Rocks, on the Cheshire shore, thus subtracting from the Garston channel or the opposite shore. The Committee decide that the canal should take a course absolutely inland from Eastham to a point half-way to Pool Hall Rocks, a distance of half a mile, the effect being to leave the existing cliff line as the boundary of the canal, the canal being some distance inland. The sills of the Eastham locks are left untouched, but the dredging is reduced to a depth of only 12ft., as proposed by Mr. Lyster, the engineer to the Mersey Dock Board. As regards Clause 42, the effect of the Committee's decision is that the deposit usually paid into Parliament when a Bill is lodged should be impounded until the works are completed. The prodeposit usually paid into Parliament when a Bill is lodged should be impounded until the works are completed. The pro-moters contended that the Standing Order of Parliament was meant to apply to railway and not to canal and dock works, and that therefore the deposit ought to be released. When the Committee met sgain on Friday, a long and warm discussion took place upon the question of Parliamentary deposit, and eventually the Committee decided that the deposit of $\pounds 275,000$ should be impounded for three years only instead of seven, as asked for by the opponents. With a view to pro-viding means for removing the works if they should be found to have injured the estuary, the opponents proposed that the have injured the estuary, the opponents proposed that the shares should be increased from $\pounds 10$ to $\pounds 16$, but the promoters shares should be increased from ± 10 to ± 10 , but the promoters resisted this as a device to strangle the Bill. They also refused to assent to a suggestion from the chairman, that to meet the contingency pointed to, $\pm 250,000$ of the $\pm 8,000,000$ of capital should not be called up for five years after the completion of the works. The Committee agreed that the proposed clause could not be sanctioned, as it would place the canal at the mercy of the Morror Decks Berd and so the appropriate failed the Mersey Docks Board, and so the opponents failed. The 38th clause, as to the raising of capital, was amended so as to meet the condition imposed by the Com-mittee, and the 36th clause was made to read thus:— "If any work executed by the company shall at any time in the opinion of the Mersey Commissioners cause any injury to the seturary or to any of the approaches thereto or to the har or estuary or to any of the approaches thereto, or to the bar, or prejudicially affect any anchorage, mooring ground, or landing stage within the jurisdiction of the Mersey Commissioners, or the access to any dock, or in any way cause injury to the navi-gation or to the due working of any ferry within that juris-diction, then and in every case the said Commissioners shall have never metrithetening any approach by them of such have power—notwithstanding any approval by them of such work—to order the company to take such steps as may appear to the said Commissioners reasonable or proper for preventing or remedying or prejudicially affecting as aforesaid." The final sitting of the Committee on Monday last was devoted to the settlement of sundry technicalities in the clauses, and in the energing WE Forter approximation to Here a for the settlement of sundry technicalities in the clauses, and in the evening Mr. Forster reported the Bill to the House of Commons.

The canal now sanctioned by Parliament is thus described by the promoters :-- "The proposed Manchester Ship Canal is a scheme for the conveyance of ocean going vessels from the sea direct into the heart of 'Cottonopolis.' The canal will be thirty-five miles long, and will impound the water by a series of locks. After leaving the city it will pass through the outer basins of the Mersey and Irwell Navigation Company, above Runcorn, and be thence continued along the Runcorn shore across the mouth of the river Weaver into the Frodsham Marshes. It will then skirt the shore near Ince and pass inland across Stanlow Point, until it nearly reaches Eastham Ferry, where it enters the river in deep water. The docks will allow of steamers of large size to load or unload at their quays, a 26ft. depth of water being maintained throughout. The canal will be faced with stone in all cases, and be lighted and buoyed where necessary, to enable vessels to pass either up or down any hour of the day or night, and at any state of the tides."

On Wednesday the Bill came before the House and was at once passed through all its stages and read a third time, the Standing Orders being suspended to enable that to be done.

LETTERS TO THE EDITOR.

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

RAILWAY SPEED.

and after careful inquiries amongst drivers on the Midland, Great Northern, and other extensive railways, as to the time occupied in Northern, and other extensive railways, as to the time occupied in slowing and starting again at stations, and the actual stop made at those stations where the "arr." and "dep." are not given in the time tables, and which will, I think, correctly represent the speeds usually attained on English railways. Here I have allowed two minutes for slowing and two minutes for regaining speed at each stop, and two minutes for slowing at the last stop, and for all stops where no "arr." and "dep." are given in the time tables I have allowed $1\frac{1}{2}$ minutes for the actual stop.

Railway.	Train.	Distance. Miles.	Time. Minutes.	Number of stops, in- cluding last.	Time— Stops. Minutes.	Speed in miles per hour.
L. and N.W.	Euston, 8.20 p.m.	10	h. m.	1011231	0370	UT TENOLE
	Holyhead, 2.27.	264	6 7	5	339	46.87
L. and N.W.	Euston, 4.10 p.m.		1 00	1.00	(see	The second
~ ~ ~	Liverpool, 8.40.	1057	4 30	6	233	50.00
Gt. West'n.	Paddington, 11.45 a.m.	0401	6 10	0	0201	15.11
Gt Wost'n	Plymouth, 5.55.	2403	0 10	0	3285	40.11
GL. WOSLII.	Exeter 7.14	194	4 14	5	218	53.57
Midland.	St. Pancras, 3 p.m.	101			210	
	Leeds, 7.25.	204	4 25	5	2321	52.63
Gt. North'n.	King's-cross, 10.35 a.m.					
	York, 3.	188}	4 25	6	227	50.00
Sth. West'n.	Waterloo, 11 a.m.					10.00
Ch Tartha	Exeter, 3.12.	172	4 12	6	216	48.00
Gt. Lastn.	Liverpool-st., 12.50 p.m.	1013	0 00	5	164	44.77
L C & D	Victoria, 8.a.m.	1012	0 20	0	104	31.11
1., 0., 0 1.	Dover Pier, 9.48.	78	1 48	4	911	51.28
Sth. East'n.	Charing-cross, 8 a.m.		- 40	1		
	Dover Pier, 9.47.	761	1 47	3	96	48.0
L., B. &S. C.	Victoria, 3.50 p.m.			1. Startest		
- 10 M M M M	Brighton, 5.5.	501	1 15	None	73	41.38
			Mi	les. Mil	le, Mi	in. Min.

 $\frac{\text{Midland Railway, 204 : 1 : : 232.5 : 1.14}}{\frac{60.00 \text{ mins.}}{1.14}} = 52.63 \text{ miles per hour.}$

From these figures the average speed on the above nine railways will be ound to be 48.20 miles per hour. M. M. London, July 30th.

THE EFFICIENCY OF FANS.

THE EFFICIENCY OF FANS. THE EFFICIENCY OF FANS. SIR,—In reply to Mr. R. H. Graham's letter re my paper on "Testing Fans," I am not surprised that he should fail to agree with it as reported, because your report contains important mis-prints, which I referred to last week. But Mr. Graham might as well refer to the letter he quotes from, in order to quote correctly." He has not remembered correctly in this case. I assumed adiabatic, not isothermal, compression—*i.e.*, I did not follow the equation $p = constant. Also, I did not use the expression <math>(p_2 - p_1)V$ for the work done in compressing the air; and I did not neglect the variation of density of the air as it changes its pressure. Mr. Graham's complaint of "inconsistency of method," therefore, solely results from his quoting incorrectly from memory, in place of referring to the letter he quotes from. In reference to the sign h, surely Mr. Graham can recognise that if the air has to be lifted in passing through the fan from a low-level inlet to a high-level outlet, that lifting involves an additional—extremely small— amount of work to be done by the fan. Regarding the inclusion of the kinetic energy of discharge in the "useful work" done by the fan, of course some confusion may quite fairly arise as to what outlet, that lifting from theory. As I defined it, it means all the work necessarily performed by the fan over and above that sportent resistance inside the fan itself. Mr. Graham has mis-urent resistance inside the fan itself. Mr. Graham has mis-merestrative work. " "Lost" was intended to mean, not wasted, work inceessarily performed by the fan over and above that pert no vercoming journal friction and viscous and eddy-making in the "waste work." "Lost" was intended to mean, not wasted, because this energy was included in the "useful work done," mot herease onzile is a false one. There the work do be done by pre-ieting it with as high a velocity as possible. The high discharge work necessarily spent outside the fan;

is not in the least so with a ventilating fan. I enclose for Mr. Graham the correct report of the paper as issued by the Mining Institute. August 3rd.

ENGINEERING CASES IN THE LAW COURTS.

SIR,—Your remarks on the patent right case of Gwynne v. Drys-dale has recalled to my mind a subject on which I have long meant to address you, and that is, the perfect farces into which many of the engineering cases tried in the London courts resolve them-selves. This, I take it, is owing chiefly to the entire absence, except in the Admiralty Court, of engineering assessors. My business takes me considerably into the courts, and I can call to mind mere huliers and a se illustration I will menti except in the Admiralty Court, of engineering assessors. My business takes me considerably into the courts, and I can call to mind many ludicrous scenes, and as an illustration I will mention one, leaving out names. The case—one on the imperfect construc-tion of machinery—had been referred from a superior court to a public arbitrator, and occupied some seven days. The leading counsel for the defence, after being well coached up on the engineering points, addressed the arbitrator for some half-hour, trying to explain a point to him. The arbitrator said, "Oh, Mr. Jones, you mean so-and-so." "No I don't," said Mr. Jones, amidst roars of laughter; "I mean exactly the opposite." To try and elucidate, arbitrator, counsel, and witnesses adjourned in cabs to view tho machinery, with the result that many of them on their return were in a worse fog than before. Is it right that engineering cases, which often cost large sums of money, should be left almost to chance as to who secures the verdict? If a competent engineering assessor was appointed to sit with the judge, much valuable time and money would be saved, and I ask THE ENGINEER to make the matter public, with the hope that some change may eventually be brought about. If the engineering profession as a body demanded this, I do not think they would have to wait long, but "what is everyone's business is no one's." M. PowIS BALE. Appold-street, E.C., August 1st.

HEDGES' SPEED GAUGE. SIE,—Captain Shiffow, R.A., is quite right in pointing out the apparent discrepancy in the illustration of my speed gauge, but as the variation of diameters of the bubble at high and low speed is the variation of diameters of the bubble at high and low speed is not more than in., it was purposely omitted on account of the small scale of the diagram to avoid confusion. I am gratified to see your correspondent understands the special novel arrangement of my speed gauge, and beg to thank him for the clear way in which he proves the unconvertible law that the depth to which the paraboloid extends is proportional to the number of revolutions. It appears from his explanation that he supposes the volume of the air to be changed. This is not the case, which I have proved by leaving a small hole open in the top of the tube cover. The working of the gauge on board ship does not affect the law, nor is the bubble displaced when the instrument is inclined or violently shaken. KILLINGWORTH HEDGES. 25, Queen Anne's-gate, S.W.,

25, Queen Anne's-gate, S.W., July 27th,

ELECTRICAL ENGINEERING AT THE INVENTIONS EXHIBITION. No, X.

Messres. MATHER AND PLAT, of Manchester, exhibit improved Edison and improved Gramme dynamos. The improvements are mainly due to Dr. John Hopkinson, who was probably the first in this country to apply a rigorous mathematical treatment to questions connected with the design of dynamos. It will be remembered that the original Edison machines brought over from the United States and some of which can be seen even now United States-and some of which can be seen even now in the electric light shed—were remarkable for the arrange-ment of their field magnets.' Each limb consisted of two or more cylindrical bars of comparatively small diameter and great length, and the two pole pieces as well as the yoke were huge blocks of cast iron. It is difficult to imagine what may have been the reason for this extra-ordinary arrangement. The most plausible explanation which will probably occur to many is that the long and

bars the length of one turn is $3 \pi d$, whilst the area enclosed is '75 πd° . If we now take a bar of oblong section consisting of a flat part of width πd and two semicircular ends $\frac{\pi}{2} d$, the perimeter is again 3 πd , but

the area enclosed is $1.25 \pi d^2$, or about 66 per cent. more than in the former case. With the same length of wire we are therefore able to excite a magnet containing 66 per delation of the same d cent. more iron, and obtain a correspondingly stronger These considerations are so simple and self-evident field. field. These considerations are so simple and self-evident that one cannot help wondering why magnets with sub-divided limbs were ever employed. In the Edison-Hopkin-son dynamo the magnets consist of wrought iron cores of oblong section, those for the 550-light machine being 18in. wide by 9½in. thick. The area of cross section is 171 square inches, and the length of each limb is 24in. There are eight layers of exciting wire, each layer containing 193 turns of '095 wire. The total number of turns on both cores is therefore 3080, and the resistance is 16 obms both cores is therefore 3080, and the resistance is 16 ohms.

known under the name of the "Manchester" dynamo. small machine of that class will be found in the East Arcade, and a larger one, driven by a Manchester diagonal engine, with special belt-tightening gear, is placed in the electric light shed, and was originally employed in lighting the West Refreshment Pavilion and Tea Gardens. Owing to some alterations in the arrangements for lighting the subway, the Manchester dynamo is now performing that work, and its original circuit has been shifted over to the combined Allen Engine and Kapp dynamo, which we illustrated last week.

The general arrangement of the "Manchester" dynamo and engine will be seen from our engravings, Figs. 1 and 2. Fig. 3 is an end view of the dynamo alone, showing to a somewhat larger scale the shape and position of field-magnets and the attachment of the brushes. The magnet cores are wrought iron cylinders $7\frac{1}{2}$ in. diameter, and the exciting coils are $12\frac{1}{2}$ in. long. They are placed vertically one on each side of the armature between the two cast



MESSRS. MATHER MAND PLATT'S DIAGONAL ENGNE AND "MANCHESTER" DYNAMO.



