THE CHICAGO RAILWAY EXPOSITION.

No. X.

THE Pullman Sleeping Car Company has for some time built its own cars, but has only lately added to its business the manufacture of ordinary passenger and freight cars at its large new works at Pullman, near Chicago. It exhibited a fine box car built for the New York, West Shore, and Buffalo Railway, which we illustrate on page 50. This car may be taken as a typical specimen of the latest and largest American freight car, and is calculated to carry 50,000 lb., or 22 tons 6 cwt. of wheat, Indian corn, &c. Though some cars were exhibited of nearly the same cubic capacity, few cars running are marked to convey more than 40,000 lb., which is now the usual car load in the States; though the advisability of building cars to carry 60,000 and even 70,000 lb. is being discussed. As the very important question of railway rates for goods traffic is intimately connected with the carrying capacity and proportion of dead weight to paying load of the vehicles used, it is interesting to investigate the construction and proportions of a typical American car, and discover, if possible, whether it possesses any advantages as compared with the widely different style of rolling stock used on this side the Atlantic. We believe no description or illustration of a modern American freight car has been published in England, and therefore we venture to believe that the following description of the car referred to at the head of this article, and which was designed by the late Mr. Howard Fry, will prove interesting to our readers. We are indebted to Mr. R. N. Soule, Mr. Fry's successor, for copies of remarkably clear and detailed working drawings, from which our illustrations are prepared.

The car is somewhat more strongly and heavily designed than is usual, the tare being 24,900 lb., or 11 tons 2 cwt., slightly less than half the capacity, or maximum paying load. The subjoined table shows the relative capacity, tare, &c., of this car as compared with representative English covered and open wagons.

	Two English covered wagons.	N.Y. W.S. and B.R. car.	Two English open wagons.
	ft. in.	ft in.	ft. in.
Stowage length, over buffers	38 6	35 11½	36 3
Height, rail to top of roof	10 11	11 1⅞	—
Width, over all	8 6½	9 4½	8 5
	tns. ct.	tns. ct.	tns. ct.
Tare	13 1	11 2	10 16
	sq, ft.	sq. ft.	sq. ft.
Area floor	223	262	208
Do. per foot stowage length	5·79	7·29	5·74
	lb.	lb.	lb.
Weight per square foot floor area	131·1	95	116·3
	cb. ft.	cb. ft.	cb. ft.
Capacity to level of top of door opening.	1311	1609	469
Capacity per foot stowage length	34·5	44·7	—
	lb.	lb.	lb.
Weight per foot cubic capacity..	22·3	15·5	—

The table shows that the American car weighs less and holds more than two English covered wagons while it occupies less length in a train. It is, however, wider than most English loading gauges permit, though without the brake wheel it might pass through the Metropolitan tunnels with an inch or two to spare. It appears that, while an English covered wagon requires 22·3 lb. weight of vehicle for each cubic foot of capacity, the same result is achieved in the American car by 15·5 lb. weight of vehicle, a very marked difference which deserves more notice than it has hitherto received. In other words, one ton's weight of vehicle gives 100 cubic feet capacity in the short wagon, and 144 cubic feet capacity in the longer car. It is, of course, unfair to make a similar comparison between covered and open vehicles; but taking the floor space as a basis, it appears again that the American car has less dead weight than an open wagon. One square foot of floor is secured by 95 lb. of vehicle in one case, and by 116 lb. in the other. The weight of the tarpaulins are included in the weight of the open wagons in order to make a fair comparison. A train of twenty-four American cars would be shorter and have less dead weight than a train of fifty English open wagons, but would have 21 per cent. more floor area.

The under frame of the car is composed mainly of six parallel longitudinals, two heavy headstocks or end sills, and two trussed cross bearers or transoms, which rest on the bogie and distribute the weight between the centre and side bearings. The longitudinals are trussed by rods passing under cross bearers, which are placed beneath the longitudinals. This arrangement of underframing permits the full strength of the timbers to be utilised, the longitudinals extend the whole length of the car, and like the transoms are not weakened by mortises, the timbers being notched only ½in. into one another. The main transoms are trussed by bolts screwed from the outside into nuts held in the eyes of wrought iron stirrups passing over the centre longitudinals. The longitudinal truss rods pass under cast iron struts bolted to the underside of the middle cross bearers, and over similar saddles resting on the main transoms. The ends of these truss rods bear on the outer side of the end sill or headstock, and serve to hold it firmly to the longitudinals. The two middle truss rods are provided with right and left-handed adjusting screws in the centre, while the outer truss rods are continuous, nuts at the ends bearing against cast iron washers recessed into the headstocks. The floor is composed of planks 6½in. by 1¾in., tongued and laid crossways of the car, and well supported by the longitudinals, the greatest distance between the latter being 1ft. 4⅜in. The headstock measures no less than 8in. thick by 10in. deep in the centre, and thus gives plenty of strength to resist shocks in shunting, though little heavier than the headstock of an English wagon 14in. deep by only 5in. thick.

The draw gear works against "draft timbers" 9½in. × 4in., which are attached by bolts and cast iron chocks to the underside of the centre longitudinals. A wrought iron strap or "carry iron" 3½in. and ¾in. passes under the extreme front ends of the draft timbers and carries the central buffer or "bull nose." The "carry iron" is secured by six vertical ¾in. bolts to a short timber bolted to the front side of the headstock or end sill. The attachment of the draw gear is unavoidably the weak point of American cars, its centre being several inches below the centre of the main frames, the strain is indirect, and the draft timbers are often pulled or knocked off. Unfortunately in the early days of railroads, the distance from the rail to the centre of the draw gear was about 2ft. 6in., and it has been impossible to materially increase it since without interfering with the interchange of stock. A single spiral spring not shown in the drawings takes both buffing and drawing strains. Two timber bumpers with cast iron faces take the buffing strain when the spring is driven home. It will be noticed that despite the powerful eight-coupled "Consolidation" engines used in the States, the draw bar, 2in. diameter with a cotter hole in it, is of exactly the same net section as that adopted on some English lines, 1½in. diameter where plain, and 2in. diameter where screwed or pierced for a cotter. Where the best Yorkshire iron is used for this purpose the strength of the draw bar of this car is probably exceeded.

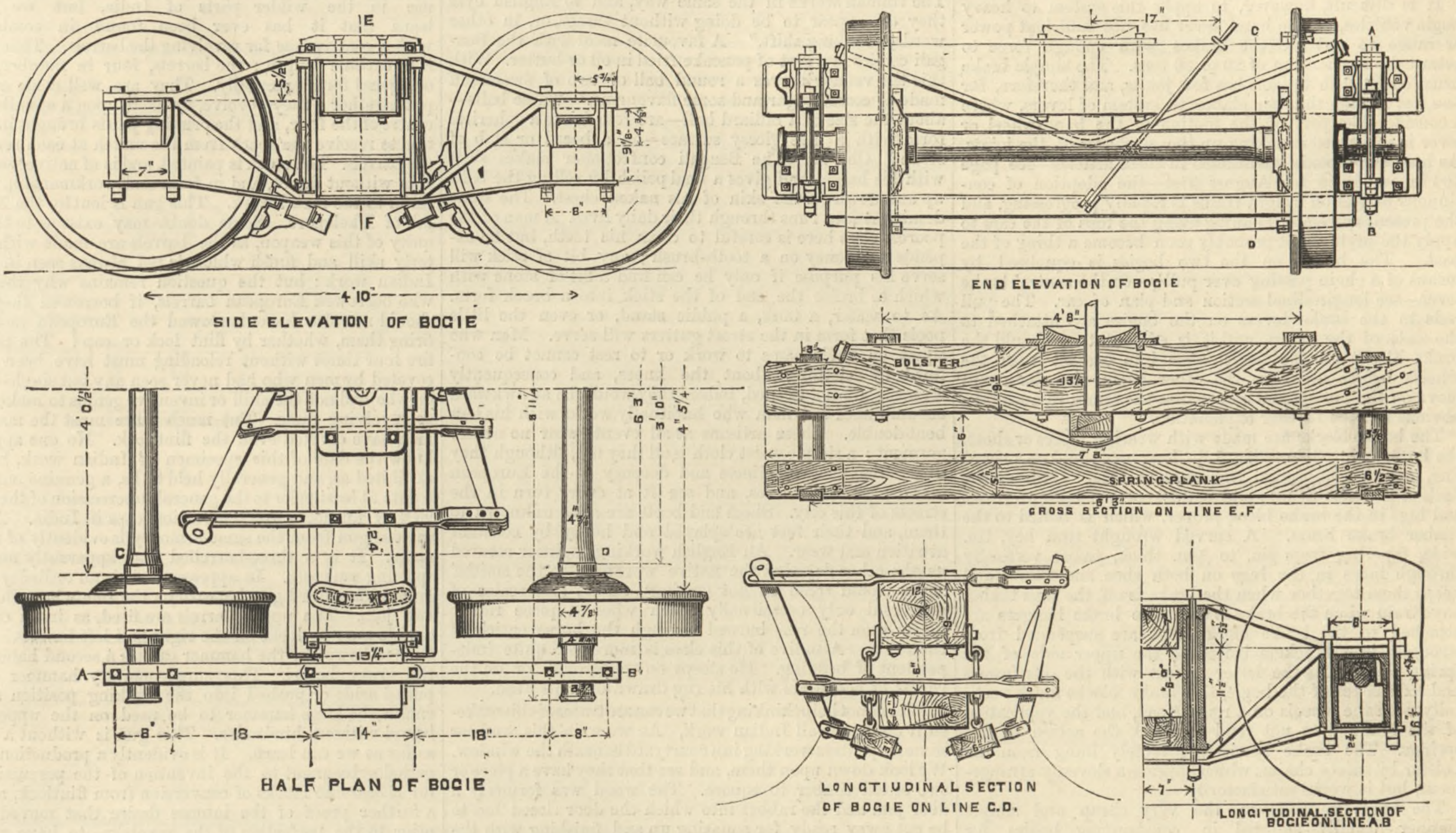
As horses are little used for shunting or marshalling in America, shunting poles for pushing vehicles on an adjoining line are a recognised institution, and are generally found on switching or shunting engines. Accordingly suitable sockets for the end of the pole are provided at the corners of the car. No diagonals are used to resist this strain, which however cannot be applied as suddenly as the push of an engine on ordinary buffers.

The outside sheeting of the car is vertical, and attached directly to the outer side of the sole or "outside sill," and consequently rain drains clear of the timbers, and cannot lodge in a rabbet or groove. The sheeting is made in very narrow strips, 3¾in. by ⅞in., tongued and grooved, so that the shrinkage of each individual board is small. The inside sheeting is laid horizontally, and stops 2in. short of the floor, allowing free ventilation between the inner and outer skins, though apparently at some sacrifice of the double safeguard against the penetration of rain afforded by the two skins. This arrangement is, however, common, in the States.

The pillars to which the sheeting is secured are inclined, and thus tend to keep the ends of the car upright when shunting, and contribute to form a deep trussed girder; the cant rail or "side plate" being the top, and the outer longitudinal or "sill" the bottom member. The sides of the car thus form a continuous girder 34ft. long and 24ft. span, each end overhanging 5ft., the effective depth being about 6ft. 8in., or about $\frac{2}{7}$ of the span. The trussed underframe is thus relieved of the task of supporting the sides and roof, and has only to carry about $\frac{5}{6}$ of the weight of the floor and the load upon it. This assumes that the ¾in. vertical bolt at each door-post takes no share of the load, which is improbable. Assuming that each bolt takes 1 ton, when the car is loaded with 50,000 lb. the load on the underframe will be about 23,600 lb., or say 5900 lb. for each truss of 24ft. span, and although it is difficult to estimate the strain on the truss rods, especially under varying temperatures, it would appear to be about four tons to the square inch, and as the screwed ends are upset, this is well within the margin of strength. The lower ends of the posts and diagonals are not tenoned into the "outer sills" or soles, but rest on cast iron shoes, and their upper ends are tenoned into the cant rail or "plate."

The two cant rails are tied together by bolts running right across the vehicle, which, with the deep carlines, double system of purlins, and tongued and grooved roof planking, make an exceedingly strong roof, calculated not only to stand a heavy fall of snow, but to brace the whole top of the vehicle firmly together. The roof forms a connection in a horizontal plane between the sides and ends of the car; and the tops of the side posts and diagonals being thus secured from swaying sideways, heavy knees staying the uprights to the floor are unnecessary. A level path 2ft. 6in. wide is provided on the centre of the roof, so that the brakesmen can run along the train to apply the brakes. The outer roof is not supposed to be absolutely water-tight, but is merely meant to turn the greater portion of the rain and serve as a protection to the inner roof, which is composed of thin corrugated galvanised iron, resting in grooves cut in the ridge poles and in the sides of the rafters, which are shown in dotted lines on the longitudinal section of the car. Any leakage falling on the inner roof runs off through a space left between the inner and outer barge boards. The roof boards run across the roof, and not longitudinally as is usual here. The water cannot therefore lodge in the tongued and grooved joints, but must either get through the joint and fall on the inner roof or run off.

This method of making a roof is not universal in the States, but though more expensive in first cost, the roof is said to last longer, and require fewer small repairs than the ordinary American styles of roof, composed either of tin laid on boarding, felt being sometimes interposed, or a double layer of planking laid to break joint, each board having two shallow grooves or gutters cut on its upper surface. The water finding its way through the joints of the upper layer is supposed to run off by the gutter in the lower layer before it can get to the joint, but owing to the confined moisture this roof soon rots. The tin roof is apt to wear into holes, and it is stated that 25 per cent. of the cars running in the States have leaky or defective roofs.



BOX CAR BOGIE.

The method of making carriage and wagon roofs universally used in England—stout oil cloth or canvas bedded on white lead laid on boarding—does not appear to be known in the States.

The doors are of simple construction, having cast iron shoes or rubbing pieces sliding on wrought iron rails. It is somewhat difficult to believe that they can be perfectly rain-tight. It is not unusual for sparks to find their way into the interior of cars when the doors are slightly warped and are not in tight contact with the sides of the door posts. When carrying grain a few rough boards are placed across the doorway, the pressure of the grain keeping them tight against the inner face of the door posts. The permanent doors can then be slid back, or left slightly open for ventilation without disturbing the freight.

Access to the roof is obtained by means of wooden ladders at each end, one of which is shown on the half end elevation on page 47. The brake can only be applied from the hand-wheel on the roof, an arrangement universal in America, and probably the only possible method of applying hand brakes throughout a train in motion. In shunting, however, at a roadside station, one brakesman has to ride on the top of the car to apply the brake, while another works the points, while with the English method of side brake levers, one man can hold the points until the wagon has passed, and then run after it and pin down the brake.

It is difficult, however, to apply this system to heavy bogie vehicles, as the hand lever has not sufficient power or range to put on the brakes with enough force to retard the momentum of 20 or 30 tons. The simple brake usual on English wagons has few joints, and therefore, far less lost motion than an elaborate system of levers, where a considerable part of the motion of the hand-wheel or lever is consumed in taking up the slackness of the joints. As has been already mentioned in these articles—see page 164 in our issue for August 31st—the adoption of continuous brakes on freight trains is rapidly progressing, and the present system of running along the tops of the cars to apply the brakes will probably soon become a thing of the past. The brake on the two bogies is equalised by means of a chain passing over pulleys on the central brake lever—see longitudinal section and plan of car. The pull rods to the brake levers on the bogies are attached to the ends of the chain, and it is evident that should the brake-blocks on one bogie come into contact with the wheels before those on the other bogie, the chain will move on the pulleys and so equalise the strain in a way too obvious to need further explanation.

The brake blocks are made with wearing pieces or shoes, the latter being 3$\frac{1}{2}$in. wide, 14in. long, measured on a chord line, and of a minimum thickness of 1$\frac{1}{8}$in. Lugs on the back of the shoe fit into and against corresponding recesses and lugs in the brake block proper, which is bolted to the timber brake beam. A curved wrought iron key, 1in. wide, tapering from $\frac{3}{8}$in. to $\frac{3}{16}$in. thick, passes vertically through holes in the lugs on both shoe and block, and keeps them together when the brake is off, the lugs taking any strain when the brake is on. The brake hangers are attached to the brake blocks, and are suspended from wrought iron brackets bolted to the upper side of the spring plank. As the latter is fast with the side frames and axle-boxes of the bogie, the brake blocks move vertically with the wheels on a rough road, and the application of the brake does not tend to check the action of the springs. The brake beams are loosely hung from the bolster by safety chains, which appears a slovenly arrangement, but it works satisfactorily.

The bogie is made in the very cheap and simple manner usually adopted in constructing bogies for freight cars in the United States. The axle-boxes are bolted rigidly to two side frames, each composed of three bars measuring 3in. wide, by 1$\frac{1}{4}$in., 1in., and $\frac{5}{8}$in. thick respectively. These bars are bent to a former, and the holes drilled simultaneously in a suitable multiple drilling machine. Two bolts passing through cast iron distance pieces brace the bars and spring plank together, and form a stiff girder to transfer the weight on the spring plank to the axle-boxes. The car rests on a cupped centre casting on the bolster—two side bearings being provided to take any rolling motion. The bolster, the sides of which are provided with rubbing pieces, works vertically between the cast iron distance pieces before mentioned. The bolster in fact is in the position of an axle-box working between axle-guards or horn blocks. Spiral springs, not shown in the drawings, are interposed between the bolster and spring plank. No special provision is made for keeping American bogies square, and it is therefore not surprising that wheel flanges often wear very unevenly in the States. The bogie is shown in the drawings with no load upon it, and therefore the bolster is against the top or arch bar of the frame. It will be noticed that there is very little expensive wrought iron work in any part of the car, and that the heavy knees, spider plates, hinges, &c., usual in English wagons, are conspicuous by their absence. This is partly due to the better quality of American castings, which can be freely used under trying strains which would fracture our weaker material. It is characteristic of the difference in the nature of the traffic of the two countries that while an English wagon is provided in every direction with knees and diagonals to resist distortion from the shocks of shunting, the American car is thoroughly trussed to resist the strains produced by its heavy paying load. We think our readers will agree with us in considering this car to be remarkably well and strongly designed, while its small weight in proportion to the load carried, compares very favourably with the results obtained on this side of the Atlantic. Some reduction of the dead weight and stowage length as compared with the cubic capacity of our goods traffic rolling-stock is much needed. The car we now illustrate shows one method of effecting this reduction. Another may be found on page 149 of our issue of August 24th, containing illustrations and description of an iron coal wagon, weighing 5 tons and measuring 14ft. over buffers, which was designed by Mr. J. A. F. Aspinall, to supersede a wooden wagon weighing 6 tons 8 cwt., and measuring no less than 21ft. 4in. over buffers, both wagons carrying the same weight of coal.

THE CALCUTTA INTERNATIONAL EXHIBITION.

No. II.