MATHER AND PLATT'S IMPROVED EDISON DYNAMO.

thin bar was chosen in order to produce a maximum magnetic moment with a minimum expenditure of exciting energy. If this surmise be correct, there must then have existed a strange misconception regarding the proper and is wound with forty complete turns, or eighty energy. If this surmise be correct, there must then have existed a strange misconception regarding the proper function of field magnets. We know now that it is not the magnetic moment of each limb, but the number of lines of force passing between armature and pole pieces which determines the electro metires force of a durance which determines the electro-motive force of a dynamo. Hence all good modern machines are designed with a view Indexe all good modern machines are designed with a view of making the number of lines a maximum; and this can best be done by employment of stout magnets of just sufficient length to get the necessary amount of exciting coils on. The subdivision of the core into a number of thin and long parallel bars has not only the disadvantage of increasing the magnetic resistance of the circuit, but also the additional drawback of wasting part of the exciting wire, as will be seen from the annexed diagram. of increasing the magnetic resistance of the circuit, but also the additional drawback of wasting part of the exciting wire, as will be seen from the annexed diagram. Let A B C be three circular bars joined by one common pole-piece P, and let

the exciting current circulate as shown by the arrows. It will be clear that those portions of the wire which come nearest to each other between the bars must, on account of the opposite directions of their currents, neutralise each other to a certain extent—or, in other



half convolutions, of 16-strand '069 wire. The machine is intended for an external current of 300 ampères, and since the area of conductor on the armature is $16 \times .00374 =$:0597, we find the density of current= $\frac{1}{2} \cdot \frac{306.88}{.0597} = 2570$ and the attachments to the armature coils are made with gold-plated spoons, which system ensures good contact, and at the same time admits of easy removal for the purpose of repairs. There are three brushes on each side, with adjustable spring and hold-off catch. The resistance of the armature is 0.009 ohms, and the statement of the afficiency as forwarded to us by the makers is as the efficiency as forwarded to us by the makers is as follows :- Total electrical power developed, 34,631 watts ; loss in magnets, 784 watts, or 2.23 per cent.; loss in armaother to a certain extent—or, in other $\$ words, part of the wire is wasted. Neglecting the difference between the diameter d of the bar and the mean diameter of the exciting coils, we find that for the three

THE "MANCHESTER' DYNAMO.

iron pole pieces, which have suitable extensions. The bottom pole piece forms also the base plate of the machine. The armature is a Gramme ring containing 120 convolutions of 203 wire, the core being 12in. long and 12in. external diameter. We are not at liberty to publish the mechanical details regarding the manner the core is supported on the spindle; but as regards the wires, they seem to be held in place by friction only. There seems to be no special pro-vision made for ventilation of the core except in so far that the external coils do not cover the whole surface of the core. The commutator contains forty bars insulated with mica, and the armature coils are attached to it in the usual way by soldered joints. Since full details of the construction of the armature are not available we can only approximately calculate the total length of conductor. It is probably about 110 yards. The com-pensation curve of this machine has been forwarded to us by the makers, and from it we find that, at a speed of 1050 revolutions a minute, the external electro-motive force is 110.9 volts if external current is 60 ampères, 111.7 rolts if enternal current is 120 ampères, 111.7 volts if external current is 120 ampères, 1111 volts if external current is 180 ampères, and 110.5 volts if external current is 213 ampères. From these figures it appears that every yard of conductor on the armature produces one volt in the external circuit—a most satisfactory result. The magnets are compound wound, each limb containing 1680 turns of '065 shunt wire, and 42 turns of treble '203 main wire. The resistance of the shunt is 19:36 ohms; that of the main, '012 ohms; and that of the armature,

that these figures are too high, and that in continuous work the coils would become hot. From a circular issued by Messrs. Mather and Platt we learn, however, that a similar machine, but of smaller size, was actually kept running for twenty-five consecutive hours, when the field coils were only found to be slightly warm. This is a most remarkable, we might almost say an astonishing result, especially if it be remembered that the special shape of the magnets would rather favour heating than otherwise. It may be opportune in this place to refer to the investigation made by Prof. Forbes with regard to the heating of a wire coil by the passage of a current. In a paper read before the Society of Telegraph Engineers, Professor Forbes has shown that the rise of temperature t in centigrades of a coil of r ohms having an exposed surface of S square centimetres can be calculated by the formula $t = \frac{24 r \text{ C}^2}{\text{E S}}$, where

ES E is McFarlan's constant, which can be taken at '0003, and C is the current. The meaning of this equation is that the heat generated by the loss of $r C^2$ watts is con-tinuously being dissipated into the surrounding air by the surface of the coil. If we assume that the permissible rise of tampentum should be the arms in coll durance we find of temperature should be the same in all dynamos, we find that the proportion between the surface exposed and the work used up in exciting the coil should be a constant. Now, a circular magnet has evidently a smaller surface of coil exposed than an oblong or rectangular magnet of the same area of core, and therefore we should expect the magnets of the Manchester dynamo to be especially liable to become hot. If experience does not confirm this it would seem that the cooling effect of the surface of coils is in reality greater than is generally assumed and we is in reality greater than is generally assumed, and we might use the dynamo just described as an example from which we can find the relation between exposed surface and wats used in the relation between exposed surface and wats used in the exciting coils. If we neglect the end faces of the coils—parts of which are covered by the pole pieces—the total area exposed is about 1000 square inches, whilst the loss in the magnets is 638 wats in the shunt coils and 582 watts in the main coils. In all we have thus 1220 watts transformed into heat, and this heat is dissipated by a surface of 1000 square inches. To be perfectly safe we would be inclined to allow rather more cooling surface -or a lesser density of current, which comes to the same thing-than has been done in the Manchester dynamos, and we would fix as the limit one watt for every square inch of cooling surface—a simple and easily remembered rule. It is, however, scarcely possible to lay down a hard-and-fast line, since the pole pieces and other masses of metal on the machine also assist in dissipating heat, and it is difficult to correctly estimate the influence of those parts.

The electrical efficiency of the machine is 90.6 per cent. The electrical efficiency of the machine is 90% per cent., and the weight of copper used is—on armature, 42lb.; in shunt coils, 100lb.; and in main coils, 100lb.; in all, 242lb. for a maximum output of 24,200 watts, or 100 watts for every pound of copper. The dynamo is driven, as stated above, by one of Mather and Platt's diagonal twin engines, with cylinders 8in. diameter, 10in. stroke, running at a speed of 175 revolu-tions a minute. The fly-wheel which at the same time

diameter, 10m. stroke, running at a speed of 175 revolu-tions a minute. The fly-wheel, which at the same time serves as pulley for the belt, is 5ft. 6in., and its boss is extended into the crank shaft bearing in order to obtain more wearing surface. The dynamo is placed close to the engine, and, in order to give the belt more grip over its pulley, the tightening arrangement shown in our illustra-tion is used. It consists of a swivelling arm which carries at one and a pulley riding loose on a stud. The other and at one end a pulley riding loose on a stud. The other end of the arm is formed into the segment of a worm wheel, into which gears a worm fixed to the bed of the dynamo. By turning the worm the lever is raised or depressed and the gripping power of the belt adjusted accordingly.

MISCELLANEOUS MACHINERY AT THE INVEN TIONS EXHIBITION.

MESSRS. ROBEY AND Co. exhibit at the Inventions Exhibition an engine fitted with a single valve, or, as it is called, the Corliss apparatus, which is principally applicable to small engines. Of this we give engravings in detail show-ing section of the valve, its attachments, and the governor.



The engine is fitted with an ordinary slide valve, which admits the steam to three-quarters of the stroke, and exhausts in the ordinary manner. The double-beat valve shown in the engravings stands immediately over the steam chest, the space in which is reduced to barely enough to contain the valve, and to allow it to travel. Steam enters by the passage A, Fig. 1, and when the valve is open, through the spaces shown by the arrows. The valve B is lifted at the commencement of each stroke, but the momentat which it has to be dropped again, and cuts off the steam, depends upon the position of the governor, while the actual work of lift-

'023 ohms. With a full load of 220 ampères, the exciting power on each limb is therefore $1680 \times \frac{112 \cdot 6}{19 \cdot 36} + 42 \times 220$ = 10,700 ampèreturns, whilst the density of current is 1750 ampères in the shunt and 2270 ampères in the main wire. Most electricians will probably be inclined to think that these figures are too high, and that in continuous work horizontal shafts F¹ and F², upon which shafts are adjust-able spiral springs, tending to give a constant dead pressure



to the inner ends of the levers. The outer ends of the levers have hard steel faces G^1 and G^2 . The rocking lever H, which works upon the centre L, is actuated by an excentric on the crank-shaft, and is so set that one end is depressed at the forward and the other end at the backward stroke. Upon the centre pins J^1 and J^2 , at each end of this lever, are hinged the crank levers K^1 and K^2 , and as



the nut of the lever H is depressed, the point of K1 pressing upon G¹ raises the valve B from its seat, and admits steam. As this depression continues the point of the lever K moves inwards, and, sliding over the face of G¹, releases it, when it immediately springs upwards, the valve falls, and instantaneously cuts off the admission



of steam. Were these levers K^1 and K^2 fixed, the distribution of steam would be constant; but the inner ends of these levers rest upon the buckle L, which is secured to the lower end of the governor spindle, and is raised or lowered by the action of the governor. It will be seen that as this buckle L rises, taking up with it the inner ends of the levers K^1 and K^2 , their outer ends approach nearer together; and while they would continue is practically flush with the top of the cylinder, this object

to lift the valves, they release them much sooner-when the governor is down the point of release being at five-eighths of the stroke, and when it is in its highest position the whole of the steam is cut off. Diagrams Nos. 1 and 2 are taken from an engine fitted with this simple apparatus. Figs. 2, 3, and 4 show an engine fitted with the more perfect apparatus used in larger engines. These illustrations show apparatus used in larger engines. These injustrations show the general design of the engine, how the valves are placed, the method of working them, and of driving the governor. Figs. 3 and 4 show details of the same to a larger size. In this case it will be seen there are two admis-sion valves A^1 and A^2 , one at each end of the cylinder. A^1 is in section, and shows not only the valves, but the small cylinder containing the air piston and special spring. The spring is used to insure the instantaneous closing of the valve, and the piston B to prevent it coming violently the valve, and the piston B to prevent it coming violently upon its seat, a slight adjustment of the set screw C so regulating the quantity of air confined within it as to allow it to drop down suddenly, but without any violence. The action of the governor is precisely the same as in the single valveapparatus; but there being two admission valves instead of one, and close upon the cylinder, the cut-off is a little sharper and the diagrams more perfect. Diagrams 5 and 6

show diagrams taken from an engine with this valve gear. On page 103 we give a section through the working cylinders, and a plan of the large patent plate-closing and double power fixed rivetter, shown in our full page engraving last week. The operation of properly closing a rivet Ing last week. The operation of properly closing a river is not quite such a simple matter as it appears. In boiler work especially, the bringing of the plates together and keeping them in close contact while the rivet is squeezed up, is a very important feature, which, until a com-paratively recent date, was either lost sight of altogether, or at best provided for in a very imperfect way. It might seem, on first consideration, that the plates could be brought together by merely using a heavier pressure on the rivet-ting dies, a practice which is still adhered to by some makers. This, however, is a mistake, as the increased pressure has in many instances produced permanent injury to the plates, while, as the full pressure does not come on until the rivet is headed, it was often found that some of the mate-rial of the rivet had been squeezed in between the imper-fectly closed plates, which, of course, effectually prevented their being brought together at all. Besides this, unless the plates are in perfectly close contact, and are kept so during the operation of closing the rivet, every extra ton pressure put on over and above that necessary to crush up the hot rivet is wasted, its only effect being to produce the defects above referred to. From the experience gained in the construction of over 800 machines of all sorts, Mr. Tweddell, in conjunction with Messrs. Fielding and Platt, Gloucester, has designed the patent plate-closing machine and rivetter which we now illustrate. The introduction of budgets are an experience by Mr. Tweddell of hydraulic pressure rivetting machinery by Mr. Tweddell some twenty years ago permitted a great improvement in the method of closing, over what was previously in use. Before rivetting commenced, flat-headed closers were put in the die holders, and the boiler being slung up, the seam to be rivetted was passed between these closing tools, and the service bolts tightened up. In common, however, with other devices since employed, this system had the objection of taking the pressure off the plates before com-mencing to close the rivets. The machine now referred to was designed to overcome this defect, while embodying several other recent improvements as well. The general view given last week shows a type of machine which, for 100 tons pressure, has been made with a gap of 12ft. The same design is also adopted for exerting pressures up to 150 tons, two machines having been made of this power, with gaps somewhat less than those for the smaller powers. A number of machines for exerting a pressure of 80 tons have also been made, and it is the opinion of many engineers of great experience in this branch, that 80 tons, when divided into two powers, one for plate-closing, and the other for rivet-forming, is quite sufficient for the heaviest boiler work yet made, and is probably more than equal to 120 tons applied without the plate closed, even assuming that the latter pressure did not produce either of the inju-rious effects to which we have referred.

The engravings, page 103, show a section through the work-g cylinders. The plate-closing cylinder A is contained ing cylinders. within the movable rivetting cylinder F, the ram C on which this works being fixed to the main frame of the machine. When in use, the pressure water from the accumulator when in use, the pressure water from the accumulator passing through pipe L is always on the cylinder A, tend-ing to keep its ram G out. This ram carries an annular cap H, encircling the cupping tool E, and always about an inch and a-half in advance of it. The mode of working is as follows:—Upon opening the valve D to the accumulator, the cylinder F moves forward, and since the space A is filled with water at the same pressure, it practically forms part of the moving cylinder F and it practically forms part of the moving cylinder F, and goes forward with it. The closing tool H being, as already stated, about 11in. in advance of the die E, it around states the plates first; but since the area of the ram C is more than double that of the ram G, it continues to advance by itself, forcing part of the water contained in A back into the accumulator, and pushing forward the cupping die E. While this is being done it will be evi-dent that the preserve due to the area of A is being dent that the pressure due to the area of A is being exerted on the plate closing tool, thus squeezing the plates together. In the 100-ton machine this pressure amounts to 40 tons, the balance of 60 tons being exerted on the die for forming the rivet. If the work is very heavy, by opening the valve B to exhaust, the pressure is released from A, and the whole 100 tons due to the main cylinder Trom A, and the whole 100 tons due to the main cylinder C is put upon the rivet head, but this occurs after the plates have been closed, and the rivet to a large extent formed, so that "washering" is impossible. The actual time occupied in closing a rivet is no longer than it is with the ordinary direct action machine. The two plungers J K are the automatic returning rams, these, together with the usual arrangements for adjusting the stroke to meet any variation in longth of single ar thickness of plates heing variation in length of rivets, or thickness of plates, being well known as having formed part of Mr. Tweddell's original design. It will be observed that the cupping tool 112

can also be worked for lighter rivetting without using the large ram at all. This is accomplished by removing the closing tool and substituting a cupping die, and using the small ram G by means of the valve B. This is a great convenience, as with these long gap machines the whole of a marine boiler furnace can be rivetted up, as well as the joints to the combustion chamber, besides which there is always a lot of odd work to be done in a boiler yard for which a comparatively small pressure will suffice. Another advantage of the arrangement is the facility it affords for flush rivetting. We hope to describe how this is done on a future occasion. For the present we will only say that we believe the difficulties in doing this class of work by machinery have been entirely overcome.

The arrangement of valve levers is clearly shown. There are only two, and in some cases they are worked by a foot treadle. As a rule, however, there is no advantage in this, as when the machine is fitted with an overhead hydraulic crane—as is generally the case—the crane valve levers are placed alongside those shown in the engraving, and one man then does all the lifting and adjusting, as well as the working of the rivetter. In some cases users require gear to adjust the length of stroke automatically, and such gear was fitted many years ago by Mr. Tweddell. It is, however, not recommended by him. Indeed, it is quite evident there is considerable risk in its use, as it really does away with one of the chief advantages of hydraulic rivetting, viz, its uniform pressure under all conditions. This is its principal advantage over geared Suppose, for example, a rivet to be too long: machines. Then the ram only stops the sooner, and makes a larger nead, but puts on a definite and known pressure; while,

LEGAL INTELLIGENCE.