INDIA is a curious country in many ways, and it is not a paradise for those who are deeply imbued with Western ideas. The native mind is slow and difficult to move. One who evolved an India out of his moral consciousness, supplemented by a knowledge that England had held the country for a century, might assume that Western ideas were rapidly pushing back the old-world notions of the East. No such change is taking place. We are no more undermining the ancient prejudices of the people of this vast continent than the waves of the Mediterranean sea are affecting those of the Atlantic. The most noticeable tendency of the mind of the average Bengali is to be content. Sir George Birdwood, in his work on the industrial arts of India, says, in speaking of art furniture and household decoration, "If we may judge from the example of India, the great art in furniture is to do without it." We think the remark might be applied to many matters besides household decoration and furniture. We see traces of the "do without" principle everywhere. The carpenter does without a bench: he squats upon his hams and makes the floor of the building or the ground of the open yard his bench. The smith raises no forge, but makes his fire on the ground and squats beside it with a bit of iron for his anvil. The tinman works in the same way, and to English eyes they all appear to be doing without things, or, in other words, "making shift." A favourite meal with the Bengali coolies is a sort of pancake fried in oil or butter. With this the vendor serves a round ball or two of sweetstuff made of coarse sugar and some flavouring. These balls—about the size of a billiard ball—are rolled into a spherical form with a nice glossy surface—on a board or slab of stone? Oh, no. The Bengali confectioner makes shift with his hands, and gives a final polish by rolling the balls up and down on the skin of his naked chest. The same dominant idea runs through their daily lives. A man of the poorest class here is careful to clean his teeth, but he expends no money on a tooth-brush; any bit of stick will serve his purpose if only he can find a bit of stone with which to bruise the end of the stick into a brush form. As to water, a tank, a public stand, or even the little pools that form in the street gutters will serve. Men who squat on their hams to work or to rest cannot be confined by clothing about the knees, and consequently trowsers are not needed, indeed they would be an awkward encumbrance to a man who habitually works with his legs bent double. These artisans at all events wear no nether garment; a simple waist cloth is all they use, although they have seen the comeliness and decency of the European method all their lives, and see it at every turn in the streets of this city. Shoes and boots are alike unknown to them, and their feet are splayed and horny by constant attrition and wear. An English working engineer assured us the other day that the native workmen in the smiths' shops would tread on hot cuttings, strips, and scales of iron, and only occasionally flinch when a piece rather hotter than the rest burned through the horny cuticle of their feet. A native of this class is moreover quite independent of bedding. He sleeps on the ground or on the rudest of bedsteads with his rug drawn over his head.

We cannot help thinking that we can see traces of this make-shift method in all Indian work. As we write this, we hear some carpenters working in a courtyard beneath the window. We look down upon them, and see that they have a piece or two of old timber to square. The wood was formerly a door jam and the rabbet into which the door closed has to be cut away ready for squaring up and finishing with the plane. The men squatted down and used adzes with one hand, and were occupied an hour in cutting away a strip of wood that an English carpenter would have adzed off in five or ten minutes, and with a few strokes of his two-handed adze. But it is more in the absence of perfect accuracy that we see the defects of the make-shift method. The Indian workman never seems to be quite master of the material. You can see where his tool jarred even in some highly finished art work. The lines are never exactly rigid, the ornamentation is never in that perfection of symmetry which defies the unassisted eye to detect the error. No line can be perfectly straight, no circle exact. A good English workman proceeds as though he desired to show practically that this is a theoretical error. If his lines be not straight, his circles out of truth, just show him where they are wrong, he seems to say. The workman in this country seem to accept the dicta of the mathematician, and to proceed on the assumption that if lines and curves cannot be exact they may as well be visibly out of truth. We mention these things because they seem to us to affect the fortunes of manufacturers who essay to supply the Indian market in two ways. The mass of the people of the country do not want our goods, because they can do without so much that we deem necessary to comfort; and they are not drawn to us by what we deem superior workmanship, because their principle of doing with out and making shift, lead them to regard with indifference matters which we regard as indispensable. This is cold comfort, we know; but India is a land of plentiful labour—so plentiful that the engineering skill of the West is beaten in the attempt to economise it. A well-known manufacturer said to us the other day, "I have abandoned the attempt to introduce pumping machinery here in competition with the man and pair of bullocks who will raise water night and day for £10 a year."

But if India cannot be induced to take our goods, or to take them in proportion to the numbers of her teeming population, she has much to send us which may be of use in our manufactures. Since we last wrote we have seen a magnificent display of hard woods from the Andaman and Nicobar islands. These are little known in Europe for the Forest Department of the Government have only recently paid attention to this source of their wealth. In the grounds of the Exhibition are about a dozen fine logs measuring from 40ft. to 47ft. in length, and siding up to 30in. in some cases. The finest of these *Pterocarpus Indicus*, of which here are four specimens, is cedar coloured, and frequently a deep scarlet. It is of dense texture, seasons well, shrinks very little, and does not expand subsequently. Its weight is about the same as oak, and it has the toughness and elasticity of American hickory. It is so hard, that in Rangoon it is largely used for bearings of machinery, and especially of circular saws. Another description, the specimen log of which is 34ft. long and 12in. siding, *Artocarpus Lacucha*, first cuts out an ochre yellow colour, which deepens to brown on exposure. It is tough as ash, and is the only light wood of India which is very strong; its weight when seasoned is about 45 lb. to 48 lb., the cubic foot, or about the same as light mahogany. The *Mowha*, or bullet-wood, is of dense, hairy texture and of very great strength. It is used for railway sleepers, for piles, and houseposts; the length of the square is up to 50ft., siding up to 2ft. Here are also iron wood, wild jack, marble wood, satin wood—not the satin wood of Ceylon—which is like box in colour, and may be used for the same purposes, and several others, all of which deserve the attention of users of timber.

We find in the Indian exhibits another proof of the truth of the aphorism, "Nothing is new under the sun," in the shape of a revolver matchlock. Col. Cologan, of the 17th Native Infantry, who drew our attention to this weapon, is of opinion that it is of genuine native workmanship and old. The matchlock arrangement is still in use in the wilder parts of India, but we cannot learn that it has ever been found in combination with a contrivance for revolving the barrels. This weapon is of carbine length; the barrels, four in number, are of octagonal form externally. They are well made and well put together; they revolve, by hand, upon a spindle in the centre of the four, and the priming pan is brought into position to receive the spark from the match at each remove of the barrels. The stock is painted, and is of native workmanship without doubt, and in form and workmanship it is inferior to the metal work. This gun is lent by the Maharajah of Dholepore. Some doubt may exist as to the antiquity of this weapon, as the barrels are made with a masterly skill and finish which is not always seen in ancient Indian work; but the question remains why the maker who borrowed European barrels, if borrowed they were, should not also have borrowed the European method of firing them, whether by flint lock or cap? The power to fire four times without reloading must have been greatly coveted by men who had never seen any but single-barrels, or who had not the skill or inventive genius to make double or revolving guns. But much more must the matchlock man have coveted even the flint lock. No one appears to know the date of this specimen of Indian work, but it is exhibited as, and generally held to be, a genuine antique of a date at least prior to the general supercession of the matchlock by flintlocks and percussion caps in India. Another curious gun from the same armoury is evidently of modern make. It is a three-barrelled piece apparently made for sporting purposes. In appearance it is an ordinary double gun, with a third gun beneath on the line where the upper two join. The upper barrels are fired, as in an ordinary double gun, by locks on the right and left barrels. In the former, however, the hammer carries a second hammer for the lower barrel. This supplementary hammer can be pulled aside or pushed into the striking position so as to enable the large hammer to be used on the upper right barrel without hindrance. This gun is without a history so far as we can learn. It is evidently a production of the period subsequent to the invention of the percussion cap, for it bears no marks of conversion from flintlock, and it is a further proof of the intense desire that moved men—prior to the perfection of the revolver—to have as many charges at their disposal as possible without loading.

At the meeting of the Royal Agricultural Society's Show at Kilburn, light railways did good service for the show and visitors by helping the latter over the quagmire which the ground soon became. At this Calcutta Exhibition, the makers of light railways are endeavouring to do themselves a little good by advertising their system in a country where such aids to locomotion are largely needed and should be warmly welcomed. Messrs. John Fowler and Co., of Leeds, have laid in the ground some lengths of portable railway with metallic sleepers. M. Decauville, of Petit Bourg, France, has also a length of railway laid down to meet this, and visitors are promised the advantage of a ride through and around the grounds. These rails are in both cases laid upon metal sleepers, and they are very readily removed. The French system, it is claimed, may be moved by four men, at the rate of 400 yards of rail to a distance of 40 yards in less than an hour. Messrs. Fowler claim that sections of 25 yards each of their line may be removed by six men in ten minutes. At the time of writing, the respective merits of the two systems have not been tested, either in this matter or as a means of showing visitors round the Exhibition.

One may wander far and wide in this Exhibition to find novelties. Inventors have a hard fight in India, and if they have not been actually warned off, they have been made to feel that they must prove the necessity for admitting them to India before a prejudiced tribunal. Where labour saving is regarded as a sort of moral evil, and where it is an actual physical impossibility, the inventor has a hard time. Great differences are to be seen in the tea plantations and amongst indigo planters. These gentlemen have commenced business with modern ideas, they work on modern principles, and they are on the look-out for and readily adopt any machinery that gives promise of doing their work for them. Messrs. Marshall and Sons, of Gainsborough, have sets of tea-sifting and rolling machinery, which are already in favour amongst the tea planters. These are various in size, they are well constructed, and bid fair to occupy the market. They are very simple and easily managed.

Attention is drawn to a building in the grounds of the Exhibition which has been put up for Burmese theatricals. It was built by the Bombay Burmah Trading Company, to exemplify economy in wooden structures. The form of construction is not new, having been adopted by the engineer of the company some years ago. We can only testify that it has a very sightly appearance, for although no more than a square open shed, open at the sides, or nearly so, the structure has an infinitely better and more attractive look than is borne by any of the Exhibition shedding. The principle of construction is to use lattice-work of wood of small scantling in all parts instead of heavy logs or beams of timber. The supporting posts are of this trellis-work, the splines being about 3in. wide by ½in. in thickness. The trellis posts are wider at the bottom than at the top, and anchor to the ground by means of stump posts. The roof and other beams, purlins, &c., are all constructed on the same principle, none of the material in a 30ft. beam being more than a few feet in length. The company in its prospectus declares that for such a truss no single piece of timber need be over 10ft. long. The saving comes in two ways in such a country as India. In the first place, short lengths of teak are a drug in the market, as slabs of short length continually arise in preparing teak logs; and next, in hilly countries the lightness of carriage of small quantities of small scantling, such as may be divided into one-man burdens, is another very great advantage. The company claims that the erection of shedding on this principle is not difficult. Skilled labour, it says, is hardly required. There are no costly iron fastenings or straps, wooden trenails and French wire nails being all that is necessary, in almost all cases, to hold the structure firmly together. We may add that it is a development of a system practised in Belfast quite thirty years ago.

The accompanying engravings illustrate Martin's "trajector."

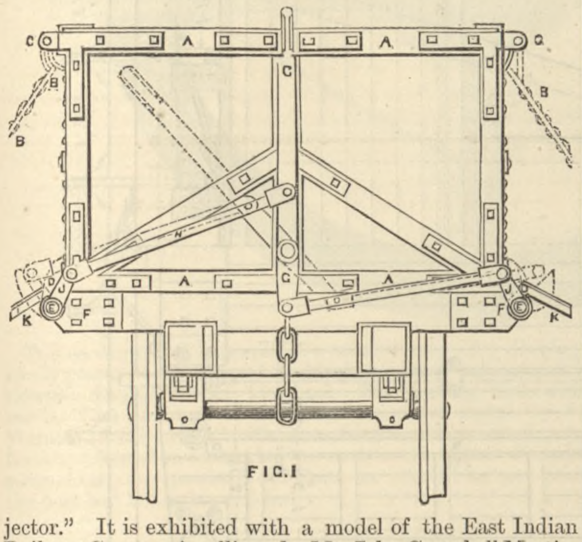


FIG. 1

It is exhibited with a model of the East Indian Railway Company's colliery, by Mr. John Campbell Martin, its inventor, the engineer of the company at its works at Kurhurballee. In ballasting a line the trajector will, it is claimed, be very useful, as it throws the ballast clear of the line on the liberation of the fastening. A train of wagons may be run up to a given point and the ballast discharged in a few

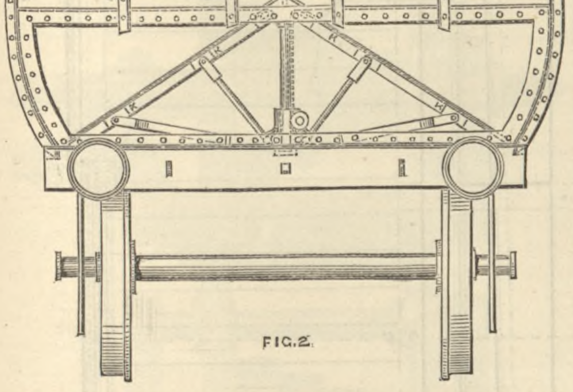


FIG. 2

minutes. In cases where the traffic is heavy and time precious the empty trucks may be withdrawn without refastening the doors or flap sides. The side doors B are hung at C, Fig. 1, and are held in position by hooks K on spindles E controlled by the levers G, H, J. The dotted lines show the position of levers and hooks when the doors are liberated. In Fig. 2 the floor when loaded is level, but for emptying it is lowered into the position shown. The inventor claims that his system may be applied to coal trucks; indeed, it is largely in use for them in India, and steps are to be taken at once, in connection with a leading firm of engineers, to introduce it into England.

LETTERS TO THE EDITOR.

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

THE EFFICIENCY OF FANS.

SIR,—After the many figures recounted by the Rev. G. M. Capell from time to time, giving the exceptional efficiency of his patent fan, I could not expect that he would acknowledge the correctness of the figures giving the results of my experiments. My object in writing was not with the hope of convincing him of their correctness. In reading the discussions in your paper on this fan, I have generally found Mr. Capell's figures questioned by practical and scientific men, and no one seems to be able to get the results he himself obtains from the fan. It was seeing this that led me early last year, when I had the loan of the fans offered me, to make the experiments, and see for myself what the fan was capable of doing. His statement of having found a clue to my observations in my having turned the fan the wrong way will no doubt make many of your readers smile.

If I had been entirely void of practical experience as an engineer, I think the clear way in which you have described the fan, and have from time to time referred to it, would have led me to avoid this mistake; but the fact that I have had over thirty years' theoretical and practical training as an engineer, and some experience in machinery experiments, leads me to think I was capable of testing one of his fans in a proper manner. My figures satisfied my mind at the time of my experiments, and after studying them, I laid them aside without any intention of making use of them, until I saw the discussions again in your paper.

The fact that practical and experienced engineers dispute his figures in all his public experiments, so far as I have seen, does not tend to lessen the confidence I have in the correctness of my own; and besides, much of his own data condemns itself. To go no further back than his last letter, where he states, in referring to some trials made on November 3rd, in connection with the South Staffordshire Mining Engineers:—"The secretary stated at the meeting he saw the 36in. fan at 699 revolutions pass 13,770 cubic feet of air per minute through the mouth of the 6ft. of 20in. diameter tube, and give in the open mouth of the tube 3½in. water gauge with indicated horse-power of 3·14."

Now, clearly there must be some mistake here, for if we apply the very clear and lucid method you give in your article on November 16th, 1883, for the calculating the power in the air, we find the following results:—The value of M or weight of air passed per second, taking 13 cubic feet to the pound, we find to be $\frac{13,770}{13 \times 60} = 17·6$ lb. The area of a 20in. diameter tube is 2·18 square feet, and the velocity of the air travelling through the tube per minute would be 6316ft., and the value of v^2 would be 11,025. Then, using the formulæ, we find $\frac{17·6 \times 11,025}{64·4} = 3013$ foot-pounds per second, or $3013 \times 60 = 180,708$ foot-pounds per minute, or 5·47-horse power. Now this, as you very clearly state in your article, only gives the net power in the moving air, without taking into account any of the friction either of fan or motive power. Yet Mr. Capell can do the work with 3·14 indicated horse-power. But if we add only 40 per cent. to this for friction—and in this class of work it is not sufficient or equal to the amount you allow in your example—we shall require an indicated horse-power equal to 7·45, instead of the 3·14 he states as being the amount. Comparing the same figures with the rule given by Mr. A. G. Steavenson in THE ENGINEER of December 7th, for finding the power required for drawing the air through the channels of a mine by fan power, which he gives as $\frac{2 \times p \times 5·2}{33,000}$. As Mr. Steavenson states, this rules applies to drawing through long channels; but as the water-gauge pressure is included in the formulæ, it will apply equally for long or short. In this calculation the value of 2, or quantity, is 13,770 cubic feet of air passed, and 3½in. is given as the water gauge or value of p; we have, therefore, $\frac{13,770 \times 3·5 \times 5·2}{33,000} = 250,614$ foot-pounds, or 7·6-horse power required.

With reference to the example Mr. Capell gives of a trial of Mr. Phillips' fan, he has obviously made an error, which he must explain, for he would hardly turn out 839 cubic feet of air with 53¾ foot-pounds as he states. I should judge that the man turning the fans in my experiments was exerting two to three times the power he would be able to do continuously through the day. The foot-pounds developed by a man turning a handle continuously is usually taken at 2600, and I suppose the figures Mr. Capel gives should be 5375·7 foot-pounds. I think the Rev. Mr. Capell has quite enough on his hands to prove the correctness of the figures he has advanced; for as stated in your article of November 16th, 1883, he appears to be creating power, and there appears to be something in the figures "no fellow can understand." I think it would be quite as much to his advantage to give a *bonâ fide* proof that my figures are wrong, by having tests of his fans in the presence of two or three engineers, experienced and reliable men, whose opinions would not be disputed. It is no desire of mine to give anything but the correct figures, and it is no interest of mine, as I before stated, to prove either fan better than the other; and therefore to accept the challenge he offers me, the game would not be worth the candle to me; but if my engagements would permit, and I had the opportunity, I should not mind spending time and money in going into Staffordshire to see him turn out 13,770 cubic feet of air per minute with a resisting pressure equal to 3½ inches water gauge, and with 3·14 indicated horse-power only. I think your readers will soon incline to the thought that there is a good deal of efficiency in the inventor, whatever there is in the fan.
THOS. HODGSON.
Newport, Mon., January 8th.

THE WILLANS ELECTRIC GOVERNOR.