JOHN GWYNNE V. DRYSDALE AND CO. THE following is the judgment or opinion delivered by Lord M'Laren in the case to which we have referred on two recent

LORD M'LAREN: After conferring with Professor Tait, who is acting as scientific assessor in this case, I do not think it necessary to call upon the respondents' counsel. Indeed, as we mentioned to call upon the respondents' counsel. Indeed, as we mentioned at an earlier period of the proceedings, our impression has been throughout that a case of infringement has not been established; but I am glad that the evidence for the respondents has been taken, because there are some points that have been elucidated more fully than they were by the evidence for the pursuer, and that irrespective of their bearing in favour either of the one party or of the other. This is an application for interdict against the contravention of the letters patent taken out by Mr. Gwynne for improvements in centrifugal pumps, the improvement consisting in an arrangement whereby the pump shall be made to turn round or swivel in relation to the frame of the engine or motor, so that its suction and discharge pipes may be placed at successively difor swivel in relation to the frame of the engine or motor, so that its suction and discharge pipes may be placed at successively dif-ferent angles to the perpendicular. We have nothing to do with the mechanism of the pump itself. I understand that the centri-fugal pump is a pump in which the water is lifted by the revolution of vanes, which takes the place of the reciprocating movement in the common pump; but that really does not enter into this case at all. Now, we have no doubt, upon the evidence and the explana-tions that have been given, that this is a useful improvement, and, as described in the specification, it is the proper subject of a patent. It appears that Mr. Gwynne had been asked by some of his customers whether he could not supply a pump in which the direction of the suction and discharge pipes could be altered, and he reflected, and came to the conclusion that the best way of doing so was by changing the adjustment of the whole pump case, instead he reflected, and came to the conclusion that the best way of doing so was by changing the adjustment of the whole pump case, instead of attempting to impress such a movement merely upon the pipes, and we have had reasons given why this was the proper way of accomplishing the object. The mechanism described is of a very simple character. Of course, it is not claimed that any of the mechanical parts are new. The claim is for accomplishing the object of swivelling the pump by a suitable combination of known mechanical arrangements; and the mechanical appliances are



on the other hand, if the rivet is too short, the ram travels further, but still exerts the same closing pressure. The same, of course, applies to passing over different thicknesses of plates. Hence any tappet or other gear arranged to cut short the outward stroke at any point is most dangerous, and the machine might as well be a geared one with fixed range. The same objection does not, however, apply to stopping the return motion of the ram, which has nothing to do with closing the rivet, and this is effected in a very neat manner by the arrangement shown by means of which the water consumption is greatly economised if a quantity of short rivetting has to be done. A tappet bracket N is attached to the main cylinder, which, it will be remembered, moves, and which as illustrated is shown at the back of its stroke. On the centre pin U, at the end of the lever U R, works a quadrant O with a number of steps in it, and these steps, by means of the lever P, can be successively brought in front of the tappet bracket N. The lever U R is fixed to the spindle by which the valve is worked, so that as soon as the tappet engages with the quadrant, it is carried round, and closes the exhaust, so stopping the return of the ram. The various steps permit of this action taking place at different parts of the stroke, regulation being effected by a simple movement of the hand lever P.

The quality of the work done by these machines is, as might be expected, of a very high class, and at the Exhibition may be seen some very fine specimens, among which we will only mention some plates, joined together by rivets 2in. diameter. We understand that machines of this type have been supplied to Messrs. Maudslay, Sons, and Field; H.M. Dockyard, Keyham; and many of the leading boiler-makers both in this country and abroad. In conclusion, we may say that this machine seems to us to embody all the essential qualities of a first-class rivetter, suitable for turning out the very best work, and we are pleased to see that Mr. Tweddell, though first in the field, has laid himself out to meet the latest conditions of boiler rivetting demanded by the high pressures now being used in modern marine engines.

In further illustration of the swivel bogie locomotive which we illustrated in our last impression, we now give a transverse section showing the arrangement of the bogie.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—Harry W. Wilkins, engineer, to the Express; and Charles J. Cock, engineer, to the Repulse, for service in the Ariel,

these-the flanges of the pump and the engine frame are to be these—the flanges of the pump and the engine frame are to be bolted together; but as the pump overhangs, and its weight is to be borne by the flange of the engine seat or motor frame, it is necessary that there should be a trunnion or check, or some pro-jecting part of one of these flanges, which is made to fit a corre-sponding depression in the other; so that the weight of the over-hanging pump shall be to a large extent borne by this projection, and not thrown upon the bolts which couple the two plates together. That would be necessary in any case of an overhanging pump, although it were not intended to be swivelled. But where it is intended to be swivelled, care must of course be taken—first, that the flanges, if plane, have their plane surfaces truly at right it is intended to be swivelled, care must of course be taken—first, that the flanges, if plane, have their plane surfaces truly at right angles to the axis of the shaft that is to pass through them; secondly, that the trunnion, or whatever is its proper name, should be a true cylinder or surface of revolution; and thirdly, that the cylindrical surface should be concentric with the shaft. These are conditions which, I should imagine, would occur to every person having even the most elementary knowledge of mechanics, and certainly to any engineer who is setting about such an invention as this. It is not only necessary that the pump should rotate for the purpose of adjusting it, but also that it should be securely clamped and fixed at the required angle when it is working, and that is provided by an arrangement which I need not describe in detail. There is an annular slot with a T-shaped section out in one of those Involve the second seco which is described in the specification, and, in the opinion of the assessor, accomplished in a very efficient and practical manner. Therefore there can be doubt that the patent is a good patent if it has not been anticipated; and we have not had any evidence that deserves consideration on the subject of anticipation, because we are quite clear that neither the patent of Mr. Bessemer nor the patent of Mr. Newton, which professedly relate to other subjects, is an anticipation of this improvement for the purpose of swivel-ling. The important points are, that the rotation may be made without discrete and the proveness of a to interface with the stability Is an anticipation of the points are, that the rotation may be mate-ling. The important points are, that the rotation may be mate-without disengaging the screws so as to interfere with the stability of the pump, and that those screws can be clamped in any angular position. It is easy to see that any improvement of this kind might be varied by mechanical appliances. If an infringer leaves out some part of the inventor's design which, though useful, is not constitute to it, this would be a colourable variation of the patented out some part of the inventor's design which, though useful, is not essential to it, this would be a colourable variation of the patented invention. It would be doing in a less perfect way the thing which the inventor has patented. If an infringer makes use of an inventor's design with improvements of his own, that would also be a colourable variation of the invention, and it will be so where a part or parts of the inventor's design are varied by the substitu-tion of chemical or mechanical equivalents for one or more of the elements of the inventor's design. If you had, for example, a slot cut upon the outside of one of the flanges instead of on the inside,

AUG. 7, 1885.

Aug. 7, 1885 is no evidence that any attempt was made on the part of Messrs. Drysdale's foreman or workmen to secure that equidistance of the holes which would admit of the two flanges being bolted together in different positions. No doubt it might be so. The gentlemen from that establishment quite candidly admitted it might be so, and I have no doubt occasionally it would be so, but they do not think, and nobody has said, that holes which are not drilled for the purpose of being interchangeable would, in the general case, be found to be so, or that that would be a mode which the maker would use if he intended the flanges to rotate face to face. It seems quite certain, according to the evidence of Messrs. Drysdale's people, that they never went through the proper process of manu-facture to enable such a result to be obtained. The evidence of Mr. Morton, to whom I put some questions on the subject, is quite conclusive. He says that very great care must be used; and he described the means of obtaining absolute equidistance on the part of the bolt-holes, and he said it was impossible that any person who received a pump in which these precautions had not been taken could bore holes such as would admit of the pump being swivelled—that it would have to be taken to a shop, and the holes bored by the aid of the proper tools and machinery. When we come to the actual machines made by Messrs. Drysdale, only three cases were founded upon by the pursuer. The first was the case of a pump that had been supplied to Ramage and Ferguson, of Leith, and it appears that in this instance the flanges of the pump were not circular, but what is called D-shaped, one side being a straight line and the other acurve, and the straight side was made to rest upon a bracket cast on the motor frame, and therefore it could not be turned round. It is said that by withdrawing the one plate from the other until it cleared the bracket, it might be turned round to an angle and then replaced. I do not know how far that is practicable, but the bolt-holes would cer is no evidence that any attempt was made on the part of Messrs. Drysdale's foreman or workmen to secure that equidistance of the to rest upon a bracket cast on the motor frame, and therefore it could not be turned round. It is said that by withdrawing the one plate from the other until it cleared the bracket, it might be turned round to an angle and then replaced. I do not know how far that is practicable, but the bolt-holes would certainly not be opposite each other, because they were not equidistant, and the arrangement of the flanges and holes was such as would only be adopted for a fixed overhanging pump. In the case of the machines that were supplied by Mesrs. Drysdale to the contractors for the Forth Bridge, I think some of them were of the same construction, and some had circular flanges; but Mr. Arrol, who desired for some special purpose to alter the angle of the suction and dis-charge pipes, caused the two plates to be detached and the angle to be altered, and then he found that the plates would not fit. What corresponds to the trunniom—the circular projection on the one flange intended to fit into the other—was not concentric with the driving shaft; and consequently, when the flange was turned round, the two parts of the bearing through which the axle was to pass were not opposite each other, and the axle could not have been passed through the pump in that position without being strained or broken. There could not be stronger evidence that the machine in question was never made for the purpose of being swivelled; and 'there is nothing to show that if the experi-ment had been tried upon the other pumps supplied to the Forth Bridge contractors, any different results would have been obtained, or are to be expected. Then, further, it has been shown that if Messrs. Drysdale's object was to make a non-rotaing pump to hang to the motor frame, they could not well have adopted any other mode of connection than that which they had adopted. It would be quite contrary to sound mechanical prin-ciples merely to bolt the two flanges together without a central boss or projection. It need not be circular; it might be square or any shape; bu be said is, that if the plates were taken off and re-turned, and new holes bored in them, you might get a pump which would swivel; but surely it can never for a moment be contended that this would be an infringement of the patent, assuming the object is not to make a swivelling pump, but one of the ordinary description. The only remaining point in the case is the order or offer which was made to execute a swivelling pump. It is rather a peculiar order. There were two cases—there was one spoken to yesterday and one this morning. The case spoken of yesterday depends entirely upon the impression made upon the mind of the witness who spoke to it—Mr. Beal. Mr. Beal went there—I don't think he is to be blamed at all—but he went there by arrangement with

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AMERICAN NOTES. (From our own Correspondent.)

NEW YORK, July 24th. NEW YORK, July 24th. THE question most disturbing the financiers of this city is how to invest the idle millions. The surplus above the legal reserve in national banks alone is 65,000,000 dols. But few acceptable oppor-tunities for investment exist. Railway securities are avoided, especially new lines; the public has been fleeced so often that it is difficult now to put good securities on the market. High autho-rities in finance and in railway management insist that a mistake is being mede in put public prove head by the rules of the rules of

rities in finance and in railway management insist that a mistake is being made in not pushing railway building now, rather than when material will cost 10 per cent. more. Between two and three thousand miles of road will be constructed this year. An effort will be made to create, by Act of Congress, a National Railway Commission, with power to investigate and recommend. Three locomotive works have orders enough to run full time, while all the rest are running from one-half to one-fourth time. Car works average one-half time; Steel rail mills are all on full; structural iron-makers are well supplied with summer orders, and bridge works are busy. Bar mills produce one-half capacity; pipe mills are on double time, and plenty of business is coming along. The western nail mills are all idle, and stocks are getting light. Eastern factories have reduced production by four weeks' suspen-sion, but prices are still low, because the productive capacity throughout the States is nearly thirteen million kegs per annum, while the consumption is between seven and eight million kegs. while the consumption is between seven and eight million kegs. When projected bridge iron making capacity is completed, the increase will be 15 per cent. over present production. The bridge builders are busy; next come rail makers, then pipe makers. The anthracite and bituminous coal trades are fairly active. The

The anthracite and bituminous coal trades are fairly active. The anthracite output for first six months of this year was 12,701,322 tons, or 437,961 tons less than first six months of last year. The production for the last half will be eighteen million tons. The bituminous production is about equal to last year. The utilisation of natural gas in Western Pennsylvania is ex-tending. All the mills but one, and all the glassworks, are now successfully using this fuel. The Alabama coal-field is being rapidly developed. Mines are running full time, and valuable markets are being built up at New Orleans, Mobile, and Pensacola. Wages paid, 50c. to 65c. per ton. New York parties are pushing railroad construction through the mineral regions of this State, in order to expand shipping facilities and bring important coal markets within easy reach. New mining

New York parties are pushing railroad construction through the mineral regions of this State, in order to expand shipping facilities and bring important coal markets within easy reach. New mining territory is being opened in several States. The miners are attempting a national organisation. Prices of fuel are extremely low in all markets. Demand is irregular. The lumber trade is very active. Building is pushed with great vigour. This year's expenditure in this city for building will reach sixty million dollars; in Philadelphia thirty million dollars. Small industries are springing up in the Southern States, and much encouragement is given to further investments. Small failures are numerous. The masses of the works are well employed. Cost of subsistence is declining. The conditions are favourable for the revival which is spoken of as probable by shrewd observers. Tig iron is 16 dols. to 18 dols. for foundry, and 14 dols. to 16 dols. for forge; bar iron, 1'40c. to 2c. per pound ; refined cast steel, 8c.; Bessemer, 3c.; and steel rails, 26 dols. to 27 dols; old rails, 16'50 dols. to 17 dols; structural iron, 2c. to 3c. per pound ; copper, 11c.; lead, 3'65c.; pine lumber, per m., 16 dols to 18 dols.; o alx, 55 dols.; yellow pine flooring, 30 dols.; stocks large; brick, 5 dols. to 6'50 dols. per m.; oement, 2'75 dols.; stone, 75c. to 1 dol. per cubic foot. All kinds of building material are firm. The con-sumption of iron, steel, hardware, machinery, &c., has been unusually light for twelve months. Manufacturers think that the law of compensation will manifest itself in this branch as in others, and that the autumn and winter months will bring out sufficient demand to effect margins. The midsummer activity is far from disappointing. far from disappointing.

LAUNCHES AND TRIAL TRIPS.

On Friday last the screw steam tug White Rose left Chepstow with a select party for the purpose of proceeding down Channel on her trial trip. On arriving in Cardiff Roads she received orders to proceed to Plymouth, where she arrived on Saturday at noon, leaving again at 8 p.m. the same evening with the fine American ship Cheesebrough, 1500 tons, in tow for Cardiff, where she arrived on Monday morning at 2 a.m., thus proving her ability for long towing, for which she was specially designed by Mr. M. W. Aisbett, superintendent engineer to the owners, Messrs. D. Guy and Co. Her principal dimensions are:-Length, B.P., 95ft.; beam, extreme, 19ft. 6in.; depth of hold, 11ft. Sin. She has been fitted by the builders with compound surface condensing engines, having cylinders 20in, and 38in, by 24in. stroke, and a boiler 12ft. 6in. by 10ft., designed for a working pressure of 80 lb. This is the fifth screw tug built by Messrs. Edward Finch and Co., of Chepstow, for the same firm. with a select party for the purpose of proceeding down Channel on her trial trip. On arriving in Cardiff Roads she received orders to for the same firm.

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

(From our own Correspondent.)

THE improved prospects of the country consequent upon the welcome rains must reflect upon the iron and steel trades. This week, therefore, the outlook must be declared more satisfactory, although the amount of work doing at the mills and forges is not an increase over last report. Indeed, Bank Holiday has been seized upon by ironmasters as a welcome pretext for delaying the start of the mills and forges this week to a somewhat later date than usual.