SIR,—We notice at page 17 of your last week's issue a reference to an electric governor, which may give a wrong impression. It is mentioned as being jointly devised by Mr. Hartnell and Mr. Willans, and made by Messrs. R. E. Crompton and Co. Will you allow us to say that, although Mr. Hartnell was engaged at about the same date as Mr. Willans upon the question of governing the speed of engines by the current produced by the dynamos driven by them, and arrived independently at very similar results, the first patent was taken out by Mr. Willans alone, and the first governor was actually made here before he was aware that Mr. Hartnell was working in the same field. The electrical details were worked out jointly by Mr. Willans and Mr. Crompton, but the whole of the experiments, which lasted several months, were carried out here, and under Mr. Willans' supervision. Two further patents, which it is almost premature to mention, have been taken out, one by Mr. Willans, and one in the joint names of Messrs. Hartnell, Willans, and Crompton; but all the governors hitherto made have been made here, under Mr. Willans' patent, and they will continue to be made here. It is a source of pleasure to us, as it is to Mr. Willans personally, that in the development of an invention which may play an important part in the future of electric lighting, we shall be able to work in concert with engineers of such eminence as Mr. Wilson Hartnell and Mr. R. E. Crompton, whose share in the improvements and extensions covered by the latest patent is of the utmost importance. But as the invention in its primary forms has taken many months of Mr. Willans' time and care, and as its first successes have been gained in combination with his patent compound engines—of which we are the makers—we think it is only fair to him and to ourselves that the facts should be stated.
WILLANS AND ROBINSON.
Thames Ditton, January 14th.

AYR HARBOUR SLIPWAY.

SIR,—Mr. Strain's letter in your issue of the 4th inst. calls for some reply from us, and with your permission we would like to state one or two facts which he has omitted.

When Mr. Strain and the representatives of the Harbour Trustees—including Mr. Taylor of the firm of Messrs. J. and A. Taylor, engineers, of Ayr—visited our works to inspect our hauling-up slip, it was pointed out to them that the machinery was originally designed by us to haul up vessels of 800 tons maximum dead weight, but that afterwards, finding that our slip and winding gear was capable of doing heavier work, we added an auxiliary engine to give the necessary additional power, and we have since successfully hauled up vessels up to 1150 tons dead weight, or more than 40 per cent. heavier than we at first intended, a very substantial proof that our machinery was not "designed too weak," as Mr. Strain takes upon himself to state.

We hope the Ayr slipway may prove equally successful. As regards the payment to us of one hundred guineas by the Trustees, we refused to accept same on any other terms than as a "Patent Right," and Mr. Strain himself drew up and worded the receipt we gave to this effect, as the following copy dated February 14th, 1882, will show:—"Received from the Ayr Harbour Trustees the sum of one hundred and five pounds sterling in full of all claims competent to us, for use by them or their contractors of our Patent Right for appliances for hauling up vessels on slipways. Dated 11th January, 1879, No. 121, at their slip dock at Ayr.—(Signed) DAY, SUMMERS, AND CO."

Respecting the validity of our patent, which Mr. Strain would now dispute, although his letter goes some way to establish the fact, we are happy to state that we have far higher authority than his to support us, of which we shall not fail to avail ourselves should occasion require it, and therefore "those who may wish to build a slip dock" will do well to hesitate before accepting Mr. Strain's gratuitous advice to ignore our claim of patent right for the wire rope system.
DAY, SUMMERS, AND CO.
Northam Ironworks, Southampton, January 15th.

[This correspondence must end here.—ED. E.]

THE CELTIC.

SIR,—The sailing power of a broken-down steamship is a subject of some importance, on which great varieties of opinion are often expressed. The following log of the White Star steamer Celtic may therefore be interesting, especially as the same ship has again met with a mishap, having, as well known, broken her screw shaft on the 16th December, 1883, when twenty-four hours out from New York, and homeward bound for Liverpool. I may mention that the Celtic has the reputation of being the best sea boat in the North Atlantic trade. Her gross registered tonnage is 3888 tons, the Britannic and Germanic being 5008 tons, and the Alaska a few tons short of 7000. It will be seen from the log that the Celtic's speed under sail was by no means contemptible, averaging about 4·56 knots.

Log of R.M.S. Celtic, Homeward Voyage, January, 1879.

Knots run from noon to noon each day.

Jan.	Knots.	
23	—	Left New York and anchored, fog.
24	—	
25	326	
26	340	
27	348	
28	330	
29	265	S.E. gale and high sea.
30	101	Propeller loose on shaft 6 p.m.; 1094 miles from Queenstown; giving six hours' steaming and nearly eighteen hours' sailing only for day's run.
31	96	
Feb.		
1	73	Heavy sea.
2	79	Heavy sea.
3	85	Heavy sea.
4	185	
5	174	
6	180	W. gale and heavy sea; propeller struck and damaged rudder post, was secured and prevented from revolving.
7	84	157 miles at noon from Queenstown.
8	—	Off Fastnet at 6.30 a.m.; towed into Queenstown, arriving 10 p.m. Passage, 15 days 10 hours 38 minutes.

New York, January 2nd.
A FREQUENT TRAVELLER.

THE NEW PATENT LAW.

SIR,—Your correspondent "P. J. L." is quite right in his reading of Sec. 13. Provisional protection is, as he says, now "a delusion and a snare." The intention plainly is that no action shall be commenced for infringement committed before the publication of the specification. A nice door is here opened for the numerous gentry who are always on the look-out for an easy way of making money, and unless I am much mistaken a new business will spring up out of this very section. There are plenty of small things, such as are generally known as "Yankee notions," which will no doubt now be patented under the new cheap law, and the inventors being in a hurry to realise will of course put their inventions on sale without delay. Now comes the time of the pirates. If they see a good thing, what is to prevent them from flooding the market with it? and as for the inventor, well he must "grin and abide." When the new Patent Bill which has now become law was first introduced into Parliament last year, I was favoured with an early copy, and wrote a number of letters to the Manchester newspapers on the subject. Amongst other points I particularly called attention to this section, and stated that if it was retained in the Act, there would be nothing for it but for inventors to file a complete specification at the outset, as provisional protection there was none. "P. J. L." being a Manchester man must have seen those letters, and if he had given any assistance at the time, we might perhaps have had that and other bad points remedied. But no! he prefers to wait until the Act is passed, and then appeal to you as if he had just made a discovery! It is next to impossible to get up an agitation on the Patent Laws, owing to the supineness of inventors and the public, and therefore they must be satisfied with what legislation is provided for them. Those who recollect what trouble it was to get the Act of 1852 passed, and how difficult it was here in Manchester to get even a handful of people together at a town's meeting, presided over by the Mayor, or by the late Sir Wm. Fairbairn, and attended as was nearly always the case by the late Mr. Webster, Q.C., and many other prominent men of the time, may well wonder how ever such an Act as the present has come to be passed at all; but what was difficult then is as difficult now, the apathy of inventors and the public is just the same—nothing can be got from Parliament without outside pressure, and in this matter of patents for inventions that certainly has never been used.
G. SEPTIMUS HUGHES.
Office for Patents, 132, Crosscliffe-street, Manchester, S.W.

ELECTRIC LIGHTING IN BRIXTON.

SIR,—Our attention has been drawn to an article which appeared in your last week's issue headed as above, in which you describe with illustrations the Clark-Bowman patent arc lamp. We think you have rather under-estimated both the candle-power and the horse-power; but what we specially wish to point out is that you say "It is very handsome, beautifully made, and very expensive." We presume this is a printer's error, and that the last word should read "inexpensive," for we can sell the lamp with globe complete at a price which compares very favourably with any in the market. Again, in the concluding paragraph you say, "It appears too delicate for heavy work." We, of course, do not know what you consider heavy work, but we have had forty of our lamps running for four months with a daily average of six and a-half hours each, and one has been running nearly twelve months without any hitch whatever.
CLARK AND CO.
411, Brixton-road, S.W., January 16th.

[Our printers are blameless.—ED. E.]

THE EMPIRE LUBRICATOR.

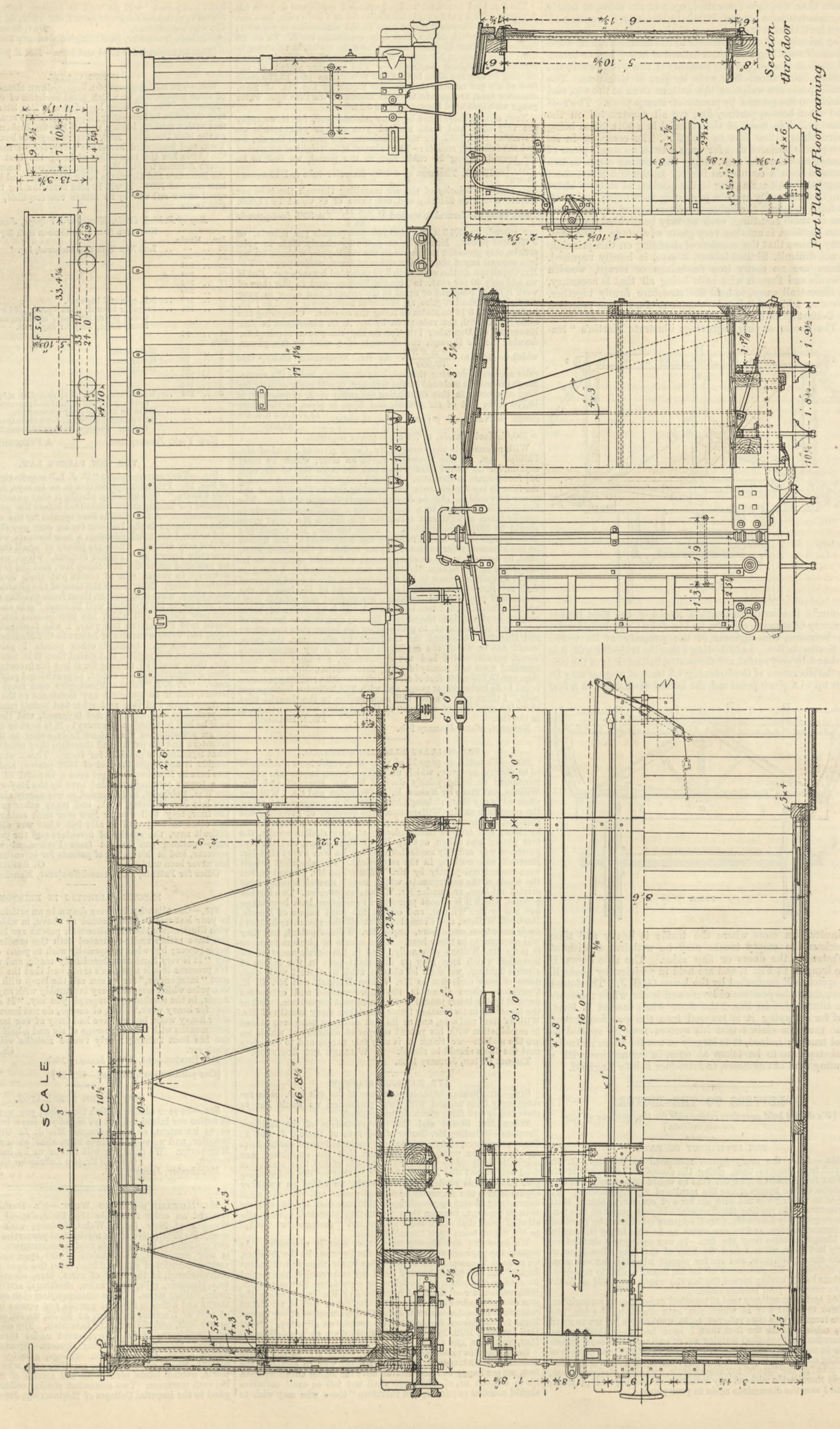
SIR,—In your edition of 28th December, you were good enough to notice our lubricator, but we regret you have been misinformed as to its origin, as our manager, Mr. J. L. Grandison, is the inventor, and we make all these lubricators at our works here in Manchester. We trust you will favour us by inserting this correction.
(For the Empire Lubricator Company),
JAMES WEIR.
Manchester, January 11th.

MR. KIRCALDY'S TESTING WORK.—Mr. David Kircaldy has received an order to supply the Technological and Industrial Museum of New South Wales, Sydney, with a collection of specimens illustrative of the mechanical properties of various kinds and qualities of the materials used in construction. The collection is now completed, and consists of 330 specimens, representing various qualities of steel and iron, from the hardest to the softest manufactured, in the form of wires, bars, sheets, plates, angles, tees, channels, rails, tires, axles, shaftings, and forgings, tested under pulling stress. Cards accompanying each specimen give the elastic and ultimate stress in pounds per square inch, contraction of area at fracture, extension at 40, 50, 60, 80, or 100,000 lb. per square inch, and the ultimate extension. The collection also contains specimens of the above, tested under thrusting, bending, twisting, shearing, and bulging stresses. Specimens of copper, copper alloys, steel and iron castings, granite, marble, stones, cement, wood, chains, hemp, manilla, and wire ropes, rivetted joints, welded joints, cards with the results of the tests accompanying each specimen. Two somewhat similar collections were supplied to the Imperial Colleges of Engineering, Japan.

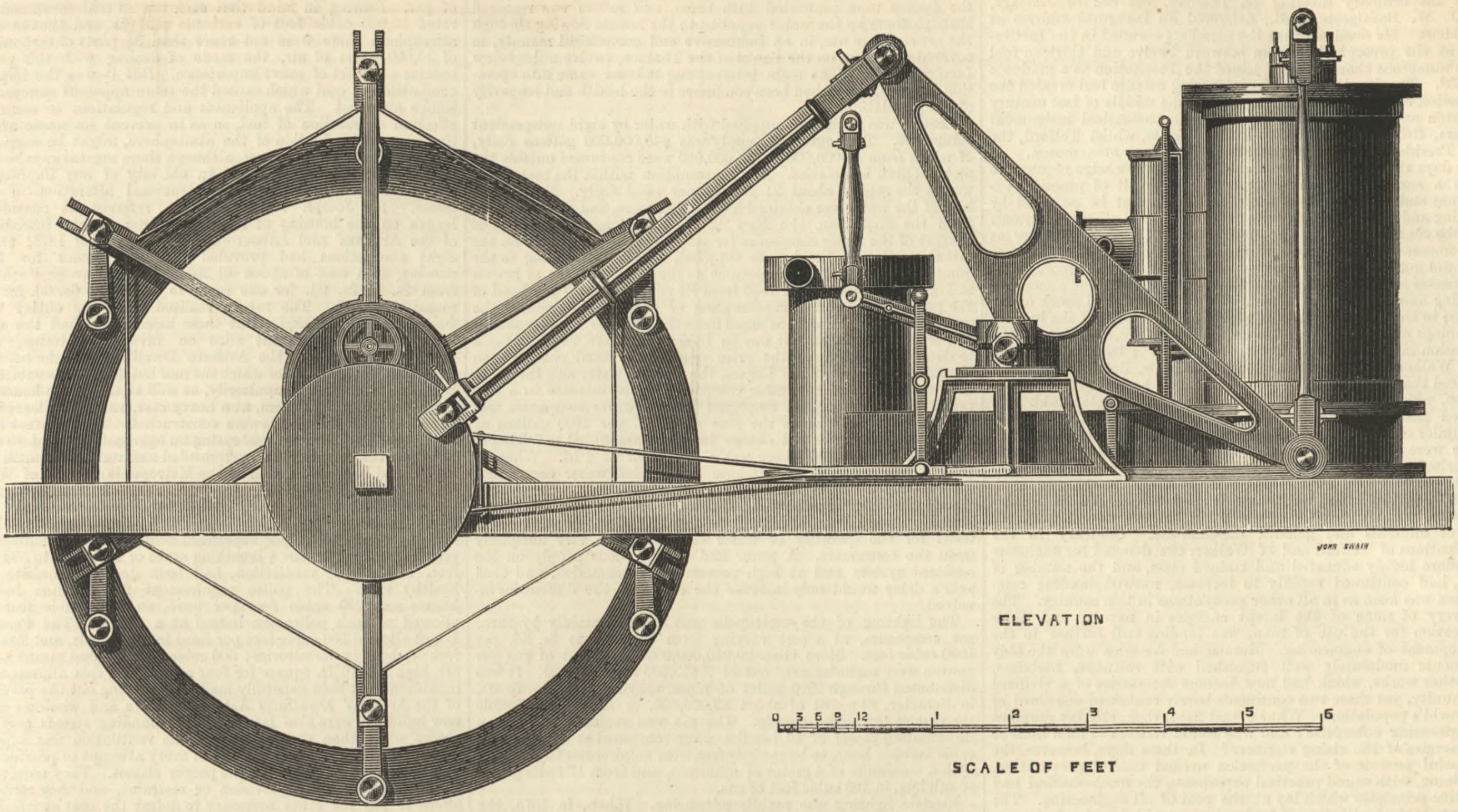
STANDARD BOX CAR, NEW YORK, WEST SHORE, AND BUFFALO RAILWAY.

THE PULLMAN SLEEPING CAR COMPANY, PULLMAN, CHICAGO, ENGINEERS.

(For description see page 47.)



AN OLD MARINE ENGINE.



THE accompanying engraving is a reduced copy of a drawing kindly placed at our disposal by Messrs. J. Jones and Sons, St. George's Engine Works, Liverpool. The drawing bears the words, "An elevation of the Etna steamboat engine, by J. Worden, 10 July, 1817." We have been unable to obtain any further information concerning this curious old engine. Perhaps some of our correspondents can assist us. It will be seen that the boat had feathering paddles.

LYON'S LATHE HEADSTOCK.

THE lathe headstock illustrated by the annexed engraving has been designed for use in the mechanical school at Cambridge, by Mr. James Lyon, demonstrator. It embodies some new features which Professor Stuart also thinks are great improvements on the usual design. It will be seen from the engraving

FIG. 1.