Orders are not very abundant in any branch; in some depart

than usual. Orders are not very abundant in any branch; in some depart-ments they are particularly short. During this month, however, an improvement in the colonial and foreign demand should be experienced, since August is generally the month when the shipping business is at its height. Thin sheets and tin-plates are in better inquiry that any other class of iron. American, colonial, and Continental orders are alike good in the branches specified, and several of the leading makers are fully engaged. The restriction policy in the tin-plate trade, though not extending to the East Worcestershire works, has yet strengthened East Worcestershire prices. Considerable inquiries are also upon the market this week for galvanised sheets for the Antipodes, the Cape, and South America. Some of the last-named orders are coming through merchants in Germany. The prices attached are in nearly all cases unsatisfac-tory except when the orders are indented. Selling prices vary greatly according to the brand. Some firms are content to accept £10 15s., and occasionally even less, for 24 w.g., bundled, delivered Liverpool, while others of sterling repute demand £12. Black sheets of the same gauges are £5 15s. to £7 5s., delivered to local consumers' works; and 27 w.g., £7 10s. to £7 15s., some makers asking £3. Plates are £7 to £8, and superior sorts £8 10s. to £9. Marked hars are unheld on the basis of £7 10s., with £3 2s. 6d. to £9.

to £9. Marked bars are upheld on the basis of £7 10s., with £8 2s. 6d. as the Earl of Dudley's quotation. Other makers, however, will sell bars which they declare to be no whit inferior at £7. The demand for these best quality irons is very limited just now. It is in the descriptions for which £6 10s. and £6 is accepted that most business is doing. Common bars are £5 10s. down to £5 5s. and even £5 2s. 6d. per ton. Hoops are £5 10s. to £6 for export quali-ties, and gas tube strip is abundant at £5 5s., with a moderate demand. demand.

The makers of chain and cable iron are just now having a dull time of it; there is also but a limited demand for strips, and with respect to angles and plates, local firms are in strong competition

time of it; there is also but a limited demand for strips, and with respect to angles and plates, local firms are in strong competition with other districts. Strip iron is being offered to the lock makers upon very favour-able terms, and it is in consequence of the low prices at which they are able to secure their supplies of iron—prices which they them-selves confess are simply astonishing—that hardware manufacturers in Birmingham and South Staffordshire, as a whole, can manage to accept current meagre rates for the manufactured goods, and yet make some sort of profit. Iron padlock makers are offered strip iron at £5. Six months ago the price was about £5 15s. Strip for best rim and mortice lock-making is quoted £6 15s. to £8 15s., according to quality. There is a fair demand for some qualities of pig iron, chieffy in foundry pigs. Quotations are fairly regular, and do not show much further weakening tendency. Official prices—generally sub-ject to a rebate for large parcels—range from about £3 to £2 17s. 6d. for all-mines; part-mine, £2 5s. to £2; common iron, £1 17s. 6d. to £1 13s. 6d. per ton. Hematites are 52s. 6d. to 54s., delivered. Derbyshire pigs are 38s. to 40s., delivered. Some Derbyshire representatives on 'Change this week firmly declined to accept 39s. at stations. Makers declare that £2 17s. 6d. for all-mines is rela-tively 7s. 6d. per ton cheaper than marked bars upon the existing basis. The unsatisfactory condition of South American finance continues basis.

The unsatisfactory condition of South American finance continues to operate against business with certain markets out there. Never-

to operate against business with certain markets out there. Never-theless, from the Argentine Republic and two or three other centres valuable orders are coming forward for miscellaneous machinery, tools, implements, and other hardwares. A large out-turn of certain classes of hardwares continues in this district on Australian account, and some young merchant firms, who boast that they are "doing business on altogether new lines," are receiving excellent order-sheets. Certain manufacturers in the edge tool wrought iron tube.

are receiving excellent order-sheets. Certain manufacturers in the edge tool, wrought iron tube, shipping tackle, stamped hollow-wares, and one or two other branches, are in receipt of such good lines that they would have been glad if there had been no holidays this week, and these firms speak of business as having an improved outlook. Steps are being taken by the committee of the Operative Nail-makers' Association to arrange, if possible, for a meeting in Bir-mingham of the whole of the employers in Staffordshire and East Worcestershire, with the view of inducing them to adhere to the 1879 list prices. The operatives state that since 1875 working prices have been reduced 40 or 45 per cent., and that what is wanted is unity of action between the masters of Bromsgrove and "the up-country districts."

prices have been reduced 40 or 45 per cent., and that what is wanted is unity of action between the masters of Bromsgrove and "the up-country districts." It is noteworthy that notices are now being served by Mr. W. B. Scott, the Government Inspector of Mines for South Stafford-shire, on owners of disused pit shafts, calling upon them to cover them with brick domes or iron plates in accordance with section 41 of the Coal Mines Regulation Act of 1872. Non-compliance with the notice may render a person liable to a penalty of £20 for each shaft left unprotected. This action is a rather new departure in South Staffordshire mining experience. The action at Stafford Assizes, to which reference was made last week, in which the Hanley Colliery Company were sued by Mr. T. B. Shufflebotham for £1000 damages to house property, conse-quent upon defendents' mining operations, has resulted in a verdict for the plaintiff with damages £225. At the half-yearly meeting of the Union Rolling Stock Company, Birmingham, the chairman announced that they had not been entering into new contracts in consequence of the quietude in trade, but that, probably in the course of the next six months, they would again be extending their operations, and taking up more business. In the meantime it would be seen that they had been progressing at a very rapid rate, comparing their position now with what it had been two or three years ago. In common with other people, they had suffered from the continued depression of railway business in America; but they might congratulate themselves that they had escaped from that period with losses which, although not ascer-tained at the present time, were likely to be extremely small in comparison with the large amount of business that had been done. Renewed serious complaints were made at a monthly meeting

Renewed serious complaints were made at a monthly meeting of the South Staffordshire Mines Drainage Commissioners, held in Wolverhampton on Wednesday, concerning the heavy expenditure which is being entailed upon the Commission through the unsound condition of the bottom of the Birmingham Canal. The Commissioners urge that the bulk of the surface water that finds its way into the mines, and that they have to pump up again, comes from leaks in the bed of the canal. Tests, which have already been made at various points, sufficiently prove this, and the Commis-sioners now complain that the Canal Company are placing every possible obstacle in the way to prevent further tests, since they fear the heavy expense which they would have to incur in repair-ing the bettom if the leak wave discovered. The Company Company ing the bottom if the leaks were discovered. The Canal Company further refuses to contribute in any way towards the Com-missioners' expenses. One of the Commissioners gave notice that unless by the October meeting a more satisfactory state of things had been arrived at, he should move that the compulsory powers of the Commissioners be put in force against the Canal Company,

NOTES FROM LANCASHIRE. (From our own Correspondent.)

Manchester.—There is no new feature to notice in the iron trade of this district. An absence of demand is still the prevailing characteristic of the market, and although prices nominally are unchanged, this is an indication not of any firmness in the market, but rather that makers have got down to a point beyond which further concessions are practically impossible, and the question is simply how soon the limit of producing iron at a loss will be reached. There was a very flat market at Manchester on Tuesday, with a

reached. There was a very flat market at Manchester on Tuesday, with a

There concessions are practically impossible, and the question is simply how soon the limit of producing iron at a loss will be reached.
There was a very flat market at Manchester on Tuesday, with a poor attendance, many representatives of the engineering branches of the densine Engineers. For pig iron the inquiry continues extremely small, and for the most part where transactions are reported, they are limited to small retail parcels. For both local and district brands the top price obtainable in the open market is about 38s. 6d., less 24 per cent., and there are one or two sellers at la, per ton below this figure. Outside brands are very low in price, Glasgow warrants having again receded to old figures, whilst Northcomtry iron is offered here at prices lower than ever. For some of the best Middlesbrough iron 41s. 4d. net cash, delivered equal to Manchester, is quoted, but there are g.m.b.'s offering in the market at under 40s, per ton delivered here.
The hematite trade continues in a very depressed condition, with extremely low prices ruling for anything like quantities, and the average quoted figures for delivery into the Manchester district are about 51s. to 51s. 6d., less 24, for good foundry qualities.
The numfactured iron trade remains in much the same condition as last reported. One or two of the large makers are still kept fairly bursy, but it is only with great difficulty that orders are yory discouraging. In most cases forges are but very indifferently supplied with orders, and business is only possible at unremunerative rates, averaging 25 5s. for Lancashire and North Stafford sheet allivered into the Manchester district, whilst North-country plates are obtainable at very little above the price of any of the Stafford sheet delivered into the Manchester and Slord districts trade continues and engine makers? Society shows a slight decline in the returns as to employment, which now give about 4 per cent. of the estam Engine Makers' Society shows a slight decline in

every department of the Association from its establishment in 1872 down to the present time, and by acclamation Mr. Robinson was elected a life vice-president of the Association. The chief event of the week in this district has, of course, been the successful passing of the Ship Canal Bill through the House of Commons Committee. Although the scheme has left the hands of the Committee burdened with one or two conditions and altered slightly in some of the details of construction, from what I can gather the promoters seem to be well satisfied with the result of their efforts. As soon as matters get into more settled shape I shall be able to obtain the details of the scheme as it is affected by the amendments of Committee, and the programme which the the amendments of Committee, and the programme which the promoters set before themselves for carrying the Bill into practical effect.

The most recent development of electricity as a motive power for tram-car propulsion has resulted in what is at present a failure on its first practical application to actual traffic requirements. This system is the invention of Mr. Holroyd Smith, of Manchester, and some time back I gave a description of an experimental car and line, with which the first trials of the system were made at Manline, with which the first trials of the system were made at Man-chester. It will, however, perhaps be as well to recapitulate the main features of the invention. The chief feature is that the car is not burdened with accumulators, but picks up its electricity for driving as it performs its journey, the electricity being generated in a fixed station at some convenient point on the line. For this purpose the track is constructed with a central underground chandel, having a narrow slit in its surface, for communication heterean the electric motors in the car and the electric conductors purpose the track is constructed with a central underground chandel, having a narrow slit in its surface, for communication between the electric motors in the car and the electric conductors within the channel. Two conductors are provided which convey the positive electricity, and the return is made by means of the rails, which are electrically connected one with the other. Communica-tion with motors on the cars is effected by means of a collector which runs upon the conductor within the channel, and is connected by insulated copper bands with an electrical terminal underneath the car. This system has been laid down at Blackpool for propelling cars along the promenade a distance of two miles, and last week a portion of it was gone over by the Board of Trade inspector, the cars being run along a short length of the line, but the result was not sufficiently satisfactory to secure the usual licence from the Board of Trade for the public working of the line. The failure, however, has not been due to any imperfection in the electrical means for driving, but to the manner in which the line has been laid down, which is certainly open to very considerable objection. From an inspection of the car. This, of course, is the source of the motive power, there would, however, appear to be considerable risk of this becoming so frequently choked up with dirt, stones, or other material, as to seriously interfere with the regular working of the car. This, of course, has not yethad the test of actual working; but I noticed that in many portions of this channel the narrow slit was so completely blocked up that the collector would have no chance of clearing its way through, and the car would, of necessity, be brought to a stand. As to the laying of the line, this defect is to be remedied without delay, and it is to be hoped that this, the most complete experiment yet made in electric driving, will then have an unrestricted opportu-nity for a full and complete test of its merits. The demand for all descriptions of fuel continues de

where collieries are working more than three to four days a week heavy stocks are accumulating. It is only in very exceptional cases that there has been any announced reduction on the quoted rates of lastmonth; but the actual selling prices are very irregular, sellers, where anything like quantities are concerned, being content sellers, where anything like quantities are concerned, being content to take what prices they can get; and list quotations are little more than nominal. At the pit mouth best coal averages 8s. to 8s. 6d., seconds, 6s. 6d. to 7s.; common round coals, 5s. to 5s. 6d.; burgy, 4s. 3d. to 4s. 9d.; best slack, 3s. 6d. to 4s.; and ordinary qualities, 2s. 6d. to 3s. per ton. In the shipping trade there has been rather less, doing, and steam coal delivered at the high level, Liverpool, or the Garston Docks, is to be got at 6s. 9d.; but the average prices for good quali ties remain at 7s. to 7s. 3d. per ton. Barrow. — The business doing in hematite pig iron is even more restricted than ever, and there are indications that there will be a necessity to further restrict the output; indeed, at

some of the works notices have been given to workmen pending the early blowing out of furnaces. The output must of necessity be reduced to prevent the further accumulation of stocks, which already are very large. From all quarters there is a very quiet demand. Prices are easier, although not quotably lower, mixed parcels of Bessemer iron being quoted at 42s. 6d. per ton net at works. Steel makers are doing very little new business, and the orders in hand are comparatively few. The mills are working short time, notbeing employed more than one-third of the ordinary working hours. Shipbuilders have not secured any new contracts, and very few inquiries are being received from either home or foreign owners. So many steamers and ships are laying up for want of eargoes that the non-necessity for building new ones is apparent. Fron ore dull, with a very quiet demand, at prices varying from 8s. 6d. to 10s. per ton. Shipping is very indifferently employed. The tower of the new municipal buildings, which had almost posed, defective foundations. The tower is of heavy solid masonry, and has cracked and given way in several places. The Corporation of the town have ordered the contractors to pull down the upper portion of the tower, and the architect—Mr. Lynn, of Belfast-will shortly report as to the best means of meeting the diffi-culty. The steam trams in Barrow, which commenced to run a few weeks ago, are being well patronised by the public, and in a few months the extension of the tram system to Old Barrow, over the high-level bridge spanning the railway and docks, will be commenced.

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THE SHEFFIELD DISTRICT. (From our own Correspondent.)

(From our own Correspondent.) JULY has been described by various manufacturers with whom I have talked as "the dullest month of the year," and there is a singular unanimity of feeling as to the continued attenuation of busi-ness. This feeling finds significant expression in the Stock Exchange quotations for nearly all local shares connected with coal and iron. Holders seem disposed to sell out, and as there are very few who are inclined at this moment to invest, the result is that values fall, though there is no intrinsic difference in the worth of the companies themselves. One leading company, the chief speciality of Sheffield, had its shares sold by auction at 3 premium not quite three months ago. Last week they were sold at 4½ discount, and yet there is no change in the condition of the establishment to warrant movement in any direction. Though a few of the heavy trades keep very well employed, chiefly on Government and foreign contracts, it is impossible to say truthfully that the lighter departments are favourably situated

say truthfully that the lighter departments are favourably situated in this respect. Several cutlery and silver-plating firms are not working full time, and others, though they have reduced their staff, do not begin the week till Tuesday. A large amount of suffering is undoubtedly being most patiently borne by the working

working full time, and other, though they have feduced ther staff, do not begin the week till Tuesday. A large amount of suffering is undoubtedly being most patiently borne by the working classes in many departments. The third ivory sale of the year at London brought about an improvement in price. This is accounted for in some measure by the smallness of the supply, about 70 tons, chiefly composed of African ivory, which was not considered quite so good as usual. Small teeth averaged from £1 to £2 advance; medium-sized teeth fetched £3 advance; and large, fine teeth £3 to £5 advance. Egyptian ivory also made from £1 to £2 more money. The result of the lessened quantity in the market caused almost a complete clearance, very little being withdrawn. When the Midland Railway Company commenced its policy of buying up the colliery companies' trucks, it was anticipated that the monopoly would unfavourably affect the existing wagon companies. This anticipation has not as yet proved accurate, although the Midland has now pushed its policy far enough, and vigorously enough, to admit of its influence being strongly felt. I have already reported the trading of several wagon companies for the year, all of which have maintained their dividends, whilst other companies have been obliged to make a diminished return to their shareholders. The Yorkshire Railway Wagon Com-pany held its meeting on the 6th instant, when it was reported that the company now owned 5585 wagons and eight locomotives. The balance of profit and loss amounts to £2572 5s. 6d., and out of that sum the directors were able to recommend a dividend equal to five per cent. free of income-tax. The British Wagon Company, which has its works at Rotherham, has done even better. Owning 9436 wagons, the company has been able to make a profit of £2340 6s. 7d., which admits of a dividend of 6 per cent. per annum, free of income-tax, and the carrying forward of £500 to next half-year. The North Central Wagon Company, Rotherham, have also made a profit sufficient to pay 6

There was a slight increase, as compared with the preceding week, reported in the South Yorkshire manufactured iron trade for the six days preceding the holiday; but there is no improvement what-ever as regards prices, the tendency being still downwards. Derby-shire forge pigs are at 34s. to 38s. at works, and Lincolnshire from 33s. to 36s. Manufactured iron is now'quoted :--Angles, ordinary, 46 to 26 15s.; best, £7 to £7 5s. Bars, ordinary, £5 2s. 6d. to 25 15s.; best, £5 12s. 6d. to £6 5s.; best best, £6 12s. 6d. to £7 5s.; best best best, £8 2s. 6d. to £6 15s.; host best, £7 5s. Bridge and girder plates, from £6 10s. to £7 10s.; boiler plates, from £7 to 27 10s.; best best, £8 to £8 10s.; and best best best, £7 5s. Bridge and girder plates, from £6 10s. to £7 10s.; boiler plates, from £7 to 27 10s.; best best, £8 to £8 10s.; and best best best, £9 10s. to £10. There is no change in the coal trade. House fuel for London and the South is in very moderate demand; the Eastern Counties and inland markets are also very dull. Steam coal is rather better at several of the pits, the tonnage by rail and water to Hull being very fair, and there is also a considerable quantity going to Grimsby. Gas-coal contracts placed at the South Yorkshire pits are stated to show a decline as compared with last year. This is probably owing to the fact that a number have been divided with Derby-shire, which at one time came solely into the Bannsley district. Railway contracts are keeping several district pits fairly well employed, and there is some demand for hard coal for smelting purposes. The coke trade holds very well, the output, which is pretty heavy, finds a market in North Lincolnshire, Derbyshire, and Northamptonshire. The annual meeting of the Cutlers' Company was held this week, when Mr. Charles Belk, of the firm of Messrs. Roberts and Belk, silver-plate and cutlery manufacturers, was elected the Master-Cutler for the ensuing year. The Cutlers' Feast will be held on Thursday, the 3rd of September, with Lord Randolph Chur There was a slight increase, as compared with the preceding week, reported in the South Yorkshire manufactured iron trade for the

Bingham, of Messrs. Walker and Hall, who are in the same line of business.