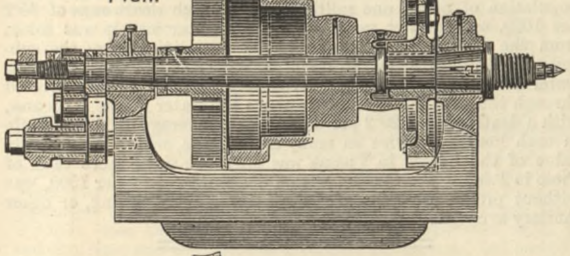
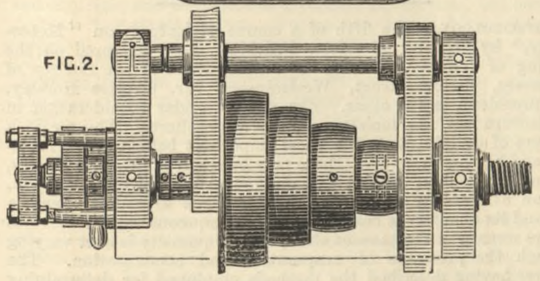
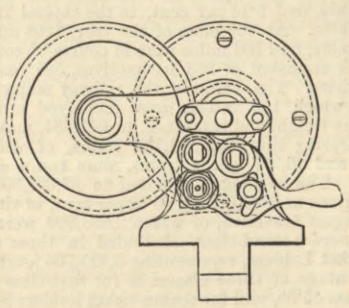


FIG. 2.



that the back spindle never projects beyond the headstock in front, and therefore does not come in the way of nuts, &c., on the back of a face-plate. The arrangement only requires one idle space on the main mandril instead of two. It enables the front pinion to be shrouded, and brings the large spur close

FIG. 3



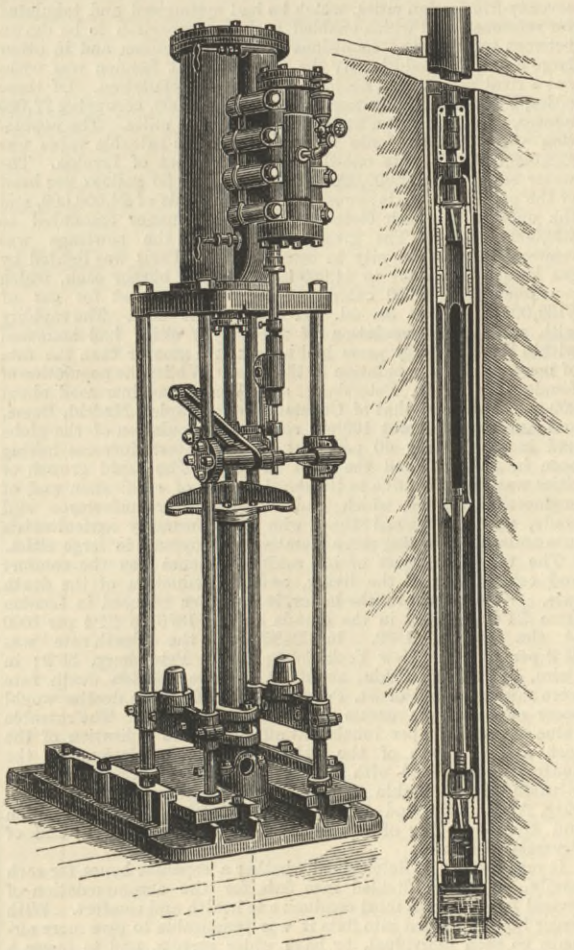
to its work; so that the only part of the spindle in torsion is the front cone.

The improvements will be understood by those interested in lathe construction, but there is no doubt that different opinions will be held or expressed on its merits, and we publish it as belonging to a subject which interests lathe constructors and amateurs in the art of turning.

THE following appointment has been made at the Admiralty:—A. J. Nye, engineer, to the Osborne, vice Norrington.

BLAKE'S ARTESIAN PUMP.

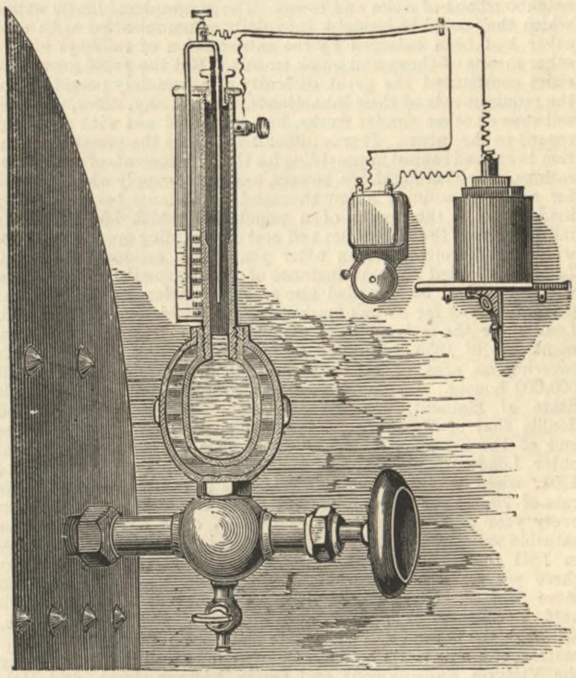
THE accompanying engravings show a form of vertical bucket plunger direct-acting steam pump, made by Messrs. George F. Blake Manufacturing Company, Washington-street, Boston, Mass., specially designed for non-flowing artesian wells, or for tube wells where the lift would be over 25ft. The pump bucket, placed down the well, discharges the water on the up stroke, while the upper plunger discharges on the down stroke. The lower barrel instead of being bushed with brass tubing is of



hard composition bored. The pump bucket and foot valve can be drawn up together through the tubing for examination or repair. The above ground portion slides to one side on the bed-plate, which is a convenience when it is desired to pull out the pump rods or take up the well piping.

ELECTRIC ALARM FOR STEAM BOILERS, &c.

THE object of this invention is to provide an electric alarm apparatus more especially intended for use as a low-water indicator for steam boilers; it is also applicable to ovens, furnaces, and other contrivances where the heat within must be regulated. The device consists of a mercury bulb inclosed in a sectional globe which forms a chamber around the mercury bulb, as shown in the engraving, which represents the device in vertical section and attached to the side of a boiler. The chamber communicates with the interior of the boiler through the valve stem, to which the globe is attached. In the plate which closes the upper end of the thermometer-like device, is fitted a thumb nut through which passes the insulated arm of a bent rod. The insulating material on the arm is threaded to match the screw threads of the nut, so that by turning the nut the bent rod may be raised or lowered to suit the temperature at which it is desired to have the alarm given. The other arm of the rod is of the same length as the first, and reaches down in front of a graduated plate attached to the thermometer tube, thus serving as an indicator for setting the rod with reference to the degree marks on the plate. In the upper right-hand corner of the engraving is shown the battery and electric alarm, which are connected by wires to the bent rod and mercury tube. When the water in the boiler stands above the low-water line, the water entering the chamber through the stem will prevent the entrance of steam, and the mercury in the bulb will have the same temperature as the water, causing it to stand in the tube somewhat below the lower end of the arm. When the water in the boiler falls below the low-water line, steam will enter the chamber, and, being of a higher temperature than the water, will cause the mercury to rise in the tube until it comes in contact with the end of the arm, when the electric circuit is completed and the alarm sounded. In the spindle is fitted a screw plug for



cutting off communication between the chamber and boiler in case it should be desired to unscrew the apparatus. The upper end of the mercury tube is enlarged above the end of the rod in order to prevent all danger of overflow of the mercury in case of excessive heat. These alarms are being manufactured by Messrs. McKenna and Carley, Cortlandt-street, N.Y. City.—*Scientific American.*

SOUTH KENSINGTON MUSEUM.—Visitors during the week endin Jan. 12th, 1884:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 11,765; mercantile marine, Indian section, and other collections, 3465. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 4 p.m., Museum, 1664; mercantile marine, Indian section, and other collections, 281. Total, 17,175. Average of corresponding week in former years, 17,076. Total from the opening of the Museum, 20,704,774.

NOTHING IF NOT SCIENTIFIC.—The stir and talk about stability, arising out of the Daphne and Austral disasters, has surely been fruitful of nothing so "fetching" as the following bit of scientific verdancy related to me as a positive fact. A chief engineer, present at the launch of a steamer in which he was afterwards to serve, accosted the manager of the yard at a moment when he was busily superintending the work preparatory to launching. Wearing a look of grave concern, the engineer said,—"I say, Mr. A., has this boat of ours got a metacentre?" Mr. A. looked at his questioner a moment, cast his eyes to a lofty part of the ship on the stocks, and then back again to the serious countenance before him, saying, as if in exasperation, "Great heavens! Mr. B., have you not got eyes in your head?" The poor man of science looked abashed, cast his eyes in the direction in which he had seen the manager look, and murmured half apologetically, "Ah, to be sure, I see it!"—*Glasgow Weekly Mail.*

INSTITUTION OF CIVIL ENGINEERS.

PRESIDENT'S ADDRESS.

At the ordinary meeting on Tuesday, the 8th of January, Sir J. W. Bazalgette, C.B., delivered an inaugural address as President. He observed that the members enrolled in the Institution at the present time were between twelve and thirteen-fold more numerous than when he joined the Institution as a graduate in 1838. The development of engineering science had created the profession of the civil engineer. About the middle of last century Smeaton and Watt commenced life as mathematical instrument makers, Brindley and Cubitt as millwrights, whilst Telford, the first President of the Institution, began as a stonemason. In their days the sentiment prevailed that the knowledge required to make a successful engineer must be the result of practical experience and natural genius alone, and could not be acquired by training and study, coupled with experience, as in other professions. But the contrast between the profession of the civil engineer at the commencement of this century with its condition at the present time did not stand out in sharper relief than did the ignorance of the masses at the beginning of this century, with the amount of learning now attained by them. Telford attributed much of his success to the thorough way in which he had mastered the humble beginnings of his trade; and both he and Walker considered the profession in their time as overstocked. But in 1856, fifteen years after Walker had given expression to this view, Robert Stephenson declared that engineering from a craft had been raised to a profession, which had spread its influence over the whole world. He showed that in the United Kingdom alone there then existed 8000 miles of railway, on which £286,000,000 had been expended. There were now upwards of 18,000 miles of railway, having an authorised capital exceeding £800,000,000, on which the gross annual receipts were £67,000,000, and the annual working expenditure £35,000,000. These railways carried 623,000,000 passengers annually, besides 500,000 season-ticket holders, and 246,000,000 tons of minerals and general merchandise. Contrary to the anticipations of Telford and of Walker, the demand for engineers of a more highly educated and trained class, and the number of these, had continued rapidly to increase, notwithstanding competition was keen as in all other occupations in this country. The discovery of some of the latent energies in nature, and their application for the use of man, was tending still further to the development of engineering. Europe and America were the only continents moderately well furnished with railways, harbours, and other works, which had now become necessaries of a civilised community, yet these two continents barely contained one-third of the world's population. What a vast field, then, still lay dormant to engineering enterprise! and who would venture to fix a limit to the energies of the rising engineer? In these days, however, the successful pursuit of the profession needed careful preparation, combining, with sound practical experience, the mathematical and scientific principles which lay at the root of all engineering. The students of the Institution of to-day were provided with advantages not enjoyed by the graduates of old. From 1867 to 1869 the Council collected much valuable information respecting the education of engineers, and many practical and valuable suggestions had been made on the subject. Its importance could not be over-estimated if the British engineer was in the future to maintain the position in the front ranks of the profession which he had hitherto held. Although not specially designed for the better education of the younger members of the profession, the delivery of a series of lectures on the "Practical Applications of Electricity," at extra meetings held for the purpose during the past year, could not have failed very materially to promote that object. The success which had attended these lectures had induced the Council to inaugurate a second series during the present session on "Heat in its Mechanical Applications." Sir Joseph Bazalgette then dwelt on those engineering works which promoted the health and comfort of the inhabitants of large cities, and by which human life might be preserved and prolonged. He observed that civilisation induced people to congregate in the neighbourhood of cities and towns. The geographical limits within which they could be brought into daily communication with each other had been enlarged by the introduction of railways and of other means of cheap and quick transit. But the rapid growth of cities constituted the great difficulty of adequately providing for the requirements of their inhabitants. Few, if any, cities, nor even railways or other similar works, had been laid out with sufficient regard to the future. It was difficult to induce the present generation to expend capital in providing for the requirements of after generations. The thoroughfares, sewers, and water supply which sufficed for a city containing a few thousand inhabitants became totally inadequate to the wants of a population which had grown to millions; and the difficulties and cost of providing open spaces or of widening thoroughfares in after years were seriously increased. London afforded such an instance of rapid growth. It was now without a rival as regarded size and population, not only in the present, but as far as was known in the past history of the world. London, or the metropolis, as defined by the Metropolis Management Act of 1855, contained at present nearly 4,000,000 people covering an area of 117 square miles, upon which were built 500,000 houses. Its population was equal to that of the whole State of Holland, was greater than that of Scotland, and double that of Denmark. At the same rate of increase, by the end of the century, it would equal that of Ireland, as indeed outer London now did. Its population had quadrupled since 1801, when it numbered 959,000; and it now increased at the rate of 70,000 per annum, equivalent to the addition to London every year of a city as large as Geneva or of Plymouth. The rateable value of property in London had grown from £6,000,000 in 1841 to £28,000,000 at present, or nearly five-fold in forty-three years. But the traffic through London has risen even more rapidly. The arterial lines of thoroughfare, wide enough half a century ago, were now altogether insufficient. Thus, although the Strand and Cheapside had been relieved by the formation of a new route between Charing-cross and the Bank, along the Victoria Embankment and Queen Victoria-street, and Holborn had been relieved by a new route from Oxford-street to Shoreditch, and new and widened streets continued to be made through the City and other crowded localities, the old lines of thoroughfare still remained congested by the traffic. There now passed over the metropolitan bridges daily 384,000 pedestrians and 75,000 vehicles, the annual increase being at the rate of 4½ per cent. and 13 per cent. respectively. The traffic on three metropolitan railways had risen from 79,000,000 passengers in 1871 to 136,000,000 in 1881, or to 373,000 daily. The government of the City of London, by its Lord Mayor and Corporation, had hitherto remained intact; but as part of the general municipality it sent three members to the Metropolitan Board of Works. The metropolis had, however, been from time to time under the management of various local authorities. Prior to 1848 there were seven independent Commissions of Sewers. These were then consolidated into one Commission. In 1855 the principle of local self-government was adopted, and thirty-eight vestries under the control of the Metropolitan Board of Works, were substituted. The Metropolitan Board was clothed with additional powers and duties, which had been in almost every subsequent year extended till it had become the administrative authority for over one hundred Acts of Parliament affecting the metropolis. The demands for improvements in the metropolis were still very pressing, inasmuch as little had been done in this direction in the first half of this century, notwithstanding the population had meanwhile increased two and a-half times. Although £33,000,000 had been expended on improvements since 1855, the arrears of the previous inaction were far from having been wiped out. Hitherto the coal dues, which lightened the burden of municipal taxation to the extent of 2½d. in the pound, had stimulated the introduction of many improvements; and should they be allowed to expire, it would doubtless tend to discourage the execution of works of urgent necessity. There were now about 2300 miles of underground covered sewers, more than half of which had been constructed in the last twenty-seven years. They varied in diameter from 9in. to 12ft. 6in. All the houses were connected with them, and refuse was removed through them by the water supplied to the houses flowing through the sewers after use, in an inoffensive and economical manner, to covered reservoirs on the banks of the Thames, twelve miles below London Bridge. The main intercepting scheme came into operation in 1870-71, and had been conducive to the health and longevity of the population.

London was at present supplied with water by eight independent companies. The aggregate supply was 140,000,000 gallons daily, of which from 15,000,000 to 18,000,000 were consumed outside the metropolitan boundaries. The consumption within the metropolis was at the rate of about 31 gallons per head daily. Nearly one-half of the water was obtained from the Thames, and the remainder from the river Lee, the New River, and other sources. The charges of the water companies for water were mostly based on the rateable value of the houses supplied, and not according to the quantity consumed. But inasmuch as the rateable value of houses in London had risen since 1855 from £4 per head to £7 per head of the population, and the consumption of water had remained the same, the price of water, as based upon the rateable value, was now 75 per cent. dearer than it was in 1855; and there was no reason to doubt that so long as the price remained a fixed charge upon the rateable value of the houses, the cost of water and the value of the property of the water companies would increase in a like ratio. The total capital employed by the water companies was about £13,200,000, or at the rate of 61·7d. per 1000 gallons of water supplied. The net charge for water amounted to 7·3d. per 1000 gallons, on which there was a net profit of 4·1d. When in 1880 it was proposed to purchase the London water companies, the arbitrator valued their interest at £33,000,000. Sir Joseph Bazalgette then showed how the mode of charging upon the rateable value of the houses, instead of by meter, made the payment for the quantity of water consumed fall very unequally upon the consumers. A purer and more copious supply on the constant system and at high pressure was demanded, and each year's delay would only increase the cost and the difficulties involved.

The lighting of the metropolis was effected mainly by three gas companies, at a cost varying from 2s. 10d. to 3s. 2d. per 1000 cubic feet. More than 20,000,000,000 cubic feet of gas per annum were manufactured out of 2,000,000 tons of coal. It was distributed through 2500 miles of pipes, varying from 3in. to 4ft. in diameter, at a cost of about £3,000,000, or more than double the cost of the water supply. The gas was required to have an illuminating power of 16 candles when consumed at the rate of 5 cubic feet per hour, to be entirely free from sulphuretted hydrogen, with a maximum of 4 grains of ammonia, and from 17 to 22 grains of sulphur, in 100 cubic feet of gas.

Electric lighting was rapidly advancing. When, in 1878, the Jablochkoff Company commenced lighting a portion of the Victoria Embankment, the charge for each lamp was 5d. per hour. This had been reduced by stages, and since June, 1881, forty lights on the Embankment and ten on Waterloo Bridge had continued to be lighted at the rate of 1½d. per light per hour. In fact, twice the illuminating power was at present obtained on the Embankment by electric lighting for the same money if expended on gas. But it had been stated that the contract had not been profitable at the latter price. Incandescence lighting, though much more costly in production, was more economical in the regulation and distribution of the light.

Sir Joseph Bazalgette then alluded to statistics respecting seventy-five foreign cities, which he had epitomised and tabulated for reference, and which enabled such a comparison to be drawn between some of the conditions existing in London and in other large cities, as would justify the assertion that London was without a rival as regarded health, extent, and population. Of these cities, Paris contained a population of 2,240,000, occupying 77,000 houses, and covering an area of thirty square miles. The population was twice as dense as in London; its rateable value was £24,000,000, not quite one-third less than that of London. The water supply was 82,000,000 gallons daily, or 36 gallons per head of the population. Its sewers had cost upwards of £4,000,000, and the expense of their cleansing and maintenance amounted to £50,000 a year. The greater portion of the sewerage was removed out of the city in cans by carts. Paris was lighted by gas lamps equivalent to 44,000 lamps of one burner each, which consumed 770,000,000 cubic feet of gas, at a cost for gas of £130,000, or about 3s. 4d. per 1000 cubic feet. The rapidity with which the population of most large cities had increased within the last forty years had been much greater than the rate of increase of the population of the globe. Whilst the population of London, Paris, St. Petersburg, and Vienna had increased about 200 per cent., and that of Constantinople, Naples, Madrid, Rome, and Amsterdam, about 100 per cent., the population of the globe had increased only 40 per cent., the greatest increase having been in America, and the least in Asia. The rapid growth of cities was doubtless due to the development of civilisation and of engineering science, which had stimulated manufactures and trade, and had turned those who were formerly agriculturists into artisans, obtaining more lucrative employment in large cities.

The ultimate object of all sanitary science was the comfort and convenience of the living, and the reduction of the death rate. With respect to the latter, it had been reduced in London from 24·4 per 1000 in the decade ending 1870 to 21·4 per 1000 at the end of 1882. In Baltimore the death rate was 21·9 per 1000; in New York, 30·6; in St. Petersburg, 35·2; in Cairo, 37; and in Pekin, about 50. If the London death rate were raised to that of St. Petersburg, 55,000 more deaths would occur each year in excess of the present deaths. The rateable value of the cities per inhabitant afforded some indication of the cost, and therefore of the extent of accommodation, of the houses, as compared with the number of their occupants. The rateable value of Pekin was £2 8s. per inhabitant; of St. Petersburg, Amsterdam, and Calcutta, £3; of Vienna £6; of London and Hamburg, £7; of Berlin, £7 14s.; of Paris, £10; and of Brussels, £11 8s.

It remained to be determined whether a separate house for each family, or houses divided into flats for the accommodation of several families, was most conducive to health and comfort. With larger houses divided into flats it was practicable to give more air-space to each individual, to have wider streets, and to house a large number of persons upon a smaller area. When it was stated that Paris, with more than one-half the population, covered only rather over one-fourth of the area of London, and gave an average of 116 persons per acre as against 53 persons per acre in London, it did not follow that Paris was overcrowded. The expression "overcrowded" should have reference rather to an insufficient air-space per individual in the dwellings and the thoroughfares, than to the density of population per acre. Separate well-built mansions for the rich left little to be desired. Large houses laid out in tenements appeared to offer many advantages for the poorer classes. In contemplating any comprehensive improvement of large cities, the following questions presented themselves for consideration:—What should be the widths of the streets? To what height should the houses be restricted? What should be the minimum air space allotted to each individual in the houses? What proportion of the area of a city should be set apart for its recreation grounds? What public buildings and markets, and what water supply, sewerage, and means of lighting should be provided? What should be the regulations to be enforced to secure the effectual combustion of fuel, and to prevent the contamination of the atmosphere by smoke? No street should be of less width than 40ft., and not less than two-thirds of the height of the houses surrounding it. The limit of the height to which houses might be carried with advantage materially depended on the height at which the upper stories could be supplied with water, and also on the height to which a useful jet of water could be thrown in cases of fire. In London, 5,800,000 tons of coal were consumed per annum, in addition to 2,000,000 tons used in the manufacture of gas. Bearing in mind that each ton of coal consumed generated 56,000 cubic feet of carbonic acid gas, and that in a pure atmosphere there were not more than 3½ parts of carbonic acid of 10,000 parts of air, the mode of dealing with this product became a subject of grave importance. But it was the imperfect combustion of coal which caused the more apparent annoyance of smoke and soot. The appliances and regulations to secure the effectual combustion of fuel, so as to prevent its waste and unnecessary contamination of the atmosphere, might be carried out in new cities at no great cost, although there must always be objection to the introduction into an old city of any improvement which rendered necessary some structural alteration in every house. Sir Joseph Bazalgette then referred at considerable length on the housing of the poor. Prior to the introduction of the Artisans' and Labourers' Dwelling Act of 1875, twenty-eight associations had provided improved homes for 32,435 persons, at a cost of about £1,200,000, at an average rental of from 2s. to 2s. 9d. for one room to 4s. 6d. to 6s. 6d. for three rooms per week. The return realised upon the outlay varied from 2⅝ to 6¼ per cent. But these associations had the advantage of selecting vacant sites on favourable terms, whilst under the operation of the Artisans' Dwellings Act the houses on any unhealthy district for which the new buildings were substituted had to be purchased compulsorily, as well as the public-houses and shops mixed up with them, at a heavy cost, and then cleared, and new thoroughfares and sewers constructed. Twelve areas in different parts of London, embracing an aggregate area of 40 acres, in which the houses were overcrowded and unfit for human habitation, had been dealt with by the Metropolitan Board of Works, at a cost of £1,500,000, and some further areas by the Corporation. The cost of the new buildings had varied from 6d. to 8d. per cubic foot. The sites which had been cleared for their erection had been sold at from 2s. to 5s. per superficial foot. In the dormitories of poor-houses and prisons a breathing space of from 450 to 500 cubic feet, with proper ventilation, had been deemed requisite for a healthy man. The police requirement for common lodging-houses was 240 cubic feet per head, and 450 cubic feet were allowed to each policeman lodged at a station. The Poor-Law Board allowed 500 cubic feet per head in sick wards, and 300 cubic feet per head in dormitories; 500 cubic feet per head meant a room 8ft. high and 15¾ft. square for four adults, and this allowance per inhabitant had been generally made in carrying out the provisions of the Artisans' Dwellings Act. The doors and windows of the new buildings were also larger, the surrounding streets and open spaces wider than previously, and the ventilation was superior. A practical difficulty was evolved in every attempt to provide suitable houses compulsorily for the poorer classes. They objected to be placed under any supervision or restraint, and they could not afford to pay the rents necessary to defray the cost at which the improved accommodation could be so provided; and even where low rents had been offered the new dwellings became inhabited by a better class than those who had been displaced, and the latter sought other poor neighbourhoods, which were thus again overcrowded. One objection to the Artisans' Dwellings Act was, that under its operation it became the interest of the landlord of the dwellings of the poor to allow them to fall into a condition unfit for human habitation, so that they might be purchased compulsorily, and the higher the rents the larger would be the amount of compensation. This class of property was frequently sublet to middlemen, who collected such rents as produced a very high rate of interest on its value. Strict supervision by one competent authority, having no local interest, was needed, so that all places might be judged by a uniform standard. More summary powers should be granted to oblige landlords to repair and maintain their houses in a habitable and cleanly condition, and to prevent overcrowding; and in case of default, after due notice, such houses should be pulled down in the same manner in which "dangerous structures" were now dealt with under the Building Act of 1855. A high death-rate would in most cases be found to be the companion of defective house accommodation, ventilation, water supply, sewerage, or scavenging. Thus St. Petersburg, with a population of nearly one million, and the high death-rate of 35·2 per 1000, was without sewerage, and its water supply was taken from the river Neva, contaminated by percolation from the subsoil. Cairo, with a death-rate of 37 per 1000, was supplied with water from the Nile; it had no sewers, and the sewage filtered through the subsoil into the Nile above the water intake. Vienna, with a death-rate of 29·2 per 1000, had an average of sixty people in each house, or twice as many as in Paris, whilst the rateable value of the houses in Vienna was only one-sixth more than of those in Paris. And Pekin, with a death-rate of 50 per 1000, was without proper sewerage, water supply, street-cleansing, or other sanitary arrangements.

METEOROLOGY.—The fifth of a course of lectures on "Meteorology," by Mr. W. Marriott, F.R.M.S., was delivered on the evening of January 10th, in the reading-room of the Society of Engineers, Victoria-street, Westminster, Mr. Charles Horsley, past-president, in the chair. The subject under consideration in this lecture was the moisture of the atmosphere. The air is a mixture of certain gases, the most important being oxygen, nitrogen, and aqueous vapour. These may be resolved into two classes, viz., an atmosphere of dry air, embracing oxygen and nitrogen, and an atmosphere of aqueous vapour. The dry air is always a gas, and its quantity is constant; but the aqueous vapour does not always remain in the gaseous state, and its quantity is ever varying through the processes of evaporation and condensation. The lecturer having described the methods employed for determining the amount of evaporation, explained how dew, hoar-frost, mist, and fog are formed. The lecturer concluded by giving a description, with illustrations, of the various forms of cloud.

AUSTRALIAN RAILWAY STATISTICS.—A recent official return shows that in New South Wales during 1882 the total expenditure for railway construction was £16,776,642, of which the sum of £15,848,494 was expended on lines opened for traffic. The net earnings were £764,228, yielding 4·55 per cent. to the total capital expenditure, and 5·14 per cent. to the capital invested on lines open for traffic. At the close of the year, 1268 miles of line were open for traffic, and 504 miles were in course of construction. The rolling stock consisted of 268 locomotives, 564 coaching, and 5445 goods vehicles. The value of the railway materials, in the conveyance of which 155 vessels were employed amounted to £447,431, and the freight and insurance, to £42,684, making a total of £490,115. During the year, 104,153 trains, of which 57,176 were passenger and 46,977 goods trains, were run a distance of 4,851,127 miles. The earnings amounted to £1,698,863, and the working expenditure to £934,635, or 55·02 per cent. of the earnings. 8,984,313 passengers travelled, of whom 2,836,909 were first-class and 6,147,404 were second-class. Included in these figures are 15,785 season-ticket holders, representing 3,425,736 journeys. The proportion percentage of these classes is for first-class passengers 16·03, second-class 45·85, and for season-ticket holders 38·12. The merchandise traffic consisted of £1,348,679 head of live stock, 235,918 bales of wool, 1,789,896 tons of minerals, and 725,281 tons of general goods. The earnings per mile open were £1518; the expenditure was £835; the net earnings were £683. The earnings per train mile were 84·05d., the expenses 46·24d., and the net earnings 37·81d. There was an increase of 411,270 in the number of first-class passengers, of 751,117 second-class and 914,614 in the journeys made by season-ticket holders, also an increase in the receipts of £99,150 from coaching traffic, and of £155,487 from goods traffic—making a total increase of £254,637. In consequence of careful management on the various lines, collisions and other serious accidents are of comparatively rare occurrence.

RAILWAY MATTERS.

CAPTAIN EADS estimates that his proposed ship railway across the isthmus of Tehuantepec, a distance of 153 miles, can be completed in two years for the sum of 25,000,000 dols.

THE first of the permanent caissons for the Forth Bridge, 70ft. in diameter, is now being put together on the beach, where it will be rivetted up by hydraulic power, and then floated into position.

THE Bill promoted by the Channel Tunnel Railway Company will not be presented for Parliamentary sanction next session. The South-Eastern Railway (Channel Tunnel) Bill is to be proceeded with.

WHEN the Northern Pacific Railroad was opened last July the people at Vancouver's Island and Puget Sound came with all sorts of banners, including the Union Jack and the flags of Germany and other countries. Many of the flags bore suitable mottoes for the instruction of the party, and one of them was "Modesty is a great virtue, but you get on better without it."

AT twelve o'clock yesterday arrangements were made for the officials and a small party of visitors to descend the Liverpool side of the Mersey Railway tunnel, in order to see the small portion of the rock cut through that remained between the heading on the Liverpool and the Birkenhead sides of the river. A small boring had been made, through which conversation was carried on.

THE gross earnings of the New South Wales lines in 1882 were £1,698,863, being £254,637, or 18 per cent. in excess of those for 1881. The working expenses were £934,635, being £196,301 in excess of 1880, and the net earnings £764,228. Of the gross earnings, the sum of £587,825 was derived from coaching traffic, and £1,111,038 from goods traffic. The proportion of the former to the latter was 34·60 to 65·40.

AT the Forth Bridge works arrangements have been completed for lighting the whole of the works on both shores and on Inch Garvie by the electric light, divided into five separate installations as follows:—No. 1 lights the whole of the works, shops, and offices on the high ground at South Queensferry; No. 2 lights the works on the shore on this bank; No. 3 lights the works on the north shore; and No. 4 those further inland at North Queensferry; No. 5 lights the works on Inch Garvie. The total provides for about 60 arc and 400 incandescent lamps. Two additional steam barges have arrived, and a hulk for use as a cement store has been anchored at St. Margaret's Hope.

A REPORT by Colonel Rich on the collision that occurred on the 10th ult. at Bournemouth West Station, on the London and South-Western Railway states that:—"The chain brake gear was so much damaged by the collision that the Somerset and Dorset carriage examiner stated that he was unable to say whether anything, and if so what, had been amiss with the chain brake which prevented the porter from putting it on. I am unable to state whether the collision was caused in consequence of the engine-driver pushing the coaches too violently, by the porter failing to apply the chain brake in proper time, or in consequence of the chain brake not being in proper working order."

THE following occurs in a report by Major-General Hutchinson, on the accident which occurred on the 10th November at Aylth Junction station on the Caledonian Railway:—"The permanent way is much too weak for the heavy class of engine employed in working the traffic. This engine weighs no less than 41½ tons on a wheel base of 14ft. 3in., whereas the chairs are very small, weighing only 22 lb. each, and the two sleepers on tbe Newtyle side of the crossing are as much as 3½ft. from centre to centre, and this on a sharp curve of about 500ft. radius. The fact of the gauge near the crossing having been found after the accident as much as 2in. wide seems to prove that the permanent way was too weak."

AT the annual meeting of the Paris Society of Engineers, held on 4th January, M. Marché was succeeded as president by M. Martin. The latter, after touching on the subject of railway tariffs, dealt with that of navigable canals and rivers. He advocated the adoption of hydraulic lifts to meet the differences of level, and also of some method of propulsion less primitive than traction by men or horses. In connection with the proposed Metropolitan Railway of Paris he weighed the advantages and disadvantages of overhead and underground lines. The former would lead to extensive alterations of streets, but the latter, though leading to no expense for expropriation, would involve difficulties of construction, and he feared that a sewer line would never be popular with Parisians. The society now numbers 2037 members.

AN interesting piece of engineering work is just now being carried out in connection with the construction of the new Midland line of railway between New-street station, Birmingham, and King's Norton. It is necessary to run two tunnels under the Worcester and Birmingham Canal, one of which will be devoted to passenger and the other to goods traffic. The passenger tunnel extends from the canal to the junction of the new with the existing line, and the effect of a rupture in the canal bed would be to flood New-street Station. To prevent the possibility of such an accident, a portion of the canal, about 35 yards long, has been pumped dry, the water being kept out of it by sheet pile fences. A strongly bound wooden trough, 7ft. deep and wide enough for the passage of one boat only at a time, has been built, 25 yards in length, in the portion of the bed thus laid bare, and when two other fences have been put down at the ends of the trough, the first two will be taken away, and the water admitted to it. The tunnel to be built will be lowered from 21ft. to 18ft. at the point where it passes under the canal.

MUCH satisfaction has been occasioned in this district, writes our Birmingham correspondent, by the announcement by Mr. Chamberlain, in reply to a communication from one of the Trader's Association in Birmingham, that the whole subject of railway legislation will come before Parliament next session. The right hon. gentleman proposes to then introduce a Bill to extend the powers of the Railway Commissioners, and for other purposes. It is regarded as a foregone conclusion, even as Mr. Chamberlain himself sees, that there will be much opposition; but traders in this part of the kingdom are not only fully prepared, but are quite eager to extend to the President of the Board of Trade the cordial support for which he asks, and without which he states he cannot hope to carry his proposals. It is less easy, however, to follow Mr. Chamberlain's lead when, in referring to the unequal rates charged by the railway companies, for the Birmingham traffic, he expresses himself as not quite able to understand why a case is not taken before the Railway Commissioners. It is difficult to persuade any set of traders just now to be the first to bell the cat. Unless success is a certainty no one hereabouts would, as at present advised, care to commence a legal war with an enemy so strong as one of our leading trunk lines.

IN the Yorkshire coal traffic by railway to London, December was undoubtedly the best month of last year, so far as regards quantity, the increase over November having been upwards of 41,000 tons. The second half of the year opened out well, and business was stimulated by the demands of the miners in the eastern field from Nottingham to Leeds for an advance of wages, which led to merchants, manufacturers, and gas and railway companies stocking heavily in anticipation of a strike. The last three months was therefore a most active period, the quantity of coal sent in each by railway to London being:—

	Tons, Oct.	Tons, Nov.	Tons, Dec.
Midland	217,541	214,879	219,298
London and North-Western	132,942	158,483	143,779
Great Western	110,380	88,908	118,864
Great Northern	121,584	95,776	101,674
Great Eastern	65,638	71,870	87,274
Other lines	7,206	7,161	7,313
Total	655,291	637,035	678,202

The increase in the quantity of coal sent to London in 1883 was shared in to a fair extent by several of the leading collieries in the West Riding, the southern portion of course taking the lead.

NOTES AND MEMORANDA.

BY his experiments recorded in the *Archiv. der Pharmacie*, 256, 1883, Herr G. Vulpius has been led to the conclusion that the rectified pyroligneous acid of commerce is usually an artificial product not obtained by the rectification of crude wood vinegar. Genuine rectified wood vinegar should contain at least 6 per cent. of acetic acid, should decolorise at least ten times its own bulk of permanganate solution, and should become considerably darker in tint after a few hours' exposure to sunlight.

THE final outburst of the Krakatoa volcano took place at twelve minutes to noon on August 27th of last year, and a great tidal depression was created in the Straits of Sunda. At 1.30 p.m. of the same day a wave was felt at Point de Galle, in Ceylon, 3000 kilos. distant, and at 2.15 p.m. one was felt at Mauritius, 5500 kilos. distant. Calculating from these observations, M. de la Croix, a French physicist, estimates the velocity of the molecular disturbance through the water of the ocean to be 2000 kilos. per hour, or 550 metres per second.

THE deaths registered during the week ending January 12th in 28 great towns of England and Wales correspond to an annual rate of 21 per 1000 of their aggregate population, which is estimated at 8,762,354 persons in the middle of the year 1884. The six healthiest places were Portsmouth, Leicester, Bristol, Derby, Wolverhampton, and Plymouth. In London 2681 births and 1493 deaths were registered. Allowing for increase of population, the births were 129, and the deaths 326, below the average numbers in the corresponding weeks of the last ten years. The annual death rate from all causes, which had been equal to 19·8 and 21·6 per 1000 in the two preceding weeks, declined again last week to 19·4.

IN a paper, "On Coal Gas and Gas Engines," by F. Fisher, published in *Dingler's Polytechnic Journal*, the author gives the analysis of the gas employed in driving a 6-horse Otto engine, which he found to be as follows:—Benzine, 0·69; propylene, 0·37; ethylene. 2·11; methane, 37·55; hydrogen, 46·27; carbonic oxide, 11·19; carbon dioxide, 0·81; nitrogen, 1·01; oxygen, trace; total, 100. With the engine running at a low speed, the gaseous mixture, after explosion, contained 2·4 per cent. CO_2 and 17·2 per cent. O; at high speed, after explosion, 6·5 per cent. CO_2 and 9·9 per cent. O, the temperature being 400 deg. C. It is therefore evident that the quantity of air taken in by this machine is from two to four times the volume necessary for complete combustion; and further, that gaseous mixtures much poorer in combustible constituents than ordinary coal gas may be used in place of the latter.

THE average annual product of sulphur is about 280,000 tons, of an average value of 109·20 lire per ton = 30,793,000 lire, or over £1,200,000 sterling. Of this total Sicily produces 242,000 tons. There is an export duty of 11 lire per ton on sulphur, and the average export is 216,000 tons. The Sicilian sulphur is mostly exported raw, as it comes from the kilns. It is of seven qualities, the values varying from 101 to 115 lire per ton. Except in the better worked "solfare," the separation of the sulphur from the earths in which it is contained is still conducted in Sicily by means of kilns, calcuroni, which do not require any additional fuel, but which entail the consumption and loss of about one-third of the sulphur itself. About 18,000 hands are employed in the Sicilian "solfare," of whom about 14,000 work in the interior of the mines, including the transport of the ore to the surface. The sulphur in many mines is still carried to the surface on the backs of boys called "carusi," of whom there are about 3500.

THE average expenditure on all highways in England is rather under £18 per mile; but of those managed by highway boards the cost amounts to fully £18¼. Comparing one county with another, the figures show much greater discrepancy than can be easily explained. In Devonshire the boards pay less per mile for repairs than anywhere else excepting only in Hampshire. In these two counties the cost is as low as £9 per mile; whereas in Shropshire, which comes next on the list, it is £11, in Cornwall and Dorset £11½, and in Somersetshire £17. No other county pays much less than £20 a mile, and in Berkshire, Durham, Northampton, and Lancashire the expense is about £30. Least economical of all is Surrey, which pays £37 a mile. The cost of road metal probably explains much of this, but the *St. James's Gazette* thinks: "In short, the expenditure seems to bear no regular proportion whatever either to the geological condition of the district, the facility of procuring materials and labour, or to any circumstance which might be expected to raise or lower the cost of road-making."