THE NORTH OF ENGLAND. (From our own Correspondent.)

THE business transacted day by day in Cleveland pig iron is still far from satisfactory as regards quantity, but the tone of the market has nevertheless improved somewhat during the last few days. Prices are certainly much steadier than they have been for a long time. No. 3 g.m.b. for prompt delivery cannot be obtained for less than 32s. per ton, and there are some merchants who demand even more than that figure. Makers quote 32s. to 32s. 6d., and the higher rate must be paid for the best brands. Consumers are, however, by no means eager, and do not order in quantity. They seem to think sellers will have to lower their quotations before long on account of the gradually accumulating stocks. The continued long on account of the gradually accumulating stocks. The continued alackness of the finished iron trade keeps the price of forge iron low. The usual quotation is 31s. 3d. per ton, but sales have been made at 1/2d. to 3d. per ton less. The price of warrants is nominally 32s. 9d. to 33s., and holders

are daily adding to their stocks. The pig iron in Messrs. Connal's store at Middlesbrough increased by 7550 tons during last month. Competition for orders for finished iron is very keen, and unfortunately those obtained are few in number and insignificant in value. Prices remain as quoted last week. The pig iron shipped from the Tees during the month of July amounted to 67,704 tons as against 77,069 tons shipped in June. Of manufactured iron and steel 23,473 tons were exported in July, against 38,859 tons in June. The principal items in July shipments are asfollows:—To Scotland, 24,835 tons; to Germany,9750 tons; to Holland, 6615 tons; to Wales, 5975 tons; and to Belgium, 2855 tons.

The directors of Messrs. John Abbot and Co., of Gateshead-on-Tyne, recommend a dividend of 6 per cent. for the financial year ending June 30th. This is at the same rate as has been paid for

A report issued to their shareholders by the directors of the Consett Iron Company states that the profit made during the last financial year was 260,122, out of which a final dividend of 10s, per share will be paid forthwith, and the special expenditure incurred by building new offices and altering their plate mills will be cleared off. be cleared off. In view of the present extremely depressed condition of the

incurred by building new offices and altering their plate mills will be cleared off. In view of the present extremely depressed condition of the Northern iron trade, it is not to be wondered at that the proportion of the cost of production payable to royalty owners should again be attracting attention. According to Sir Lowthian Bell, who has investigated the matter very closely, the accumulated coal and ore royalties on a ton of pig iron amount to 3s. 3d. per ton of pig iron, or 10 per cent, of the present market value thereof. It is precisely the same in amount as it was when pig iron was sold at 26 per ton. Indeed, considering that the purchasing power of a sovereign, estimated in necessaries of life, has largely increased of late, the above constant sum for royalties really represents much more value than it did. All concerned in the production or consumption of iron—in other words, the entire population of the country— may now very properly cry out against this oppressive tax. So many operatives being out of employment, and so large a propor-tion of employers being in a position scarcely more enviable, it does not seem right that royalty owners, who do nothing whatever for their money, should still be receiving value equal to, and undeed greater, than that which they did in the best of times. Landowners under the pressure of unoccupied farms, or in the fear of such contingencies, have everywhere modified rents in a downward direction to meet the necessities of the times. But royalty owners have as yet done absolutely nothing. It has been suggested that a sliding scale might be adopted, making royalties vary according to the realised prices of pig iron, as is now so usually done, to settle wages rates. It is to be hoped that the Cleveland ironmasters will not let the matter rest until at all events some relief is afforded to the trade from this incubus. A meeting of royalty owners might be called, and the case clearly and forcibly laid before them. If they would agree to what is reasonable the thing would b

NOTES FROM SCOTLAND. (From our own Correspondent.)

(From our own Correspondent.) THE Glasgow iron market has been quieter this week in con-sequence of the demand for warrants experienced for several weeks previously having become much less pressing. For makers' iron also the inquiry has slackened, and the small shipments are not very encouraging. In the past week they aggregated 7598 tons, against 9571 tons in the preceding week, and 9544 tons in the corre-sponding week of 1884. The stocks in Messrs. Connal and Co.'s stores have increased by 2000 tons in the course of the week. One furnace has been put in blast at Gartsherrie and one at Glen-garnock, and there are now ninety-two in operation, as compared with ninety-five twelve months ago. Business was done in the iron warrant market on Friday last at 41s. 2½d. The market was closed on Monday, as it was a bank holiday. On Tuesday the market re-opened at 41s. 2d. and advanced to 41s. 2½d.; but at these figures scarcely any business was recorded. Business was done on Wednesday at 41s. 3d. to 41s. 4d. cash. To-day—Thursday—warrants were very scarce, and prices advanced to 41s. 6d. cash. The current values of makers' iron are as follow :—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 46s. 6d.; No. 3, 44s.; Coltness, 49s. and 46s.; Langloan, 47s. 6d. and 39s. 6d.; Quarter, 41s. and 38s. 6d.; Govan, at Broomielaw, 41s. 6d. and 39s. 6d.; Shotts, at Leith, 48s. and 47s. 6d.; Carron, at Grangemouth, 51s. and 47s.; Kinneil, at Bo'ness, 44s. and 43s.; Glegarnock, at Adrossan, 46s. and 44s.; Eglinton, 41s. 3d. and 38s. 6d.; Dalmellington, 43s. and 40s. The past week's shipments of iron and steel manufactures from THE Glasgow iron market has been quieter this week in con-

and 40s.

The past week's shipments of iron and steel manufactures from The past week's shipments of iron and steel manufactures from Glasgow embraced six locomotives and tenders for Sydney, valued at £13,500, and four for Calcutta, worth £10,800; a stern wheel steamer, shipped to Alexandria, £7500; and a small dredger and plant for Melbourne, £2350; machinery, £5700 to different places; sewing machines, £2603; steel goods, £2528; and iron manufac-tures £33,000 tures, £33,000.

worth of gold quartz was saved as specimens or made into jewellery and ornaments. NEWSPAPER STATISTICS.—A correspondent of *Le Figaro* has compiled some interesting statistics as to the total number of newspapers and other periodicals published in every part of the world, and he brings the total number up to 35,000, thus giving one to every 28,000 inhabitants. Europe, according to his calculations, has 20,000 newspapers, Germany coming first with 5500, of which 800 are published daily, the oldest being the *Post Zeitung*, pub-lished at Frankfort in 1616, while the one with the largest circula-tion is the *Berliner Tageblatt*, which prints 55,000 copies. Great Britain comes next, with 4000 newspapers, of which 800 are pub-lished daily, while France has 4092, of which 360 only are daily. Italy comes fourth, with 1400 newspapers, of which 200 are pub-lished at Rome, 140 at Milan, 120 at Naples, 94 at Turin, and 79 at Florence, the oldest being the *Gazetta di Genova*, first published in 1797. Twelve hundred newspapers are published in Austro-Hungary, of which 150 are daily, the most remarkable of the Austrian journals being one called *Acta Comparationis Literarum Universarum*, which is a review of comparative literature, with contributors in every part of the world, each of whose articles is printed in its native tongue. Spain has about 850 journals, of which a third are political, and Russia has only 800, of which 200 are printed at St. Petersburg and 75 at Moscow. Several of these journals are published in three different languages, and there are also four published in french, three in German, two in Latin, and Neilson and Co., Hydepark Locomotive Works. Messrs. Alessrs, Neuson and Co., Hydepark Locomotive works, Glasgow, have secured an extensive order to build fifty locomotive engines for the East Indian Railway Company. Locomotive engi-neering has been well employed in Glasgow for a long time, and this important contract will help greatly to keep the industry fully

this important contract with here because the engaged. The coal trade has been moderately active in the course of the week. Inland orders for household consumption are necessarily small, but the shipments at some of the ports are heavy. At Glasgow 25,161 tons were dispatched; Greenock, 2751; Grange-mouth, 13,905; Ayr, 8609; Irvine, 3805; Troon, 7911; and Bo'ness about 8000 tons. The coals shipped at Burntisland in July amounted to 68,967 tons, as compared with 71,819 in the corresponding month of 1884.

amounted to 63,967 tons, as compared with 71,819 in the corre-sponding month of 1884. The question of the miners' wages has again been considered at a mass meeting of the men held in the Hamilton district of Lanark-shire. The chief speaker, Mr. M*Neill, contended that the time had now come for getting back the 6d. unwarrantably taken from the men. He was credibly informed that large contracts had been received from the Baltic and other foreign ports, and the cause of this was that the colliers were civilize their employers the coals for received from the Baltic and other foreign ports, and the cause of this was that the colliers were giving their employers the coals for 7½d. a ton. They were sending the coals to foreign lands almost for nothing, and he urged that they must say to their employers, "'You must cease this mad competition; at least, you must cease carrying it out at the expense of the miner." It was resolved to hold another meeting a week hence, and in the meantime to solicit an increase of wages.

an increase of wages. The second general meeting of the Cloncurry Copper Company has just been held in Glasgow, and the chairman, the Hon. G. R. Vernon, said that the great distance of Cloncurry from the sea-port, the difficulty of transport, and of getting the machinery there, were not easy to overcome; but he had much pleasure in informing the shareholders that everything was now working pleasantly and well. The price of copper when they invested in this property was £70 a ton, while it had now gone down to £43 and £44. But from the calculations which had been made it was thought that even at present prices they would be in a position to sell copper in this country with a fair margin for dividends. The new shipping launched on the Clyde in the past month aggregated only 10,210 tons, against 15,917 in July, 1884, and 28,915 in July, 1883. During the seven months the total amount put in the water has been 108,635 tons, as compared with 164,742

in July, 1884, and 224,817 in the same month of 1883. There is about 40,000 tons less shipping on the stocks than twelve months ago

Messrs. Barclay, Curle, and Co., of Glasgow, have despatched by rail to Plymouth the fifth couple of the twelve mahogany tenders they have been constructing for Government vessels, and

The past week's Clyde launches included her Majesty's s.s. Scout, a steel cruiser built by Messrs. J. and G. Thomson, of Clydebank, 220ft. long, 34ft. beam, 19ft. depth of hold, and 1430 tons dis-placement. She is to steam 16½ knots.

WALES AND ADJOINING COUNTIES. (From our own Correspondent.)

(From our own Correspondent.) THERE is little of note to record in present iron and steel industry. About 5000 tons, principally rails, were shipped from Cardiff and Newport during the week. The most noticeable eargees were 2500 tons to Madras, 900 tons to Valparaiso, and 300 tons to Rouen. But I am happy to be the bearer of good tidings, which may tell in a most favourable way on some of the Welsh works. A correspondent of mine in the Cape says that a friend of his in Sydney, prominently engaged in railway work, says that over eleven millions have been granted for new railways. This is giving a great impetus in the colony, and will soon be felt here. A better time for placing orders could with stocks of pig—Cytarthfa, for example, could take an immense order at a low figure, and work off with despatch; and though there are fears current of our stocks of foreign ores failing, this only applies to a few of the works. Dowlais, Tredegar, Ebbw Vale, and Blaenavon are well supplied. Last week nearly 30,000 tons came to hand at Newport and Cardiff from Bilbao, and the fear of cholera coming to that port and interfering with our com-mercial arrangements is evidently telling with effect. The cholera has already affected our Barcelona and Carthagena shipments, and hence the increase from Bilbao. I should strongly advise the Welsh ironmasters to press for quick delivery, and lay in abundant stock. stock

stock.
The report of the Taff Vale Railway is to hand, and I note that a dividend of 10 per cent, and 5 per cent. bonus, is recommended. The capital expenditure of the last half-year has amounted to £143,758 15s. 11d. In all respects the report is most favourable, and reflects highly on the ability with which the line is managed. The Rhymney Railway dividend is, I hear, to be 10 per cent. The increase in iron ore traffic should tell well. The joint line of the Rhymney and Great Western into Merthyr is now complete, and will shortly be opened for passenger traffic. The Taff is working a short line from their Merthyr terminus to Cyfarthfa Works. While on the subject of railways, I may add that Sir Daniel Gooch is making preparations for a special train to run through the Severn Tunnel early in September.
Now that we are entering upon the colliery accident season, too much caution cannot be exercised, especially with so many reckless men amongst the collier fraternity. Last week I chronicled two cases, which were duly punished. This week two more colliers were punished for gross thoughtlessness in one of the Plymouth Mortgagees pits. They were detected in South Duffryn with an open lamp, one having opened it in order to give the other a light. The coal trade remains in much about the same quiet condition as it has been for the last few weeks. Some part of this is due to the cessation of iron ore traffic from Barcelona and Carthagena. Vessels on this line used to take out return cargoes to a considerable extent. But apart from this the coal trade is dull both at Newport and Cardiff. It is not so bad at Swansea. There the clearances have been well maintained, and if more tonnage came in it could be well utilised.
Patent fuel is in better demand at Cardiff and Swansea, and small steam is ingood request. The report of the Taff Vale Railway is to hand, and I note that

Patent fuel is in better demand at Cardiff and Swansea, and small steam is in good request. The opinion of tin-plate workers respecting the stop-week favourable to a persistence in this method of improving the trade. Prices are firm at last quotations. Buyers, it is true, did not rush in quite so eagerly as they were expected to do by makers, and it is very likely that they will finesse a little by holding back. In the end, if makers keep firm and united, there is little doubt but that the large buyers will have to give in, as stocks are by means large. Present prices are: I. C. coke, 14s. 3d. to 14s. 6d.; steel sheets, 14s. 9d. to 15s. Special sheets are in good demand. The men at Rhiwderin are still idle.