THROUGHOUT the whole of England there is about one mile of high road to every 361 acres of land. Of the 103,000 miles thus laid out, rather more than one-seventh are "main roads," and the rest ordinary highways; one mile of the former being included in every 2700 acres, and one of the latter in every 420 acres. In the west country all sorts of roads are more in proportion than elsewhere. Gloucester is the only county which has more than one mile of main road for every 1000 acres. But Worcester is very nearly as well provided; and Wilts, Somerset, Hereford, and Shropshire have a mile in each 1300 acres. But in Westmoreland the proportion of acreage to a single mile of main road is 3800, in Lincolnshire 4000, in Northumberland 4200, and in Yorkshire and Lancashire very nearly 5000. In these figures only those roads are considered which are managed by district boards; but if the table were made to include those also managed by unions, the result would not be altered materially. Suffolk exhibits the greatest poverty in main roads; but then it is well provided with less important highways, of which it has about a mile in every 280 acres. The same proportion appears in Worcestershire; Lancashire and Yorkshire, which contain very few main roads, are also scantily provided with other highways; and Huntington is still worse off, as there is only one mile of ordinary road in it for every 600 acres.

IN a paper on "Machine Oils," by F. Seifert, in *Seifensied-Zeit.*, 25, 295, the sale of lubricating greases and mineral oils is, the author says, largely increasing. Not only are mineral oils greatly superior as machine oils, but it is freely acknowledged that mineral lubricating oils are superior to other mineral oils. According to the writer they can be prepared almost free from smell, and of considerable consistency. They contain no free acid, do not become acid with elevation of temperature, nor have they any action on metals. These oils are miscible in all proportions with vegetable oils and fats. "Cylinder oil" is a pure mineral oil, possessing, however, similar qualities and consistency to rape and cotton oils; it is free from acids and foreign constituents, and does not decompose at 600 deg. Fah., properties which no animal or vegetable oil combines in itself. The manufacture of machine oils is simple and very easily carried out. Any fine non-drying oil can, after refining and purifying, be used as a lubricating material. Cotton oil takes the first place among all the fatty oils, and but for its price would be employed much more frequently than it is. Poppy oil, croton oil, radish oil, &c., are comparatively little used. Sesame oil, almond oil, earth-nut oil, and rape oil are better fitted for the preparation of machine oils, and the last named, being the cheapest, is more used than all the others. It is never perfectly pure as met with in commerce, and must therefore be refined. Various more or less satisfactory methods of refining it have been employed—for example, those in which sulphuric acid, oxide of zinc, oxide of lead, potash lye, potassium bichromate, and sulphuric acid are employed. An oil almost as clear and transparent as water is obtained in the following manner:—100 lb. rape oil are heated to 75 deg. C., and washed with 3 lb. of potash lye of 30 deg. B.; after about ten to twelve hours the oil is transferred to a clean vat, left to cool down to 41 deg. to 37·5 deg. C., stirred and mixed with a solution of ½ lb. potassium bichromate, 1½ lb. hot water, and 1½ lb. of sulphuric acid—22 deg. B. The mixture is then washed with a sufficiency of hot water, left to stand for some hours, and the purified oil is filtered off from the impurities present. An excellent machine oil consists of 50 parts of rape oil mixed with 100 parts of mineral lubricating oil.

MISCELLANEA.

THE total number of visitors to the Calcutta Exhibition up to the 15th inst. amounts to 307,000.

THE Fisheries Exhibition Commissioners have awarded "a diploma of honour" to Mr. J. Hayes for the "Fromentin automatic boiler feeder," used successfully on the steam boilers in the electric lighting machinery department.

WE are requested to state that the liquidation of the North Woolwich Telegraph Works Company, Limited, in no way affects W. T. Henley's Telegraph Works Company, Limited, which carries on its business at North Woolwich as heretofore.

THE Technical Schools in carpentry, lace-making, &c., in connection with the University College, Nottingham, will be formally opened by Sir Frederick Bramwell on the 24th inst. The workshops will be open for the inspection of visitors at four o'clock in the afternoon of that day, and the mayor will take the chair at the evening meeting at 7.30 o'clock.

A LETTER which has been received in Birmingham from the Patent-office in reply to a communication from a manufacturing firm in Birmingham, should be taken as having now set at rest the doubts which existed regarding the continued use of the word "patent." The Registrar says that "only such persons as 'represent that any article sold by them is a patented article when no patent has been granted for the same' will be liable under the 105th section of the new Act. There is, therefore, nothing in the section to prevent the use of the word 'patent' on any article which has at any time been patented either in this or other countries." A similar conclusion was arrived at only the day before the receipt of this letter at a special joint meeting of the Birmingham, Wolverhampton, and Walsall Chambers of Commerce.

THE new P. and O. steamer Valetta has made a trial trip at Greenock, but owing to a heavy gale which was blowing, a measured mile trial was impossible. The ship, however, made 16 knots an hour against a strong ebb tide and very high sea, and behaved splendidly. The Valetta is a handsome vessel of 5000 tons gross register. She is 421ft. long, and has 45ft. beam. The dining saloon, music, and smoking rooms are of large dimensions, and are elegantly fitted. The dining saloon extends from side to side of the vessel, and measures 42ft. by 41ft. The Valetta is fitted with the electric light; accommodation is provided for 200 passengers, and there is capacity for 4000 tons of cargo. Messrs. Caird and Co., of Greenock, are the builders.

THROUGH the authorities of the Vienna Museum of Technological Industry a programme of a special international competitive exhibition of novelties in technical wood turnery has been issued, and prizes, consisting of silver and bronze medals, are offered for the following:—(1) For new processes which tend either by physical or chemical means to enhance the value of wood to be used as a raw material in turnery. (2) For improvements in the construction of tools useful in turnery, and for exceptional good finish in any turning tools, &c. (3) For a complete set of tools and appliances necessary or useful in wood turnery. (4) For improvements in the construction of lathes and auxiliary machines for wood turnery. (5) For specimens of wood turnery which have claim to novelty and technical merit. Information may be obtained from Mr. Paul N. Hasluck, Polytechnic Institute, Regent-street, London, W.

IT is not a little curious in the history of monopolies that the supply of American nickel comes almost entirely from certain Pennsylvania mines owned by a single individual, who thus controls the supply of the product. On account, says the *Times*, of its superior quality to the imported nickel, American commands a higher price. It is true that nickel mines have been discovered from time to time in the United States, but the uncertainty as to probable yield or the remoteness of the mines have prevented the investment of capital for their development. The latest discovery, according to a communication from San Francisco, is of important deposits of nickel ore having been found in Churchill county, Nevada, the ore yielding 30 per cent. of pure nickel. If this should prove correct, and the mines can be developed, manufacturers of goods into which nickel enters will welcome the competition. By the new American tariff, a reduction is made on pure nickel and alloys of nickel, and it is considered that this will lead to a large increase in German and English importations. The prices of nickel for the past few years have remained tolerably steady.

A CORRESPONDENT recently writing to the *American Machinist* says:—"In all theory, and in my practice, I have been led to believe that it was impossible to raise water by suction over 28ft. or 30ft., and that it was not good practice to pump it over 25ft. But my attention was called to the fact, that at a certain establishment in this city they were pumping water by suction 27ft., and having considerable curiosity, I called to investigate. The engineer stated as a fact that they were pumping water by suction 37ft. that is, from the surface of the water to the suction-valve of the pump, 37ft., with but slight variations. About 25ft. from the bottom end of the suction-pipe is a tee with nipple and elbow. From this elbow, a stand-pipe of the same diameter of the suction-pipe extends to the same height, and is covered with a cap. There is a check-valve at the bottom end of the suction-pipe. The explanation is:—Fill both pipes with water, then screw the cap air-tight on the top of what I should call the stand-pipe, the action of the pump will suck the water out of the stand-pipe and form a vacuum in it that will sustain the water in the suction-pipe, so that the pump will lift the water the 37ft. without any trouble."

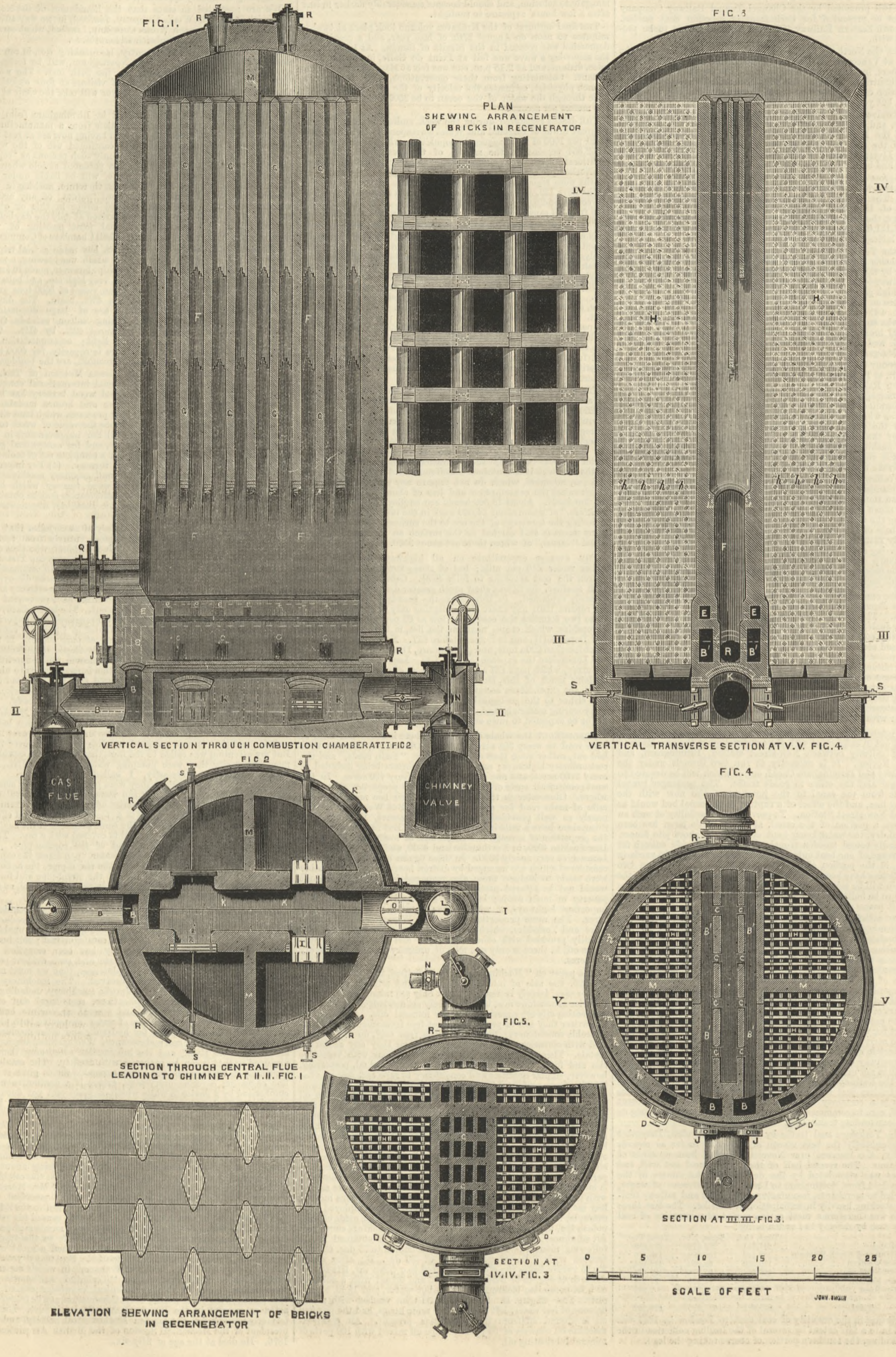
CATALOGUES of engineering manufactures having a recognisable claim to notice an account of the care bestowed in their production have been lately rather numerous, so that we have been unable to mention any in particular. But the catalogue just published by the Pulsometer Engineering Company has been compiled and executed with so much care and taste and such evident painstaking attention to detail and completeness, that we must make an exception to a rule lately observed. The machinery described and illustrated is chiefly hydraulic machinery, including the pulsometer in its numerous applications, centrifugal and other forms of pumps for contractors' and general use, engines, boilers, cranes, filters for large quantities of water, swimming bath plant, cement and other mills, parts for hydraulic and other machinery, and for its installation and maintenance. Well executed engravings of all these are given, and the information concerning them is arranged so that it can be gathered with facility. The catalogue is printed on white paper, but a very agreeable tint is given it by a line engraving covering every page, giving it a distinctive mark emphasised by a device in white which is plain and yet does not obtrude itself. It only needs the name of the firm on the back of the book to make it complete.

MR. C. W. MERRIFIELD, whose death took place at Brighton on New Year's Day, was one of our ablest mathematicians possessed of practical technical knowledge. He entered the Education Department of the Privy Council in 1847. In 1864 he became honorary secretary of the Institution of Naval Architects, being about the same time elected Fellow of the Royal Society. On the establishment of the Royal School of Naval Architecture, Mr. Merrifield was appointed vice-principal, becoming afterwards principal. On the transfer of the school to Greenwich, he returned to the Education Department as senior examiner. Ill-health caused his retirement in May last. Besides contributing a large number of papers on naval architecture and other technical subjects to the transactions of various societies, Mr. Merrifield published a great many papers on pure and applied mathematics. For many years he edited "Longmans' Text Books of Science," in which series he published a successful volume on "Technical Arithmetic and Mensuration." Mr. Merrifield's technical knowledge caused him to be placed on the Unseaworthy Ships Commission, and he frequently acted as assessor in the Wreck Commissioner's Court. He was formerly president of the London Mathematical Society, and was president of the Mechanical Section of the British Association in 1876. He died at the age of fifty-six.

REGENERATIVE FIRE-BRICK STOVE.

MESSRS. FORD AND MONCUR, DISTINGTON, ENGINEERS

(*For description see page 58.*)



VERTICAL SECTION THROUGH COMBUSTION CHAMBER AT II FIG 2

VERTICAL TRANSVERSE SECTION AT V.V. FIG.4.

SECTION THROUGH CENTRAL FLUE LEADING TO CHIMNEY AT II.II. FIG I

SECTION AT III III. FIG.3.

SECTION AT IV.IV. FIG.3

SCALE OF FEET

ELEVATION SHEWING ARRANGEMENT OF BRICKS IN REGENERATOR

TO CORRESPONDENTS.

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

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

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

A. C.—*The trade you name is a very good one.*

EFFICIENCY OF FANS.—*A letter on this subject awaits the application of correspondent G. T. H.*

HOT-AIR PRESSURE.—*J. B. will get the information he requires from Mr. E. A. Cowper, Great George-street, Westminster.*

ENGINEER.—*Cementing the tank will, if properly done, so that the water cannot get behind it, prove a perfect remedy for the corrosion of which you complain.*

J. B. F.—*The temperature of saturated steam with a pressure of* 10 *lb. above the atmosphere is* 240 *deg. That of steam with a pressure of* 30 *lb. above the atmosphere is* 274 *deg.*

J. L. (Manchester).—*The distance from port to port was wrongly stated at* 60 miles. *The canal portions amount to about* 60 *kilometres, but the distance from port to port is* 47½ *miles, or about* 76 *kilometres.*

INQUIRER.—*The permissible error in levelling over three miles with a difference of* 20*ft. will depend on the purpose of the levelling, but in so short a distance for most work no appreciable error would be admitted.*

H. B. M. B.—*We have already given the figures you want. Coal gas cannot be used for generating steam, the cost being altogether too great. It remains to be seen whether water gas can be used in a few cases, where convenience is of more importance than economy.*

H. T.—(1) *Sheets are corrugated in stamping presses. They are then passed through a bath of melted zinc. We do not understand what you mean by "proportions of galvanising material." There is only the one material—zinc.* (2) *Whereabouts in the trough is the depth* 11*in.? It cannot have that depth throughout its whole length with the proportions you name. Consult Neville's Tables.*

DUPLEX PUNCHES.

(*To the Editor of the Engineer.*)

SIR,—I should esteem it a favour if any reader could give me the address of the makers of duplex punches—spade brand. H. G.

Birmingham, January 10th.

CANADA AS A FIELD FOR EMIGRATION.

(*To the Editor of The Engineer.*)

SIR,—If "Emigrant Engineer," who writes inquiring as to "Canada as a field for emigrants," in your last issue, will send me his address, I shall be happy to give him some information as to railway work in Canada, where I have been employed for several years as an assistant engineer.

Rattray, Peterhead, N.B., January 15th. GEORGE L. CUMINE.

A FEW QUESTIONS ABOUT STEEL.

(*To the Editor of The Engineer.*)

SIR,—Will you oblige by giving me in your next issue (1) the weight of iron used in shipbuilding in 1883? (2) The weight of steel used in shipbuilding in 1883? (3) Where I can find illustrations to help me in making a complete series of crucial tests of steel, so as to form a showcase of the pieces tested? (4) The maker of a suitable instrument for measuring test pieces, say similar to a micrometer. QUERY.

Middlesbrough, January 12th.

[Perhaps some of our correspondents will be able to answer questions 1 and 2 and 3. For a reply to question 4, we may refer "Query" to Professor Unwin, Indian Engineering College, Egham, Staines.—ED. E.]

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Jan. 22nd, at 8 p.m.: Ordinary meeting. Paper to be read with a view to discussion, "The Adoption of Standard Forms of Test-Pieces for Bars and Plates," by Mr. William Hackney, B.Sc., Assoc. M. Inst. C.E. Friday, Jan. 25th, at 7 p.m.: Students' meeting. Paper to be read and discussed, "The Expenditure of Power in Steamship Propulsion," by Mr. James Johnstone Bourne, Stud. Inst. C.E.

INSTITUTION OF MECHANICAL ENGINEERS.—Thirty-seventh annual general meeting on Thursday, Jan. 24th, and Friday, Jan. 25th, at 25, Great George-street, Westminster, at 7.30 p.m. on each evening. The annual report of the Council will be presented to the meeting, and the annual elections will take place. Notice has been given of the following alterations in the Bye-laws, to be proposed at the meeting:—By the President: That Bye-law No. 21 shall hereafter read as follows:—"It shall be the duty of the Secretary, under the direction of the Council, to conduct the correspondence of the Institution; to attend all meetings of the Institution, and of the Council, and of Committees; to take minutes of the proceedings of such meetings; to read the minutes of the preceding meetings, and all communications that may be ordered to be read; to superintend the publication of such papers as the Council may direct; to have the charge of the library; to direct the collection of the subscriptions, and the preparation of the account of expenditure of the funds; and to present all accounts to the Council for inspection and approval. He shall also engage—subject to the approval of the Council—and be responsible for all persons employed under him, and set them their portions of work and duties; and all members or others calling shall be referred to the Secretary. He shall generally conduct the ordinary business of the Institution, and shall refer to the President in any matters of difficulty or importance, or requiring immediate decision." By Mr. Arthur Paget: That words to the following effect shall be added to Bye-law 20:—"The Secretary shall devote the whole of his time to the work of the Institution, and shall not engage in any other business or profession." The following papers will be read and discussed, as far as time will admit:—On Thursday, Jan. 24th, "Experiments on Friction; Report of the Research Committee;" adjourned discussion. "On the Consumption of Fuel in Locomotives," by M. Georges Marié, of Paris On Friday, Jan. 25th, "On the Physical Conditions of Iron and Steel," by Professor D. E. Hughes, F.R.S. "On Portable Railways," by M. Decauville, of Petit-Bourg, Paris. "On the Moscrop Engine Recorder, and the Knowles Supplementary Governor," by Mr. Michael Longridge, of Manchester.