PRECIOUS STONES IN THE UNITED STATES .- The estimated value of American precious stones sold as specimens and souvenirs in 1884 was 54,325 dols., and the value of the stones sold to be cut into gems was 28,650 dols.; total, 82,975 dols. About 140,000 dols. worth of gold quartz was saved as specimens or made into jewellery

are printed at St. Fetersourg and 75 at Moscow. Several of these journals are published in three different languages, and there are also four published in French, three in German, two in Latin, and two in Hebrew, besides several in Polish, Finnish, Tartar, and Georgian. Greece has upwards of 600 newspapers, of which 54 appear at Athens, while Switzerland has 450, and Holland and Belgium about 300 each. There are 3000 journals published in Asia, of which no fewer than 2000 appear in Japan; but in China the only newspapers not published by residents at the Treaty Ports

Belgium about 300 each. There are 3000 journals published in Asia, of which no fewer than 2000 appear in Japan; but in China the only newspapers not published by residents at the Treaty Ports are the Ning-Pao, an official journal published at Pekin, the Chen-Pao and the Hu-Pao, published at Shanghai, and the Government journal which was brought out in Corea last year. There are three newspapers published in French Cochin China and one in Tonquin— VAvenir du Tonkin—the rest of the newspapers credited to Asiaappearing in India, with the exception of six, which are publishedin Persia. Africa can boast of only 200 papers, of which 30 appearin Egypt, and the remainder in the colonies of England, France,&c. The United States possess about 12,500 periodicals, of which1000 are published in 1794. Among the United States journalsthere are no fewer than 120 edited and published by negroes, theoldest of these being the Elevator, which was brought out at SanFrancisco about eighteen years ago. Canada has 700 newspapers,a considerable proportion of which are published in French; andin South America the Argentine Republic comes first, with 60newspapers. Australia has 700 journals, nearly all published inEnglish, and the Sandwich Islands 8, of which 5 are in English and3 in the native tongue. Out of the 35,000 periodicals enumeratedabove, 16,500 are in English, 7800 in German, 6850 in French1600 in Spanish, and 1450 in Italian.

and ornaments.

AUG. 7, 1885.

NEW COMPANIES.

THE following companies have just been registered :-

Appalachian Company, Limited. This company was registered on the 24th ult. with a capital of £300,000, in £1 shares, to carry on mining and smelting operations, and to acquire lands and property for cultivation, agricultural, building, and improvement purposes. scribers are:--The sub-

Charles Bosdel, White House, Telegraph-street,

journalist Herbert Mott, 214, Cornwall-road, Notting-hill, C. E. Stiffe, 154, Alexandra-road, South Hamp-stead, clerk W

The number of directors is not to be less than three, nor more than seven; the subscribers are to appoint the first, and are to act *ad interim*; remuneration, 5 per cent. of the net profits, but not to exceed £500 per annum to each director.

Benham and Froud, Limited.

This is the conversion to a company of the business of general metal workers, lately carried on by the late Augustus Benham and Joseph Wm. Froud, at 40, 41, and 42, Chandos-street, Charingcross, and at the factory in Taylor's-buildings in the rear thereof, and at 98 and 99, St. Martin's-lane. It was registered on the 29th ult. with a capital of £50,000, in £10 shares, with the follow-ion as fact a sharehous. ing as first subscribers :-

*H. A. Barnard, 1, Cheapside, Birmingham, metal merchant.
*H. A. Benham, 40, Chandos-street, general metal "G. M. Fraser, 40, Chandos-street, commercial *J. W. Froud, 40, Chandos-street, general metal worker *R. W. Laws, 40, Chandos-street, metal designer *J. E. Tresidder, 6, Paragon, New Kent-road, secretary to a company *W. H. Tomson, Wylde-green, near Birmingham.

⁸W. H. Tomson, Wylde-green, near Birmingham. ¹ The number of directors is not to be less than three, nor more than nine; qualification, 50 shares; the subscribers are the first. The remu-neration of ordinary directors will be 50 guineas per annum, and the travelling expenses of such as live more than twenty miles from London will be paid. Messrs. H. A. Benham, J. W. Froud, and W. H. Tomson are appointed managing directors at such remuneration as the board may determine. determine.

Bernstein Electric Lamp Company, Limited. Bernstein Electric Lamp Company, Limited. This company proposes to purchase and work the letters patent No. 2604 A.D. 1882, No. 6075 A.D. 1882, and No. 3915 A.D. 1883, relating to improvements in incandescent lamps, the inven-tions of Mr. Alex. Bernstein. The company was registered on the 29th ult. with a capital of £100,000, in £10 shares. The purchase considera-tion is £11,000 in fully paid shares. The company will also pay Mr. Bernstein a royalty of 2½d. for every lamp constructed by the company under the said patents. The subscribers are :--Shares.

Shares. *Alex. Bernstein, 9A, Commercial-road, Pimli

electrician Julius Maier, Ph.D., 23, Melrose-gardens, West Kensington. *Ludwig J. Mond, 20, Avenue-road, N.W., manu-facturing chemist *J. T. Brunner, Northwich, alkali manufacturer. Walter E. Wynne, 40, Chancery-lane, solicitor W. W. Wynne, 40, Chancery-lane, solicitor G. A. Holme, 40, Chancery-lane, solicitor

The number of directors is not to be less than The number of directors is hot to be less than two, nor more than five; the first are the sub-soribers denoted by an asterisk; qualification for other directors, 20 shares; the company in general meeting will determine remuneration.

Britannia Iron and Steel Rolling Mills, Limited. This company was registered on the 23rd ult. with a capital of £20,000, in £5 shares, to carry on business as steel converters, iron and steel manufacturers, miners, smelters, engineers, brick-makers, and manufacturers of railway rolling stock and railway and other plant, fittings, and machinery. The subscribers are :--

Shares David Owen, Merthyr Tydvil, dealer in iron and

- steel J. B. Beer, Lindsey-grove, Bermondsey, clerk Col. H. E. Glass, Bentley Lodge, Upper Norwood G. E. Alder, 122, Liverpool-road, clerk R. Crawley, South unpton-street. Reading A. Marsden, 167, Kennington-road, secretary J. Hamilton, 26, Palace-street, Buckingham-gate

- Registered without special articles.

Chester and Wirral Coal and Cannel Company, Limited.

This company proposes to acquire and work mineral properties, situate in Bagilt, and par-ticularly the Chester and Wirral Coal and Cannel Company's mines, situate in the parish of Holy-well, Flint. It was registered on the 29th ult. with a capital of £50,000 in £5 shares, with the following as first subscribers :-following as first subscribers :---

John Coups, Hyde, Chester, colliery proprietor. *R. G. Curr, Manchester, chemical manufacturer *J. Gresty, Weaste, Manchester, metal merchant T. Evans, Bagilt, Flint, colliery manager *J. Frankish, Manchester, engineer G. E. Wilkins, Manchester, secretary R. Boardman, jun., Hyde, wine merchant 20

2 The number of directors is not to be less than three, nor more than seven; qualification, 20 shares; the first are the subscribers denoted by Directors' remuneration, an asterisk. £3 3s. for an asterisk. Directors remuneration, £3 3s, for each attendance at any meeting of the board; they may also divide £100 for each 1 per cent, dividend above 10 per cent, per annum. Mr. John Coups is appointed general manager.

Davies Brothers and Company, Limited.

This is the conversion to a company of the business of Messrs. Davies Bros. and Co., of the Crown Works, Wolverhampton, galvanised iron

manufacturers. It was registered on the 29th ult. with a capital of £100,000, in £100 shares. The subscribers are :-

c. Wood, Harrington-street, Liverpool, provision

The number of directors is not to be less than

three, nor more than five; qualification, three shares; the first are the subscribers denoted by an asterisk; the company in general meeting will determine remuneration.

Gold and Silver Ore Treating Company, Limited.

This company proposes to acquire and work inventions relating to the crushing, pulverising, smelting, reduction, and amalgamation of ores, pyrites, minerals, and mineral substances. It was registered on the 29th ult. with a capital of

£150,000, in £5 shares. An unregistered agree-ment of the 28th ult., between Augustus Kerr Phillips and Arthur Henry Koch, is adopted. The subscribers are :--

C. R. Heap, 2, Bury-street, St. James, engineer. Arthur Kingsley, 62, Coleman-street, merchant. H. A. Whitaker, 80, Bishopsgate-street, merchant Roy Prichard, 10, Moorgate-street, accountant ... W. Thompson Hill, Trouville-road, Balham, mer-chant

A. K. Phillips, 81, Sinclair-road, North Kensington ... W. J. Cordner, 20, Bucklersbury, engineer ... The number of directors is not to exceed eight;

the subscribers are to appoint the first directors and are to act ad interim; qualification, 25 shares; remuneration, £600 per annum and 10 per cent. per annum of the net profits.

Mid-Lincolnshire Iron Company, Limited.

Under an agreement of 20th may the company, will take over the business of iron ore merchants, carried on at Gretwell, Lincoln, by the co-part-nership trading as the Mid-Lincolnshire Iron Com-pany. It was registered on the 27th ult. with a capital of £49,000, in £100 shares, with the follow-income for the analogue of the state of the stat

The number of directors is not to be less than four, nor more than seven; qualification, 10 shares; the first are the subscribers denoted by an asterisk. The company at the annual meeting

The number of directors is not to be less than five, nor more than twelve; qualification, shares or stock of the nominal value of £20; the first are the subscribers and Messrs. R. M. English, T. Fawcett, Wm. Smith, A. Simpson, and D. H. Foster.

Sharp and Co., Limited.

This company proposes to trade as sanitary,

ventilating, gas, water, and electrical engineers, and for such purposes will take over the business of Mr. Sampson Low, jun., trading as Sharp and Co. It was registered on the 29th ult. with a capital of £50,000, in £5 shares. The subscribers

Arthur Regd. Vibert, 38, Frederick-street, W.C.,

Arthur Regu. Vibert, 66, 2010
sanitary engineer
Sampson Low, jun., 11, Holborn-circus, sanitary engineer
E. Hughes, 7, Westminster-chambers, accountant
C. M. H. Crawshay, 35, Azenby-square, Peckham, C. M. H. Crawshay, State, Peckham, State, Peckham, C. M. H. Crawshay, State, Peckham, State, Peckham, C. M. H. Crawshay, State, Peckham, Peck

G. M. B. Otter architect
architect
E. Marston, 188, Fleet-street, publisher
W. Clement Wells, 6, Billiter-street, solicitor
G. Excell, 70, Winston-road, N., clerk
G. Excell, 70, Winston-road, N., clerk

The number of directors is not to be less than The number of directors is not to be tas that three, nor more than seven; the subscribers are to appoint the first, and are to act ad interim; qualification, 50 shares; the company in general meeting will determine remuneration.

Tregurtha Downs Mines, Limited. This company proposes to acquire and work mineral properties situate within the Stannaries of Cornwall and Devon, and elsewhere. It was registered on the 23rd ult. with a capital of £80,000,

registered on the 25rd uit, when a capital to 50000, in £1 shares. The company will adopt an un-registered agreement of the 22nd uit, between Hy. Ryan Lewis and Wm. Derry, of one part, and Wm. Slee Wellborne, for the company, of the other part. The subscribers are:—

James Milne, 3, Newman's-court, Cornhill, mer-

D. Sweeny, 45, Reaston-street, New-cross-road .. C. F. Roseby, 102, Gloucester-road, engineer Wm. Taylor, 35, Holly-road, Chiswick ... Charles Prickett, 98, Frederick-street, Barnsbury, clerk

G. W. F. Robinson, 18, Sutherland-square, Wal-

 W. F. Rohnson, 18, Sutherland-square, wal-worth, clerk
 H. R. Bate, 91, Sussex-road, Holloway, short-hand writer. The number of directors is not to be less than

The number of directors is not to be tess than three, nor more than five; the first will be appointed at the first general meeting, the sub-scribers acting *ad interim*; qualification for sub-sequent directors, 300 fully paid shares. The board will be entitled to £500 per annum for remuneration

T. Grant, Pocklington, builder A. W. House, Pocklington, hotel proprietor A. Berriman, Pocklington, farmer, &c. G. Scarie, Pocklington, brewer J. W. Cook, Pocklington, hotel-keeper E. C. Moon, Pocklington, farmer, &c. G. E. Barlow, Pocklington, chemist

Jane Lovel, Malton, York, spinster *R. Goudie, Ayr, Scotland, solicitor *G. Robb, Glasgow Hy. Leck, Hollybush, Ayr, landowner *John Wood, Troon, Scotland, ironmaster *W. Macrorie, Ayr, solicitor J. Cunningham, Mayboll, Scotland, farmer Mrs. J. Anderson, Kilmarnock, Scotland

will determine remuneration.

Foster.

are :-

Shares

Shares ... 100 100

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ing as first subscribers :---

Under an agreement of 26th May this company

merchant

chant

THE PATENT JOURNAL. Condensed from the Journal of the Commissioners of Patents. Shares *M. Bayliss, West Heath-road, Hampstead.... *E. A. Davies, Wolverhampton, galvanised iron manufacturer W. M. Bayliss, Hampstead, physiologist *J. Saunders, Wolverhampton, metal broker H. S. Bamford, Bromborough, Birkenhead... A. C. Bamford, Cheapside, Liverpool, commission merchant

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

Applications for Letters Patent.

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

28th July, 1885.

28th July, 1885.
9039. HOLLOW METALLIC KNOB for DOORS, &c., J. Empson and J. Hewitt, Birmingham.
9040. PROPELLING GUIDING, &c., TORPEDOES, R. Scott, Newcastle-upon-Tyne.
9041. TRIPLE EXPANSION STEAM ENGINES, R. Edwards, Grantham.
9042. MINCING MEAT, &c., G. R. Kaye, Leicester.
9043. SCOURING WOOL, C. TOppan, London.
9044. COMBINED INSTRUMENTS for DESK PURPOSES, F. L. Stowell, London.
9045. TRICYCLES, L. F. Appleton, London.
9046. TRICYCLES, J. Lee, Southsea.
9047. OSTEOCLAST OT BORE BREAKER, I. A. and H. Best, Birmingham.

Best, Birmingham. 48. BREECH-LOADING FIRE-ARMS, T. Bailey, Bir-9048.

9048. BREECH-LOADING FIRE-ARMS, T. Bailey, Birmingham.
9049. FIGURED TERRY OF LOOPED FABRICS, W. Warrington, Manchester.
9050. COMBINED MATCH-BOXES and CIGAR-CUTTERS, W. P. Thompson. -(W. M. Ducker, United States.)
9051. ROTARY ENGINES, &C., W. Hopwood, Liverpool.
9052. STOCK CARES OF CARRIAGES for ANIMALS, G. D. Burton, London.
9053. REESERVING VEGETABLE PRODUCTS, C. H. Sharman, London.

man, London. 054. Electric Table Lamps, R. H. Courtenay, 9054. London. London. 9055. SPRING SEATS, J. Harrington, London. 9056. TRANSFERRING GRAIN, A. J. Boult.-(L. Smith.