SOCIETY OF ARTS.—Wednesday, Jan. 23rd, at 8 p.m.: Seventh ordinary meeting, "Science Teaching in Elementary Schools," by Mr. William Lant Carpenter, B.A., B.Sc. Sir John Lubbock, Bart., M.P., F.R.S., will preside. Thursday, Jan. 24th, at 8 p.m.: Applied Chemistry and Physics Section, "The Manufacture of Gas from Limed Coal," by Professor Wanklyn. Mr. David Howard, F.C.S., F.I.C., will preside.

DEATHS.

On the 8th inst., at Laurieston Lodge, West-end, Hampstead, N.W., after a long and painful illness, EUGENIUS BIRCH, M.I.C.E., aged 65 years.

On the 10th inst., at Broomhill, Partick, Glasgow, ANTHONY INGLIS, engineer and shipbuilder.

THE ENGINEER.

JANUARY 18, 1884.

RAILWAY RATES.

THE condition of trade generally throughout Great Britain is unsatisfactory. The turnover of money and materials is perhaps larger than it has been before; but the profits are small. We do not propose to draw here general deductions from the facts. We wish to direct attention to the effect which trade will have on railways and railways on trade in the immediate future. It would perhaps be difficult to find a subject which possesses more importance just now; but we confess we approach it with considerable doubt as to whether any amount of discussion can modify the course of proximate events. Nothing, however, can possibly be gained by silence; something may perhaps be effected by speaking. The question for consideration is in certain respects narrow enough. It is, simply, ought the railway companies to carry goods and passengers at lower rates than they do now? From the manufacturers and the general public there is but one answer to be expected. They say "yes." The railway companies say "no; we are not able." If it is granted that railway companies having secured a fair profit, should demand no more, then it will be admitted on all hands that the question, already narrow, may be still further reduced, until it stands, Can railway companies charge less than existing rates and make a profit? The answer to this query is of extreme importance. It may mean not only the ruin or prosperity of certain districts, but that of gigantic branches of trade; and it is not too much to say that the railway companies are bound by the duty which they owe to the nation, to reduce rates to the lowest possible limit. It is a noteworthy fact, too, that almost every change in the direction of reduced fares or increased comfort has been attended by pecuniary advantages conferred on the companies. Thus, for example, the at one time much despised third-class passenger traffic is now known to be a perfect mine of wealth, as yet, we may add, but imperfectly explored; and it remains to be seen whether what has been done with passengers may not be done with goods and minerals. We had occasion some time since to give figures setting forth the cost of running an average coal-train from a colliery district to London. The accuracy of our figures has never been disputed, and they showed that the total cost of running the train was less than one-third of the sum charged as freight by the railway companies. When arguments such as these are used, it is frequently retorted that the average cost of working the railways of the United Kingdom is 50 per cent. of the total receipts. It would be very difficult to find any other business in which men can embark and realise a return equal to one-half of the whole turnover of the year. Tramways, for example, have working expenses equal to from 80 to 90 per cent. of the total receipts, and yet they manage to pay a dividend. Railway companies, with much larger proportional gross profits, do no more. But if the cost of working be 50 per cent. of the receipts, then it seems clear that the railway companies cannot charge more than twice the cost of transport; and if this be so, what, it may be asked, becomes of our figures? The answer is, of course, that there may be a dead loss in running a passenger train, and that the coal train must pay the deficit, and for itself besides. If this be the case, then it is clear that the passenger traffic of a district or a railway may have an important influence on the goods traffic. This point deserves more attention than it has hitherto received.

Let us suppose that on a given railway the profits are 50 per cent. of the receipts, but that the cost of the passenger traffic equals the amount paid for tickets. Then it is clear that the whole burden of dividend is borne by the goods traffic. This is no doubt an extreme case, but it is not so far from the truth as may be supposed. Indeed, as regards certain express trains it is altogether true, these trains being run at a dead loss. On any railway with a large mixed traffic it is essential that the passenger traffic shall be made to pay and pay well, in order that the goods traffic may be kept at a moderate figure. The cost of goods traffic may, perhaps, be lowered in many cases, though not in all; but that must indeed be an exceptional line on which passenger fares are not too high. Much has been said recently concerning the development of railways, but the subject has not been very intelligently handled. When we examine matters for ourselves, we find that the development really consists in the augmentation of the dimensions of railway plant by, perhaps, 50 per cent., and in little else. Thus, for example, the iron rail weighing 65 lb. to the yard, has given way to the 82 lb. steel rail. The engine and tender, which weighed together 50 tons, are replaced by others weighing 70 tons. Our coaches are much higher and heavier than those of thirty years ago, and our trains are longer and carry more passengers; but the speed has not augmented much, only whereas but a few trains attained fifty miles an hour in the days of our fathers, a great many do now. Still, we are apparently as far from an average of, say, sixty-five miles an hour between any two towns like London and Birmingham, as we were fifty years ago. This great development in size has, however, conferred a considerable benefit on railway companies and the nation at large. It has rendered it possible to augment the length of trains. In old times the fast expresses seldom consisted of more than eight or nine coaches. More could not be put on if time was to be kept by the engines then in use; and this fact practically stopped all attempts to add third-class carriages to express trains. But the advent of engines with 18in. by 24in. cylinders, carrying 140 lb. pressure, practically doubled the size of the trains. The engine with cylinders 16in. by 22in. has become a thing of the past on all important railways. The increase in the size of the locomotive and the development of third-class traffic have gone hand in hand, and the profits of railway companies are now found in that very traffic which was at one time looked upon as a source of loss.

Returning now to the question with which we are most concerned—namely, can railway companies reduce their goods tariff or not? We may reply—as indeed will be seen from what we have just said—that the answer may to a large extent depend on the way in which the passenger traffic is managed. It is the greatest possible mistake to do as some directors and chairmen of companies, and maintain that goods and passenger traffic are distinct, and must be considered separately. Thus, we find a chairman expressing his regret at a half-yearly meeting that the passenger traffic has shown a loss, but that the goods traffic has been extremely satisfactory. The truth is that every branch of business carried on by a railway company acts on and influences every other for good or evil. The most prominent point, however, for consideration just now is, the possibility of making passenger traffic more remunerative than it is. Every one now knows that the low-priced third-class passenger pays better than any other—better, indeed, than almost anything else which it is possible to carry. No one can say that the limit has yet been reached, and we feel certain that a further reduction beyond any yet made in third-class fares would be attended by the most satisfactory results. Far greater numbers would have to be carried, but this presents no difficulty with modern rolling stock. Third-class passengers are not always in a hurry, and the experiment of running long trains of third-class passengers at a moderate price is one worth trying. For example, a train of the kind from London to Liverpool might travel at an average speed of thirty-five miles an hour, including say four stops of five minutes each. This would make the time occupied on the journey about six hours, and a train of thirty coaches would be quite within the power of a single engine. Such a train would hold about 1500 passengers, and at a 10s. fare, the proceeds would be £750. It is needless to remark that the profits as regarded this particular train would be enormous. Whether it would be possible to fill such a train regularly day after day we have not sufficient data to say; but it is at least certain that the most unexpectedly favourable results have followed on a lowering of fares and tariffs, and the railway companies which most study their interests will do well to push a highly successful experiment yet further. It is not quite certain that a reduction of freights could in all cases be made to pay, because the traffic may already be as great as can be dealt with. These are the conditions under which an improvement in the passenger train profits is most likely to permit a reduction to be effected in the cost of transport of minerals and goods.

ENGINEERS AND CONTRACTORS.

THAT disputes should occur between the engineer and contractor, during the progress of every undertaking, seems in the opinion of many engineers to be unavoidable. We, however, hold a different opinion. That disputes do occur, all must admit; generally speaking both parties are to blame. Specifications for machinery or for ironwork are commonly drawn upon old-fashioned stereotyped lines. Some of the clauses are vague, while others are simply impracticable, the thing demanded being impossible of execution. In using such specifications the engineer is clearly the one in fault. On the other hand, contractors in numerous cases do not sufficiently read or attentively study the specifications on which their contracts are really based; and are consequently often unpleasantly taken by surprise when called on by the engineer to perform certain work which they had overlooked, and the execution of which may cost a considerable sum, involving possibly a serious reduction in the profit balance. Here it is clear the contractor is himself to blame, but not to the same extent that the engineer is indirectly. He, as we have said above, issues a specification that is in many points nothing but a fossil. The contractor is a good business man, has got to know the style of such documents almost by heart, and he contemptuously glances over each page, just to gather the chief points therein; examines the drawings, takes out his quantities and sends in his tender. He obtains the contract, and almost at the outset the imperfection of the specification brings him in collision with the engineer—for example as to the way in which the iron is to be tested. The engineer reserves to himself the power of fixing the number of tests to be made; this is not quite fair, because all the plates and angles from which the test pieces are cut are, if not rendered useless for other work, at all events greatly lowered in value. The ironmaster will only take them back as scrap at a nominal price that will scarcely pay for carriage; and if not returned they may lie rusting in the contractor's yard for years before any job comes to hand into which they may be worked. The result of this is that the profits of the contract depend to some extent on the disposition of the engineer. One man may rest content with two tests out of one or two deliveries of iron, and not seek to spoil very large and valuable plates at all, while another may require four, five, or more test pieces out of every delivery of iron, and insist on cutting plates however large. Manifestly this is injudicious for all parties. The contractor will either add to his tender money enough to ensure him against loss from a great number of tests; or else if he be of the sharp practitioner order he will allow for only two or three tests, and trust to his ability to wriggle out of demands for more. Thus it comes either that the engineer's client pays more than he otherwise would, or else a cause of dispute at once arises. All this might be avoided by the test clause of the specification being so drawn as to define the greatest number of tests the engineer shall make. For example, that he shall have power to take test pieces from any three plates, bars, tees, or angles respectively of each individual delivery of iron, and in the case of plates exceeding individually a specified size, the contractor shall give the engineer timely notice of their rolling, so that he or his representative may attend and see them rolled, and then and there take test samples from the trimmings. It is true that some ironmasters object to tests made from such trimmings; but if a pile of adequate size be rolled, a margin amply sufficient to yield iron of quality equal to the plate itself will be obtainable. It has been suggested that the ironmaster should be required to supply a certain number of plates of a size so much in excess as would allow of tests being taken without spoiling the plates. At first sight this seems simple enough, but the principle is faulty; virtually it renders the test valueless, because if the ironmaster or contractor choose to be dishonest, he may very easily roll a superior iron into the test plates, while the rest may be any poor iron. It may be said the ironmaster cannot tell which are the extra-sized or test-plates. True, but of necessity the contractor knows, and he, if disposed to be dishonest, can inform the maker. Therefore, we repeat, this system violates the test principle. The method of drawing the test clause we have suggested is clear and definite, and both parties to the contract plainly see what is to be done.

Another badly defined item in test clauses is that nothing is said as to whether the mean average of a series of tests is to be taken, or that the lowest test is to be equal to the standard specified for. Thus, for example, three tests may respectively be, in tons per square inch, 23, 22, and 21. The mean of these equals, we will say, the standard demanded, and the contractor may have thought that the mean would be taken, but finds the iron rejected, the lowest test being below the standard. Then ensues loss of time, letter-writing, and so forth. How easily could all this be avoided by simply saying that the lowest test must not be under the standard demanded. The foregoing remarks equally apply to the elongation or reduction of area test. Again, another ill-defined test stipulation is that which demands that the iron shall bear to be bent cold, say to right angles, without cracking. Here is vagueness personified. Every worker in iron possessing any sort of knowledge of his business knows that testing iron by bending can be effected so as to make the best iron appear to disadvantage, while very poor stuff may, by careful nursing, be made to seem much better than it really is. All depends on the method by which the bending is effected. Very excellent iron, if secured to a heavy anvil, and with but a short portion projecting, and this rapidly and with great force struck by a very heavy sledge, will assuredly appear bad, and will probably not only crack, but break off long before the specified angle is reached; while a far inferior iron, projecting a long way from the anvil, and, as it were, tapped gently down, bending to a large radius, will yield without a crack. Iron bent by hammering is also more severely tested than if bent by pressure, other things being equal. We assert, therefore, that the demand that iron shall bend to a certain angle, without specifying the method of bending, ought altogether to be abandoned. There is now no want of testing machines, at any of which a series of tests can be carried out at short notice by properly competent and independent men; and to avoid disputes it would be well that all specifications stated definitely that the tests should be made at one of them. As to the expense, of course the contractor will make due allowance for it in his tender, and if the number of tests be defined in the manner we have suggested, he will be quite safe.

It will be convenient if we here draw our readers' attention to a point wherein contractors are placed in a difficult position by the loose practice of some engineers—we refer to the relaxation of specifications. Competition is terribly keen, and it often happens that the question of the price at which a contractor will tender will depend upon his knowledge of the character of the engineer with whom he will have to deal. There are individual engineers whose interpretation of their specifications is so severe, so stringent, that all contractors who know them, either refrain from tendering at all, or else put on a price so large as to secure a profit whatever happens; a price larger than, as we observed above, they would ask even with severe engineers if the clauses of the specification were well defined. On the other hand, there are engineers who certainly draw severe specifications of the usual antiquated type, but whom contractors know to be, or hope to find, asking much more than they will insist upon if only talked to nicely. These gentlemen, we venture to say with the greatest respect, are generous at the expense of justice. The essence of fair play in all contracts is a perfect understanding at the outset on the part of the one as to what is required, and on that of the other of how much it will cost. Gentlemen who habitually relax their specifications are unjust to themselves, to their clients, to their professional brethren, and to contractors. An engineer of this type will get lower tenders from the man who knows him than from those who do not, for the first can by experience judge pretty well what percentage he may discount for relaxation, and he gets the work as against the stranger, who, if he knew the engineer, would probably tender at even a lower rate. Relaxations, too, are unjust to other engineers, because they demoralise contractors; and after getting concessions from one engineer on his work, they, or some of them, begin to think that although certain demands are embodied in their contract, they are hardly used if the engineer insists upon their fulfilment. It is scarcely necessary to add that specifications, as now drawn by some engineers, leave nothing to be desired. It is no disparagement to the engineers if we add that they have availed themselves of the assistance of a competent barrister in the first instance.

LEAD PIPES.

The letters which we have received on this subject show that it is one of considerable interest. In our impression for the 16th November last we gave some illustrations of burst lead pipes, and a statement of the pressures under which bursting took place, and of the strength of the lead as deduced from the bursting stresses. In the same article, reference was made to the peculiar and local form of many of the fractures of burst lead pipes as distinguished from the long hair-line crack which characterises the fracture of a considerable number of pipes destroyed during severe frosty weather. An explanation was given of the origin of the peculiar form of burst which takes place at a local swelling, but as the explanation was new, it excited some adverse and some confirmatory criticism. The explanation was not, perhaps, given with sufficient fulness. We now therefore return to this subject, especially as some of the remarks of our correspondents are worthy of attention.

If we consider a pipe in, say, a horizontal position and in an exposed place, so that the water contained in it is equally losing heat throughout the length of the pipe, freezing will proceed from without inwards throughout the whole body of water, and the expansion which takes place when the water falls from 40 deg. Fah. to 32 deg. Fah., and the greater expansion which takes place when the water at 32 deg. is changed into ice, will result simply in the circumferential and longitudinal extension of the pipe, or it will burst throughout its entire length, the ensuing crack being only sufficient to allow for the expansion of the solidified water acting as any expanding solid. When once the water has become ice, then further reduction of temperature causes contraction in volume; but as the solidification of the water takes place from the exterior, the water which freezes last has no opportunity of escape when the pipe is cracked. The air liberated from the water in freezing will occupy the upper part of the pipe, and being spread throughout its length, will not materially affect the result. The conditions are, however, very different with the water in a vertical pipe. In this case, still assuming the whole length of the pipe to be exposed to a low temperature, and to be nearly full of water, the dissolved air liberated from the freezing water will ascend to the top of pipe, where it will collect under an increasing pressure. Freezing of the water continues until the exterior portions are solidified. As solidification proceeds, the still fluid but lessening axial water nucleus expands and continually breaks the upper surface of ice where it extends itself into the small space occupied by the air. This continues until the whole water content of the pipe has become solid, and the pressure of the air has been continually augmented. In this way the greater length of the pipe has been simply filled with a solid perfectly fitting core which will not burst or crack it, but the upper part is under the elastic pressure of the imprisoned air. If the room left for the air in the first instance were very small—that is, if the pipe were very nearly full of water—the pressure might be very great, and a great pressure is not necessary to cause a gradual extension of lead under a tensile stress. In this way, even supposing the pipe to be uniform thickness, the diameter of the upper part will gradually enlarge, and then the destruction is commenced, for the pressure necessary will not only decrease in proportion to the increase in diameter of the pipe, but the pipe itself thins, so that the bursting pressure becomes less in a rapid ratio.

In practice, however, these conditions do not often obtain—at least, as far as regards the exposure of the whole length of the pipe. That the air from the freezing water collects in the upper parts of pipes is, however, certain, and the result is as we have described, for a lead pipe is wholly indifferent as to whether it is exposed to air or water pressure, and will burst when either is too much, though Mr. Stokes, in the letter we printed on the 7th ult., seems to be under the impression that air cannot act as a cushion and yet act as pressure-conveying medium. The experiments by Barthélemy bear upon this point, and are of interest. That Mr. Stokes has prevented the bursting of pipes by providing them with a dead end, placed so as to act as an air vessel, is not any disproof whatever of the bursting of pipes by air pressure, inasmuch as if the air vessel is of any considerable capacity, the compression of the contained air will be very small—that is to say, that the compression of the air in the pipe by the air freed from the water and by the expansion of the water and ice will be inversely proportional to its volume. The fact, moreover, that pipes have been prevented from bursting by using this dead end is a proof that the freezing water nucleus will and does extrude itself, in a closed pipe, into the free space, and does this at a sufficiently low pressure to save the pipe; and, moreover, as once ice has formed it begins to contract by reduction of temperature, it of itself tends to extrude its central core, and will do this most readily in the way we have described. Again, in practice a pipe is rarely exposed throughout its entire length. Hence we have the pressure resulting from the expansion of the freezing and solidifying water transmitted as a fluid pressure to certain localities. Under these conditions the pipe will not be burst at the part wherein the water is converted into a solid, but at the part or parts wherein the water has longest remained liquid, and the extent to which the gradually freezing rod of ice in the most exposed parts of the pipe will act as a ram may be easily seen when it is remembered that the ice is between 7 and 8 per cent. greater in volume than the water. The water in the part or parts of a pipe which have been protected from loss of heat may thus in a closed pipe be subject to very great local pressure, with a resulting fracture like those we have illustrated. The wonder is, not that pipes burst, but that they do not do so more frequently in severe winters than they do, and the explanation is probably to be found in the fact that very few pipes are perfectly closed, inasmuch as they have one or more attached fittings which allow of some loss of pressure in the incipient freezing stages. The letter from Mr. Dawkes, which we published on the 14th ult., evidently gives the result of practical experience, which will be seen to agree with the theory which has been advanced in our issue of the 16th November last, and now more fully explained.