9056. TRANSFERRING GRAIN, A. J. Boult.-(L. Smith, United States.)
9057. STEAM OF HOT WATER RADIATORS, S. D. TOMKINS and J. N. Matlock, London.
9058. APPARATUS for TREATING WHEELS with OIL, B. Young, Milwaukee, U.S.
9059. WASHING MACHINES, J. O. Hardwick, London.
9060. PRODUCING DESIGNS ON METALLIC SURFACES, A. Brin, London.
9061. SPOOLING MACHINES, J. Balderston, Glasgow.
9062. WORKING OUT RESULTS from INDICATOR DIA-ORAMS, G. F. Redfern.-(J. G. Claud-Mantle, Hol-land.)

land.) 9063. PEDALS for VELOCIPEDES, W. Bown and J. H.

9063. PEDALS for VELOCIPEDES, W. Bown and J. H. Hughes, London.
9064. REGULATORS for ELECTRIC ARC LAMPS, H. J. Haddan.-(H. Henneberg and R. O. Lorenz, Austria.)
9065. STEAM ENGINE LUBRICATORS, H. J. Haddan.-(W. H. Craig, United States.)
9066. TRICYCLES, J. W. Matteson, London.
9076. CHARES, &C., USEd on BOARD SURP, P. JENSEN.-(A. J. V. Tegner, Denmark.)
9068. CAPSULE for BOTTLES, W. W. Rogers.-(The Johannes Brunnen Company, Germany.)
9069. DRIVING GEAR for BICYCLES, H. Pipo, London.
9070. STEAM ENGINES, H. Otway, London.
9071. SUSPENDING LIAMPS, W. R. Lake.-(C. T. Root, United States.)

9071. SUSPENDING LAMPS, W. R. Lake.-(C. T. Root, United States.)
9072. LIOHTING DEVICE, W. R. Lake.-(J. B. Mitchell, United States.)
9073. BUSTLES OF DRESS IMPROVERS, W. R. Lake.-(The Weston and Wells Manufacturing Company, United States.)
9074. FASTENERS for DRIVING BELTS, W. R. Lake.-(E. C. Smith, U.S.)
9075. COMMODES, W. R. Lake.-(J. Bennor, U.S.)
9076. COLTING TEETH OF GEAR WHEELS, W. R. Lake.-(E. A. Marah, U.S.)
9077. PRODUCING PICTURES UPON CANVAS, G. BOWDON, LONDON.

London. 9078. FASTENING BUTTONS, H. H. Leigh.-(C. E. Barber,

Germany.) 9079. STEERING GEAR, R. D. Bowman, London. 9080. TIP VALVE GEAR, R. D. Bowman, London. 9081. PACKING for CYLINDRICAL SURFACES, W. Ross,

ATTACHING BUTTONS to Boots, &c., W. Wass,

London. 20083. HEATING WATER, J. P. Blackford, London. 20084. REVOLVER ACTION, H. Schlund, London. 20085. SECONDARY VOLTAIC BATTERIES, O. Imray.—(A. 9085.

W. Hemp, Germany.) 9086. SIGHT FEED LUBRICATORS, W. A. G. Schönheyder, London. 9087. PRESERVING STONE, A. W. L. Reddie. - (T. Egles-

ton, U.S.) 9088. SADDLES for VELOCIPEDES, M. Foley, London. 9059. GAS BATTERIES, F. L. Harris, London.

29th July, 1885.

29th July, 1885. 9090. SCREW and DRIVER, D. Thomas, London. 9091. Phorographic SLIDES, H. B. Hare, London. 9092. ATTACHING MATTRESSES to BEDSTRADE, J. B. Row-cliffe, Manchester. 9093. THRASHING and GRINDING MACHINE, W. Corbett, Birmingham. 9044. MUSICAL INSTRUMENT CASES, R. R. Shields, Manchester. 9055. HIGH-PRESSURE SELF-CLOSING COCK, J. Friend, Exeter.

Dovelor, Sourge-Box, G. Litherland, Barnsley. 9096. SNUFF-Box, D. McDonald, Glasgow. 9098. TURNING MALT, R. C. Sinclair and J. Hodson, London

London. London. 9099. CRADLES, D. Thompson, Glasgow. 9:00. FRICTION CLUTCHES, J. Davison, Newcastle-on-

9100. FRICTION CLUTCHES, J. DAVISON, NewCastle-On-Type.
 9101. COOLING the FOULING in GUN BARRELS, J. B. Fenby, Sutton Coldfield.
 9102. NAVAL RAMS, R. Scott, Newcastle-on-Type.
 9103. OBVIATING OF ALLAVING THIRST, A. W. Hosking, Unput and Statement of Content of Conte

Liverpool. 9104. STEERING RUDDERLESS, &c., VESSELS, R. Watson,

9104. STEERING ACCEPTING AND ADDRESS AND ADDR

J. KEELING, &C., FAPER, W. W. Colley and M. Hart, London.
 S. EPARATORS, T. Parker, London.
 S. ELECTRIC AIR PUMP, S. C. O. Currie and I. A. Timmis, London.

9109. GRINDING, &c., PANS, J. Prince and W. Johnson, Leeds. 9110. SPINNING and DOUBLING FRAMES, R. T. Gilli-

9210. WINDOW SASHES and FRAMES, W. E. Frost, London.
9211. FLUSHING WATER-CLOSETS, H. S. Gibbs, London.
9212. TELEPHONE TRANSMITTERS, E. C. Parker, London.
9213. TAKING UP the SLACK in WIRES OPERATING RAIL-WAY SIGNALS, J. Coleman and I. Henson, London.
9214. NEW AZO COLOUES, M. HOffmann and A. Wein-berg, London.
9215. DECORATING WINDOW and other GLASS, H. Doul-tor London. 9110. SPINNING and DOUBLING FRAMES, R. T. Gillibrand, London.
9111. MACHINERY for IMPARTING a SPIRAL FORM to WIRE, T. HOUSLEY, LONDON.
9112. VELVET PAPER, R. F. Dorendorff.—(M. Krause, Germany.)
9113. ADJUSTABLE NEEDLEWORK FRAMES, I. A. Middleton, London.
9114. PHOTOGRAPHIC CAMERAS, J. J. Walker, London.
9115. THERMOMETERS, A. Haddow, Edinburgh.
9116. REGENERATING APPARATUS, R. de Soldenhoff, London.

9117. DRIVING GEAR for VELOCIPEDES, R. Caswell, Lo

918. ARMOUR-PLATING, A. O. Jones, London. 919. CALENDERS and MANGLES, H. J. Haddan.-(A.

Völket, Germany.)
9120. TYPE WRITING, M. A. Wier, London.
9121. PACKING CASES, K. J. L. Best, London.
9122. BBAKES, E. F. Maitland, London.

9123. CLOCK OF WATCH DIAL, C. and E. B. L. Kent, 9123. CLOCK OF WATCH DIAL, C. and E. B. L. Kent, London.
9124. BRAKES, R. J. Crawford and A. C. Binns, London.
9126. EXPLOSIVE SUBSTANCES, P. A. Newton.-(A. Nobel, France.)
9126. EXPLOSIVE COMPOUNDS, P. A. Newton.-(A. Nobel, France.)
9127. GRAIN-BINDING MACHINES, A. J. Boult.-(W. Butterfield, U.S.)
9128. ELECTRICAL BELLS, &C., J. S. Sledge and A. Slatter, London. ELECTRICAL DELLS, CC., V. S. MARGE AND Slatter, London.
Slatter, London.
Clark.—(J. Haag, France.)
VALVE GEAR for STEAM HAMMERS, C. Davy, London 9129.

115

9130. VALVE GEAR IOT STEAM HAMMERS, C. DAVY, London.
9131. TESTING CANVAS, &c., J. F. O'Connor, London.
9132. PROPELLER and other SHARTS, W. R. Lake.-(Broten's Scanless Metal Company, U.S)
9133. MATCH-BOXES, &c., W. R. Lake.-(F. S. Svenson, Svender).

9130.

Sweden.)

30th July, 1885. 9134. COMPLETING, &c., ELECTRIC CIRCUITS, E. Wood,

9134. COMPLETING, &C., ELECTRIC CIRCUITS, E. Wood, Hatcham.
9135. ROTARY ENGINES, J. Clissold, Nailsworth.
9136. PREPARING COTION for SPINNING, G. P. Leigh, Manchester.
9137. BICYCLE, R. P. Scott, Coventry.
9138. MECHANICAL NURSE CHARKS, L. L'Hollier and J. J. Rochford, Birmingham.
9139. LEATHER GLOVES, W. N. Thring, J. Luffman, and H. W. Southcombe, Yeovil.
9140. COVERS of FANCY ROLLERS of CARDING ENGINES, R. Slack, Manchester.
9141. ACIDULATING SYRUPS, &C., J. C. Thresh and W.

9141. ACIDULATING SYRUPS, &C., J. C. Thresh and W. Bratby, Manchester. 9142. SHEARING OF CROPPING WOVEN FABRICS, D. Bailay, Haliay.

9142. SHEARING OF CROPPING WOVEN FABRICS, D. Bailey, Halifax.
9143. TELEPHONIC TRANSMITTER, E. G. Colton, London.
9144. MOTOR, C. Humblot, London.
9145. COPVING WRITTEN DOCUMENTS, &c., J. Fleming, London.
9146. REDUCING ALUMINUM from its SALTS, J. B. Thompson and W. White, London.
9147. OPENING, &c., FANLIGHTS, &c., W., C. A., and J. Ward Leeds

Ward, Leeds.

Ward, Leeds. 9148. BREARING and CRUSHING MACHINES, G. H. Stowe, Sheffield. 9149. RULER, J. R. M. Mallett, London. 9150. SMOKE DRAINAGE, &C., J. F. Coslett-Williams, London.

9150. SMOKE DRAINAGE, &C., J. F. Coslett-Williams, London.
9151. SPOON for ADMINISTERING LIQUID FOOD to INFANTS, C. E. Challis, London.
9152. BRACKETS for DROP-DOWN FLAPS of TABLES, P. C. Jones, Guildford.
9153. STEAM ENGINES, W. H. Wheatley and J. W. Mackenzie, London.
9154. CEMENT, W. Joy, London.
9155. BUTT HINGES, F. Farley, London.
9156. INDICATING the TRIM OF SHIPS, E. L. Berthon, London.

London. 9157. TRANSLUCENT ADVERTISEMENT, T. J. Dewick,

London.

Jondon.
JISS. ELECTRIC MOTOR, J. B. Denis, London.
9158. ELECTRIC MOTOR, J. B. Denis, London.
9160. LAMINATED GOODS, A. T. Fullicks, London.
9161. ECONOMISING FUEL in STEAM BOILERS, S. W. Snowdon and F. Tolkien, London.
9162. PREPARING OILS for LAMPS, A. Domeier and B. Nickels, jun., London.
9163. FNEUMATIC RAILWAY BRAKES, J. IMTRY.-(W. Lillic, France.)
9164. COMPASSES and BINNACLES, B. RUSS, London.
9165. WATER WARTE PREVENTING APPARATUS, W. H. Beck.-(C. J. Croppi, France.)
9166. FASTENER for STUDS, H. Hexter, London.
9167. VELOCIPEDES, P. M. PATSONS, London.
9168. APPARATUS for COOKING MEAT, &c., H. W. Hart, London.

London.

31st July, 1885. 9169. COATING METAL PLATES with TIN, &c., H. Hall,

London. 9170. RIPENING and PURIFYING MILK, J. McKerlie, Edinburgh.

London.
9170. RIPENING and PURIFYING MILK, J. McKerlie, Edinburgh.
9171. FLUID-TIGHT JOINTS for PIPES, W. E. Walker, W. Peile, and W. Cook, Manchester.
9172. CLEANING, &C., FRUT, E. Hardon, Manchester.
9173. FITTINOS of WATER GAUGES, &C., A. Bradshaw, Halifax.
9174. ORNAMENTING WATCH-CASES, W. Williamson, Birmingham.
9175. BOILERS, J. Millington and H. Jones, Liverpool.
9176. TAFS and Cocks, W. Foster, Birmingham.
9175. Sourses, J. Millington and H. Jones, Liverpool.
9176. TAFS and Cocks, W. Morton, Halifax.
9178. SEWING ROWS of STITCHES, W. W. Jones and W. B. Garniss, Ashbourne.
9179. PNEUMATIC MOTORS, R. C. Sayer, Newport.
9180. FIRE-LIGHTERS, J. G. Davison, Sunderland.
9181. SAFETY BICYCLE, F. Devoney, Greenock.
9182. EYELET, H. G. Smith, Birmingham.
9183. PRODUCING SLOW MOTION, R. HOWARTH, Wolverhampton.
9184. HYDRAULC CRANES, A. B. Brown, Glasgow.
9185. AIR PUMP and other VALVES, W. B. Thompson, Glasgow.
9186. MUSIC CARRIER and STAND, R. R. Shields, Manchester.
9187. SEWING MACHINES, W. F. Beardslee, Paris.
9188. MITREING PRINTER' BRASS RULE, J. D. and A. L. Cook, London.
9191. TRIPLEX COMBINATION LECGING, H. HYNGL, LONDON.
9183. MARCHINES, W. H. B. Hinde, London.
9194. ANIR-CERLING INONS, W. LURS, LONDON.
9185. MAIR CHENISO INDERS, &C., W. J. Adeley, Belfast. - 2014 March, 1885.
9185. APPLYING DRAG to BOBINS, &C., W. J. Adeley, Belfast. - 2014 March, 1885.
9185. ACRUAL VELOCIPEE, R. G. OWEN, LONDON.
9184. MULLES TOR SPINNING, W. HURS, LONDON.
9185. MORT FEED LUBRICATORS, J. DeWARDE, LONDON.
9184. MULES TOR SPINNING, WORL
9185. MORT FEED LUBRICATORS, J. DeWENDON.
9184. MULES COMBINATION LECGING, H. FRANKENBURG, LONDON.
9185. MENNER, H. COMPANE, WORL
9186. MULES TOR THERES, MARCHINES, W. J. Adeley, Belfast.

DYEING COTTON YARN, H. J. Haddan .- (E.

9197. DYEING COTTON YARN, H. J. Haddan.—(E. Haeffely, France.)
9198. PLANING MACHINES, H. J. Haddan.—(Reinhardt and Bohnert, Sazony.)
9199. ELECTRIC ABC LAMPS, H. J. Haddan.—(R. and B. H. Walther, Germany.)
9200. WELDLESS METALLIC PIPES and TUBES, S. Fox, London.

9201. FIRE-BOXES OF STEAM BOILERS, S. FOX, London. 9202. SPECTACLE FRAMES, G. L. Johnson, London. 9203. ARTIFICIAL FUEL, J. Robbins, London. 9204. FILTER PRESSES, D. K. Clark and W. J. E. Foakes,

PLOBER PRESSES, D. R. CIAR and W.J. E. FORKES, London.
P205. BOOTS, H. W. Morris, London.
P206. TRACE, &C., for FLY FISHING, W. Collis, London.
P207. ACTOMATICALLY AERATING MALT, &C., J. Chailender, London.
P208. BEETLING ENGINES, G. Horner, J. Haithwaite, and A. Dobson London.

and A. Dobson, London. 9209. Sawing Machine, C. E. Rowlands, London. 9210. Window Sashes and Frames, W. E. Frost,

9215. DECORATING WINDOW and other GLASS, H. Doulton, London, and J. Slater, Burslem.
9216. BUTTONS, C. D. Abel.—(R. Pöschel, Saxony.)
9217. BOXES or CELLS for ELECTRICAL BATTERIES, &c., W. H. Quarterman, London.
9218. STEAM ENGINES, W. H. Wheatley and J. W. Mackenzie, London.
9219. COUNTER PIVOT of WATCHES, A. Benoit, London.
9220. WATER-CLOSET APPARATUS, W. D. Scott-Moncrieff, London.

9221. RAIN WATER FLUSHING APPARATUS, W. D. Scott-

9222. BLOCKS OF SLABS for ORNAMENTAL PURPOSES, A. T. Fullicks, London.

9197

London.

London.

Moncrieff, London.

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9223. RADIATORS, L. W. Leeds, London. 9224. SACKS, A. J. Boult.-(F. A. Kolbe, jun., Saxony.) 1st August, 1885.

9225. HEATING SOLID SUBSTANCES, W. Weldon.-(A. R. Pechiney et Cie., France.) 9226, AIMANACK and DIARY, R. Crookall, Lancaster. 9227, DECOMPOSITION of the RESIDUAL AMMONIUM CHLORIDE, W. Weldon.—(A. R. Pechiney et Cie., France.)

France.) 9228. BICYCLE, G. A. de M. E. Dagg, Westmeath. 9229. LIFE-SAVING APPARATUS for FIRE, J. Woolven, 9220. LIFE-SAVING APPARATUS for FIRE, J. Woolven, Hore.
9230. TAPES for TURNING SPINDLES of MACHINERY, I. Jackson and G. Williamson, Glossop.
9231. METALLIC DRUMS for CONTAINING CHEMICAL SUBSTANCES, H. W. Todd, Liverpool.
9232. CARPET SWEEPING APPARATUS, E. L. TURNEY, Longport.
9233. REVOLVING PERPETUAL CALENDAR, F. Port, Bir-mingham.
9234. HEATING APPARATUS, M. COULSON, Spennymoor.
9235. KNIVES for OPENING CANS, H. C. Harrison, Bir-mingham.
9236. CLOSING, &C., PRESERVE JARS, H. Faulder, Man-chester.
9237. PLATEN PRINTING MACHINES, D. T. Powell, London.

London. 9238. Condenser Carding Engines, E. Gessner, jun. -(E. Gessner, sen., Saxony.) 9239. WATER METERS, B. P. Stockman, London. 9240. WALKING STICK, &c., FERRULE, E. J. Totterdell,

9240. WALKING BIGK, G. J. Satchwell, Birmingham.
9241. FLOWER HOLDERS, J. Satchwell, Birmingham.
9242. HEATING WATER, F. BOSShardt.—(Messieurs E. Delarocke and Nepheros, France.)
9243. GRINDING, &C., GLASS, &C., A. J. Boult.—(J. R. Bock, Bavaria.)
9244. MACHINE TOOLS, A. J. Boult.—(J. R. Bock, Bavaria.)

9244. MACHINE TOOLS, A. J. Boult.—(J. R. Bock, Bavaria.)
9245. FASTENING for HORSESHOES, M. Vint, London.
9246. PRESERVING ARTICLES OF FOOD, E. Whillier, London.
9247. OBTAINING LIGHT, H. N. Heffner, London.
9248. FIXING GAS BURNERS, E. Edwards.—(G. Félix, Galvaning.)
9249. UTILISATION OF SUGAR SCUM, A. G. Wass, London.
9250. CLEANING and POLISHING BOOTS, G. W. B. Edwards, London.
9251. METALLIC BOXES, G. H. Williamson, London.
9252. ULADING GRAIN, A. G. BROOKES.—(T. R. F. Karlonea, Germany.)
9253. FLAING OIL-CAKES, J. DOWNS and J. C. Thompson, London.

son, London. 9254. CRISPING THREADS, O. Imray.-(F. Pereyron et

9254. CRISPING THREADS, O. IMIRAY.—(F. Pereyron et Cie., France.)
9255. PHOTOGRAPHY, B. C. Le MOUSSU, LONDON.
9256. PHOTOGRAPHY, B. C. Le MOUSSU, LONDON.
9267. HYDROCARBON BURNERS for STRAM BOILERS, &c., A. M. Clark.—(J. Marion, J. Cawerly, B. Fischer, and J. S. Valk, United States.)
9258. REOULATING the SUPPLY of GRAIN to MILLSTONES, W. R. Lake.—(G. Schwahn, Germany.)
9259. WATER-PROOFING LEATHER, T. LAYCOCK and J. Owen, London.
920. NETS, J. Y. Johnson.—(C. Galland and J. Chawnier, France.)
926. Proves, &c., R. Boyle, London.
9262. PRISON CLIS, R. Boyle, London.
9262. PRISON CELLS, R. Boyle, London.
9263. PROVELS, R. Boyle, London.
9264. Proves, dc., IN of RAILWAY or other CARRIAGES, R. Boyle, London.

R. Boyle, London.

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

320,684. METHOD OF MAKING ELECTRICAL CON-DUCTORS, William S. Platt, Waterbury, Conn.-Filed May 15th, 1884. Claim.-The method herein described of making electrical conductors, the same consisting in providing a core of iron or steel having in its face a longitudinal channel, then enveloping said core with a sheath of

320,684



copper or other suitable material, the edges of said sheath being overlapped and forced within said channel, substantially as set forth.

channel, substantially as set forth. 320,703. LUBRICATOR, Phillip L. Schmitt, Quincy, Ill. —Filed April 10th, 1885. Claim.—(1) A lubricator consisting of the reservoir I, a steam supply pipe connected with a condensing coli communicating with the reservoir, sight feed tubes on each side of the reservoir, equalising branch pipes D, extending from the main supply pipe P to the caps of the sight-feed tubes and direct connections between the sight-feed tubes and the parts to be lubricated, substantially as described. (2) In combination, the oil reservoir of the lubricating cup, the steam supply pipe P and its lateral branches D, the sight-feed tubes



arranged upon each side of the reservoir condensing coil, and the regulating valve *m*, placed in the said pipe A above the junction of the branches D with the pipe P, all substantially as described. (3) In combina-tion with the reservoir of a lubricator cup, the pipe P and its branches D, the pipe A, extending upward from the junction of the pipes P and D, and termi-nating in a coll wound downward around the said pipe A, and communicating with the reservoir at the top thereof, substantially as described. 290 700 Concernent D, The D, and the formation of the substantial of the second because t

320,700. CONCAVE FOR THRASHING MACHINES, Georgy A. Roberts, Three Rivers, Mich.—Filed November 26th, 1884. Claim.—A concave for thrashing machines, com-

A concave for thrashing machines, com-



in combination with the dividing plates *i* and collars *j*, interposed between said plates and the points of nearest approach of the bars thereto, and the tension bolts *g*, passing through said bars, collars, and plates, substantially as and for the purpose specified.

substantially as and for the purpose specified.
320.746. STEAM CONDENSER, Thomas Barber, Flatbush, N.Y.—Filed January 29th, 1885.
Claim.—(1) A steam condenser consisting of a condensing pipe A, having an open end a for connecting with an engine, and provided at its other end with a lateral bend b for connecting with a suction pump, and a cold-water pipe partially surrounding the condensing pipe, and having an approximately semicircular bend e, so that the cold-water pipe opens into the condensing pipe laterally at or near right angles thereto, substantially as described. (2) A steam condenser consisting of a condensing pipe and provide a suction pump, a cold-water pipe partially surrounding the coher end b for connecting with an engine, and the other end b for connecting with a suction pump, a cold-water pipe partially surrounding the condensing pipe and opening thereinto at or near right angles thereto, and a pivotted swinging valve C arranged at the point of communication between the condensing and cold-



water pipes for controlling the distribution of water into the condensing pipe, substantially as described. (3) A steam condenser consisting of a condensing pipe A, which receives the exhaust steam at one end, while its other end is adapted to be connected with the suc-tion pump, a cold-water pipe B, which partially sur-rounds said condensing pipe and opens into the same near its receiving end, a valve C situated in the cold-water pipe, and a slot or slots formed in said valve, substantially as and for the purpose described.

320,826. AUTOMATIC WASTE VALVE FOR ENGINE CYLINDERS, Warren R. Townsend, Grand Rapids, Mich.-Filed December 18th, 1884. Claim.-In a waste valve, the combination, with the body A, provided with the inlet a and outlet b and the



value stem d, of the cap ϵ , provided with the tube i, projecting down into the body and serving as a shield and guard to the value stem, substantially as herein shown and described.

321,001. SHIFTING EXCENTRIC, Franh X. Black and Gustav Kaffenberger, Hamilton, Ohio.—Filed April 17th, 1885. Claim.—In an adjustable excentric, the combination of a shaft, a collar rigidly secured to the shaft and provided with guideways transverse to the shaft, an



excentric having a cylindrical bore oblique to the axis of the excentric, and having jaws engaging the guideways of said collar, and an oblique core fitting the shaft and the excentric, and fitted to slide thereon and therein, substantially as and for the purpose set forth. forth.



320,936. MACHINE FOR BENDING TUBE SKELPS, Jas. Hooven, Norristown, Fa.-Filed November 22nd, 1884.

kept from springing when forced together, as set forth. (2) In a skelping machine, the female roller N1, having the groove n^1 , its bottom curved, and the edges $n^2 n^2$ tangential, as described, in combination with the roller M1, much narrower than the groove n^1 , whereby the edges of the skelp bearing on the parts $n^2 n^2$ are forced inward, as and for the purpose set forth. forth.

Jorth.
321,030. ROLLEE MILL FEED MECHANISM, William Hutchison, Ottawa, Ontario, Canada.—Filed F.bru-ary 5th, 1885.
Claim.—(1) The combination, with the fixed and adjustable feed hoppers B C, of the rotary saucer F, divergent feed boards I I, and adjustable hinged shutters N N¹, whereby the feed material thrown out by the saucer is divided equally to the two pairs of rollers L L, M M, by adjustment of the shutters, as set forth. (2) The combination, with the fixed and



adjustable feed hoppers B C, of the cant boards O OI, rotary saucer F, divergent feed boards I II, having adjustable hinged shutters N N, rollers J J, and feed boards K K¹, whereby the material thrown out by the saucer is distributed and conveyed in a thin film to the rollers L L, M M, as set forth.

nim to the follows if it, it in, as we forth. 321,054. SOREW FASTENING FOR BOXES OR CASES, *Bugen Ritter, Ehrenfeld, Germany.—Filed February* 28th, 1885. *Claim.—A* screw having threads at one end and a head at the opposite end, in combination with a cylindrical nut or socket having its interior threaded to receive and hold the screw, and its exterior



threaded so that it may be screwed into the edges of the box or case, and having also a transverse hole or slot for the introduction of a locking pin, substan-tially as herein described.

aber for the introduction of a notking pin, substantially as herein described.
321,149. ELECTRIC RAILWAY SYSTEM, Frank J. Sprague, New York, N.Y.-Fild March 21st, 1885. Claims.-(1) In an electric railway system, the combination of two or more motors mounted upon the same car or train of cars and propelling the same, and a current regulator for simultaneously controlling the field magnets of all said motors, substantially as set forth. (2) In an electric railway system, the combination of two or more motors mounted upon the same car or train of cars and propelling the same, a current regulator for simultaneously controlling the field magnets of all said motors, and a current regulator for simultaneously controlling the field magnets of all said motors, substantially as set forth. (3) In an electric railway system, the combination of two or more mounted upon the same car or train of cars and propelling the same, a common field circuit for said motors, and an adjustable resistance in said field circuit, substantially as set forth. (4) In



an electric railway system, the combination of two or more motors mounted upon the same car or train of cars and propelling the same, a field circuit common to all said motors, and an adjustable resistance, and a circuit reverser in said field circuit, substantially as set forth. (5) In an electric railway system, the com-bination of two or more metors mounted upon the same car or train of cars and propelling the same, a common field circuit for said motors, and a current regulating device therein, a common armature circuit and a current regulating device therein, and means for reversing the direction of rotation of the motor, substantially as set forth. (6) In an electric railway system, the combination of two or more motors

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mounted upon the same car or train of cars and propelling the same, having their armatures in multiple arc relation to each other and their field magnets in shunt relation to the armatures, a current regulating device common to all said armatures, and a current regulating device common to all said field magnets. In multiple arc relation to each other and their field magnets in multiple arc relation to each other and their field magnets. In multiple arc relation to each other and their field magnets, substantially as set forth. (7) In an electric railway system, the combination of two or more motors mounted upon the same car or train of cars and propelling the same, having their field magnets, and a current regulating device common to all said field magnets, and a current regulating device common to all said field magnets, and a current regulating device common to all said field magnets, and a current regulating device common to all said field magnets, and a current regulating device common to all said field magnets, and propelling the same, having their field magnets in multiple arc relation to each other, and all the field magnets in shunt relation to each other, and all the field magnets, substantially as set forth. (9) In an electric railway system, the combination of two or more notors mounted upon the same car or train of cars and propelling the same, a common to all the field magnets, and a current regulating device common to all the field magnets, substantially as set forth. (9) In an electric railway system, the combination of two or more motors mounted upon the same car or train of cars and propelling the same, a common field circuit for said motors, an adjustable resistance and a circuit roverser therein, aubstantially as set forth.
321, 66. SkrErr LARF, John L. Williams, Shenandoah, R. - Field Annuary 24th, 1885.

reversor therein, substantially as set forth. 321,166. SAFETY LANF, John L. Williams, Shenandoah, Pa.-Filed January 24th, 1885. Claim.-(1) The combination with the base of the Imp, its wick tube, and a glass cylinder at the lower part of the lamp, of a wire gauze cylinder extending down within the said cylinder, a stationary sleeve projecting downward from the upper part of the lamp, and a sliding sleeve on the said wire gauze cylinder, substantially as herein shown and described. (2) The ported above the same, the glass cylinder between said base and ring, and the wire gauze cylinder between said base and ring, the sleeve D, depending from the ring down through the ring of the ring b⁸, supported above the ring b⁸, the sleeve D, depending from the ring b⁸, and the sliding sleeve E, substantially as herein shown and described. (3) The combination



with the base of the lamp, the stationary sleeve D, and the sliding sleeve E, of the ring b6, supported above the base and provided with the annular groove c¹, to receive the lower end of the sliding sleeve, and the wire gauze cylinder C, projecting through the said ring, substantially as herein shown and described. (4) The upper sleeve D, with its perforated cap-piece c³, in combination with the wire gauze G, arranged to cover the perforation in said cap-piece, a screw socket adapted to receive said gauze, and the screw gland c⁵, for holding said gauze in place and to provide for its removal from the lamp, substantially as specified.

S21,192. CIRCULAR SAWING MACHINE, John Connell, Rochester, N.Y.-Filed November 25th, 1884. Claim.-(1) The combination of the fixed brackets or hangers C, the pendulous saw frame suspended therefrom, and the weighted lever pivotted to the bracket and acting directly on the frame to urge the 321,192



same backward, as described. (2) The pendulous saw frame having the roller or projection thereon and the angular weighted lever mounted on a fixed axis above the roller and acting on the latter, as described.

1821,406. FEED-WATER HEATER AND PURIFIER. Andrews W. Ward, Galipolia.—File October 30th, 1854. Claim.—(1) The combination of the drums B B1, arranged, respectively, between the boilers, and pro-vided with a perforated tube E having a blow-off on each end, and the boilers A Λ^1 A², each having com-munication at its rear end with one or more of the



drums and provided with the tubes F, arranged sub-stantially as shown and described. (2) The combina-tion, with the boilers A A¹ A², each provided with a tube F of the drums B B¹, each provided with a per-forated blow-off tube E, the pipe C having the arms or extensions c c and c¹ c¹, and the tube D having a water entrance therein, substantially as specified.