THE BRITISH MUSEUM LIBRARY.

To engineers, as to members of all other professions, the vast national collection of literary works at the British Museum afford a means of research which is constantly used. It is therefore of the utmost importance to them, as to others, that its utility should be kept up to the needs of the present day, and it is becoming evident that if it is to be so the responsible authorities must soon undertake an extension of the present accommodation. The fine dome which has served as a reading-room for about thirty years past no longer affords the space which is required. We hear of intending readers whose avocations do not permit of their arriving early at the Museum being quite unable to find seats. Day after day is this the case, and it is certain that the difficulty already felt will soon increase to a proportion which must demand a very considerable extension of the space at present available. No arrangements could surpass those now in force. There is a thorough organisation, and the attendants are both civil and energetic in carrying out their duties. The extension of the buildings is the only way in which the inconveniences to which many readers are subjected can be overcome. It is, therefore, desirable that every attention should be given to the matter; and we are aware that the subject is much discussed. The requirements of a reading-room prohibit to a very great extent any increase of accommodation by adding to the height of the present buildings, because much of the study that goes on in the library is that of ancient writings, the perusal of which requires an overhead and particularly strong light, and this is now admirably provided by the well-lighted dome under which readers sit. The ground area available to the trustees for further building is exceedingly limited; and we have recently witnessed in the removal of the Natural History collection to South Kensington, an enforced endeavour to provide accommodation at the present institution for the valuable and extensive series of antiquities which has been long stowed away, owing to want of space for exhibition in the basement of the buildings.

Our reference to South Kensington reminds us of a proposition for relief which we have heard seriously discussed. No one would desire for an instant to see any division of the collection now stowed in Great Russell-street; but it has been deemed practicable by some to divide the readers. Many of these last would find South Kensington far more convenient for resort than the Bloomsbury institution, admirably situated though the last named is for general purposes. Could not therefore, it is argued, in these days of scientific progress, some attempt be made to work two sets of reading rooms from the central library? It has been proposed with this object that a pneumatic tube should be laid between Great Russell-street and South Kensington, and that a telephonic line should practically place the guardians of the library in as close communication with would-be readers in the latter place as they are at present with those in the former. Books could be forwarded and returned by means of the pneumatic tube almost as readily and as safely as they are now taken from the shelves of the library to the readers in the dome; and although we are aware that objections might be raised to the means of transit suggested, they do not appear to us to be likely to be insuperable. At all events, given a presumed impossibility to meet the demand, which we have named as becoming urgent, for an extension of the reading rooms on the present site, the suggestion put forth is at least worthy of consideration, for it seems to us that some careful organisation would be all that would be required to prevent confusion arising from the transit of books to and fro. The authorities might impose restrictions in the case of manuscripts which might be liable to injury during transport, but we imagine they would need to be but of very limited operation. One great point would certainly be gained if the proposal could be carried out, and that would be a very considerable increase in the convenience of numerous students who now find it a tiring journey to and from the Museum in Bloomsbury, while the out students at South Kensington would be able to make ready reference to many authorities which it may be desirable for them to consult.

While on this topic we may refer to one or two points in connection with the present reading-room which, it seems to us, might be improved upon if any further buildings are contemplated. On the whole the system of ventilation of the dome works satisfactorily; but there are times at which certain parts of it are almost unbearable from the inrush of cold air. Old readers are well aware of these localities, and where choice is permitted to them—which, from the enormous demand for accommodation, is but rarely—carefully avoid taking seats in them. The idea of supplying hot or cold air as may be required through the desks was a good one, but these are not carried high enough to prevent, under some conditions, a very disagreeable result to those persons sitting below them. It appears to us that to the higher pressure on immediate entrance from the main ventilating shaft is due the chilling draughts which we have named as being felt in certain parts of the room, and some endeavour should be made to ensure more equal pressure before the air is allowed to escape into it.

The electric lighting is certainly not perfect, and those who oppose the system on the ground of sparse distribution may in the Museum find strong reason for their objection. There are now four lights, one in the centre and three towards the sides. The light from these is thrown at such an angle that a reader has constantly to dodge the heavy shadows thrown by the head of his next neighbour on the work he may be perusing. Nothing can be imagined more irritating than this, and as of course during the progress of reference perfect quiescence is impossible, these dark shadows are constantly darting to and fro upon the pages read. It should be a *sine quâ non* in any future lighting arrangements that the light should be more fully diffused. A greater number of lights of less intensity ought to be employed, while one or two of the present character should be suspended at a much greater elevation than at present to break chance crossing shadows. The introduction of the electric light at the Museum library has been an inestimable boon to the readers, and has doubtless led to the great extension of their numbers, which now renders necessary further accommodation; but that the existing system employed may be greatly improved upon is a matter which admits of no doubt.

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE annual report of the Council of the Institution of Mechanical Engineers has just been issued. At the end of the year 1883 the total number of names of all classes on the roll of the Institution was 1440, as compared with 1370 at the corresponding period of the previous year. The increase arises as follows:—There were added to the register within the year 113 names of all classes; there were lost from the register by deceases 22 names of all classes, and by resignation or removal 21 names of all classes. This is very satisfactory evidence of progress. The pecuniary position of the Institution is also, we are glad to learn, very satisfactory. The attendances at the meetings have been good:—There were at the annual general meeting 82 Members and 67 visitors; at the spring meeting 81 Members and 18 visitors; at the summer meeting 152 Members and 33 visitors; and at the autumn meeting 82 Members and 71 visitors. Concerning research, the report contains not much of importance. Mr. Tower is, we learn, to resume his experiments on friction, in conjunction with Mr. Tomlinson. As regards steel, the Council regret to find that, owing to the difficulties existing in the preparation of suitable material, the results during the past year have not been so conclusive as Sir Frederick Abel had hoped to make them; they are nevertheless full of interest, and will be described in a report to be read at a future meeting by that gentleman. As to rivetting, the experiments mentioned in the last annual report have been carried out, and a report of them is being prepared by Professor Kennedy for circulation among the members. Some changes have been proposed in the internal management of the Institution, among others the retirement of the able assistant-secretary, Mr. Bache. It is to be regretted that these changes have been made the subject of an attack on the Council, which is, to say the least, extremely undignified. Statements have been freely published which are only worthy of attention because of the remarkable ingenuity with which their authors have perverted facts. It is to be hoped that the great body of the members will know how to appreciate the efforts of a few who have recently done all that lies in their power to drag the reputation of the governing body of the Institution through the mire. We allude to this subject with extreme reluctance, for the questions at issue are in no sense public property; but it is impossible to pass over this matter without an expression of our disapproval of the course taken by a few malcontents.

LITERATURE.

Modern Steam Practice and Engineering; a Guide to Approved Methods of Construction, and the Principles relating thereto, with Examples, Rules, and Formulæ. By J. G. WINTON, Engineer, assisted by W. J. MILLAR, C.E. London: Blackie and Son. 1883. 1120 pp., 8vo.

CRESSY'S well-known encyclopedia of civil engineering was not even in its day half so ambitious an attempt with reference to what was then known as civil engineering, as is this book on "Modern Steam Practice and Engineering." No wider field could possibly have been taken, and when it is remembered that at least half of this number of pages would be essential to deal with one or two subjects alone, such as the marine engine and shipbuilding engineering, in such a way as to justify the preface, it will be seen that some parts must be so scantily treated as to be useless. The preface states the object of the book is "to furnish a reliable guide to the practical engineer, a book to assist the draughtsman, the foreman, or the workman, in the engine shop and the building-yard, to turn out each in his own department well-designed, substantial, and thoroughly finished work." Thus, not only is the scope of the book very great, but it is supposed by the authors to supply all the literary help that is wanted by the designer, the foreman, and the workman. The task which the authors set themselves is, therefore, something herculean; but no one or even two men can cram all "modern steam practice and engineering" into one or two heads, or into one book, though a thick one. Indeed, it is remarkable that a great many subjects are very successfully dealt with.

The book opens with coal and coal mining, then proceeds to deal pretty fully with stationary and marine boilers. The treatment of steam from the boiler to the cylinder is then discussed, and a return is made to the manufacture of boilers. The regulation of steam by the slide valve; the indicator diagram, and the expansion of steam follow, and together all these make up the first part of the book on the boiler and steam. "Stationary engines" is the title of the second part, and in this, pumping engines for mines, for water works, and for drainage and general purposes are dealt with, followed by winding engines, blowing engines, rolling mill engines, compound reversing rail mill engines, the Corliss engine, high and low-pressure combined beam engines, rules for pumping engines, rules for the beam engine, water pressure engines, and hydraulic machine tools. The next part is on marine engines, the order of the subjects being as follows:—The oscillating engine, horizontal direct acting and return connecting rod engines, the screw propeller, the compound engine, and rules for horizontal direct-action marine engines. Locomotive engines are the subject of the fourth part; this includes combustion in the locomotive, the British locomotive, the American locomotive, the locomotive tender, continuous brakes, compound locomotive engines, special locomotive engines, specification of locomotive engines for London, Chatham, and Dover Railway, rules for the locomotive engine, road locomotive or traction engines, portable engines, steam road roller. Iron shipbuilding is the subject of the fifth part, which includes principles of marine designing, building of iron vessels, armoured and unarmoured war ships, vessels for dredging, examples of specifications, examples of scantling and steel for shipbuilding. The remaining part, about one-eighth of the whole, deals with all the other subjects, including floating docks, girders, girder bridges, suspension bridges, marine and submarine work, tubular wrought iron cranes, fire engines, gas engines, caloric engines, electric motors, electric lighting, strength of materials, transmitting power, formulæ for wheels, shafts, &c. We have given this catalogue of the contents of the book to show that at least the titles of a very large number out of all the many things included in the branches of engineering comprised in the title are given in the book. There can be no reason for objecting to the production of a complete treatise on steam and other branches of mechanical engineering; but we believe that a book which pretends to supply information which will enable draughtsmen to design and others to carry out all sorts of work well, but which only very incompletely deals with many of the subjects comprised in the title, is one which is not likely to meet with much favour. If the authors had confined themselves to marine and locomotive engineering they would have had space with which to have done justice to their subjects. As it is, they have attempted to do far too much.

The first chapter, on coal and coal mining, consists of a nine page article such as might be expected as an introduction to a small popular book on coal mines and their ventilation. It is too general and superficial to be of any use to anyone. Following this is a description of distinctive forms of stationary boilers, illustrated by small engravings chiefly of the diagram kind, the description being sufficient and accompanied by remarks on the performance and purposes of the different kinds. Following this is a chapter "On Boilers, by Fairbairn," and the authors say, "We propose under this head to consider the steam boiler in its construction, management, security, and economy." It does not appear what Fairbairn has to do with this chapter; the experimental information given is perhaps due to Fairbairn, but there is much that is not his and which he would not have claimed. There is nothing new in the chapter, it is unsufficient, and other writers who have followed that experimentalist have already written much more clearly on boilers than it seems to be in the power of Mr. Winton to do. He speaks of the "tensile strain across the fibre of boiler plates, as in some samples, being greater than their tensile strength when torn asunder in the direction of the fibre," (a sentence the construction of which is typical of almost all in the book,) but afterwards says that boilers diagonally plated are the strongest, because the tensile strength of plates is slightly greater in the direction of the fibre. Nothing further is added to guide the designer in selecting or rejecting diagonal plating. We are told that "locomotive boilers are usually worked at 120 lb. per square inch, and taking one of the usual construction we shall find that it rushes on the rail with a pent-up force within its interior of nearly 60,000 tons." What would the foremen or the workmen for whom this book is supposed to have been compiled understand from this? In the instructions for arriving at the dimensions of Cornish and Lancashire boilers we have no modern treatment of the subject. The old rule-of-thumb cubic yard space, cubic foot of water per horse-power, and square foot of grate per nominal horse-power is the sort of thing that is given, instead of showing the designer, foreman, and workmen how to arrive at his requirements in accordance with the consumption of steam by modern engines. Marine boilers receive rather better treatment, and the confidence of the reader is somewhat restored by the evidence that the information given is the result of practical experience, which is much better than theory unguided by that experience; but it is necessary in these days to give students something more than cut-and-dry rules. They must be placed in possession of that which will make them to a great extent independent of the cookery-book kind of empiric half science. In one place, speaking of the strength of boiler shells, the authors say, "The tensile strain of the best boiler plate is about 62,544 lb., and the worst 34,000 lb. per square inch. Taking one-sixth of the mean, or 8045 lb.—this is assuming the best plates are used, if the plates are of inferior quality it is obvious the constant is too high proportionally, although it may answer in practice with a parcel of the best plates untested—we have for a boiler 6ft. in diameter and with 60 lb. steam per square inch, the following result—the seams being single rivetted—$\frac{78 \times 60}{8045} = \cdot 58$, say $\frac{9}{16}$ as the thickness." This is the author's way of looking at this thing, and if a foreman reads it over a few times he may possibly get at what it means. Why he should take a mean of the best and worst plates, and then assume that the constant so obtained presumes the use of the best plates, is rather puzzling. It will, however, be seen that the author's way of obtaining the thickness does not give the thickness at all, but the whole sectional area required to resist the bursting stress, and hence the thickness is, from his data, about double what would be required. He notices that this does not agree with what others have published, and he then observes that as the common expression $T = \frac{P\,D}{2\,C}$, and using the constant 6200 for best Yorkshire plates, gives a thickness less than he finds by his own rules, "this is a result not at all to be desired." He does not appear to see that it is only by chance—namely, by his neglecting the effect of reduction of area by holes in the plate, and thus getting a higher constant—that he escapes obtaining a result just twice too high, inasmuch as the stress is resisted by the material of a shell at both ends of a diameter. The same error is repeated with respect to marine boilers. On this subject the authors, or author, for Mr. Millar seems responsible only to some extent—needs to clear his ideas; and it would be well if he could find out when he means to speak of stress, when of strain, and when of strength. His book is only saved from the wreck which it would suffer if it depended on the scientific treatment of the subjects by the righting effect of the information which is given here and there as the result apparently of long practical experience.

The author puts down impurity of water as the chief cause of priming, and want of circulation second, and in illustration of his ideas refers the reader to an experiment with a saucepan full in the one case of boiling water, and in the second full of potatoes and water. The potatoes he regards as impurities. We hasten to say that any steam boiler worked with water full of impurities as large as potatoes would probably give trouble. Experience in this direction must, however, be limited, so we cannot speak with certainty on the point. In dealing with the sizes of ports in cylinders, and the opening of the ports by the slide valves, the author goes back to an old rule for finding the size of cylinder for a nominal horse-power with 7 lb. steam pressure, so as to take a given fraction of the cylinder area for the port area, thus neglecting the effect of high pressure and of piston speed on the necessary area of ports. The modern "draughtsman, foreman, and workman," is left to gain an idea of an indicator from a drawing of M'Naught's indicator, and the vibrating arm for working the indicator as illustrated, has a slotted end to allow for the rectilinear movement of the crosshead and the angular movement of the arm, so that the velocity of the latter is not the same as that of the crosshead throughout its path. The expansion of steam is condensed by the author into a very small space. He seems very much afraid of annoying the susceptibilities of his readers by algebraic expressions, and he therefore almost everywhere resorts to long-worded rules, and one cannot get very far in the treatment of the expansion of steam with these clumsy tools. The descriptions of stationary and mine pumping engines are better done, and the same may be said of the marine engine. The construction of the locomotive is also dealt with at great length, and much careful attention to its details. The agricultural locomotive, and the portable engine, however, came off with but very scant notice.

On iron shipbuilding a good deal of space is occupied, but the subject receives that sort of attention which any subject gets when information and space are scarce. For instance, "The Principles of Marine Designing" is the title of the first chapter on the subject, but there is little use in telling a foreman that "the sheer line of a vessel should be curved according to the wave line theory" unless the wave line theory is explained, and it is not. The workshop and shipyard parts of iron shipbuilding are dealt with at some length, and the "Transactions" of the Institution of Naval Architects provides a good deal of material on the stability of ships.

The remaining subjects of the book are all treated with great brevity. Summing up the impressions gathered from a careful perusal of the volume, we are forced to the opinion that though a few parts of the book are well done, it is on the whole a failure. The author attempted too much. It is a pity he did not restrict himself in his programme. It contained subjects enough for a dozen books if each had been adequately treated. The publishers' work has been well done, and the book has the one good feature—a complete index.

LAUNCH AT BARROW.—On Monday last the s.s. Caledonian was launched from the yard of Messrs. Caird and Pendie at Barrow. The Caledonian has been built to the order of a Leith shipping firm, and is 250ft. long, 35ft. beam, 24ft. depth of hold, and a tonnage of 1700 tons. She has been specially constructed for the general cargo trade, but has accommodation for a limited number of passengers. She is classed 100 A1 at Lloyd's. The Caledonian was launched with masts and rigging complete, and on leaving the "ways" was taken in tow by a Glasgow tug, and proceeded to the Clyde to have her engines and boilers fitted by Mr. Kemp, of Govan.

DEATH OF MR. WILLIAM ROWAN.—The death is announced, on Saturday last, of Mr. William Rowan, of Belfast, widely known throughout Ireland and the United Kingdom as one of the most practical and skilful of mechanical engineers. The firm of John Rowan and Sons has long attained wide celebrity, not only on account of the excellent work which it produced, but also because of the great ingenuity and genius shown in every department. This was mainly due to Mr. William Rowan, who maintained the growing reputation of the firm. When the business passed under the Limited Liability Act Mr. William Rowan was first the general manager, and subsequently the consulting engineer; but of late years he separated himself from the old concern, and established a new business in Great George's-street, chiefly for the manufacture of an invention of his own, known as "Rowan's piston." Mr. Rowan was widely known, and his services were keenly appreciated in marine engineering circles. His firm was far in advance of most other engineers in marine engine design and economy years ago, as the results of the trials of the Thetis showed, and after that they have had the honour of doing more to advance the economy of steam at sea by the construction and improvement of the compound engine than, perhaps, any other firm. Mr. Rowan's loss will be severely felt. He was a man of modest but genial disposition, and leaves a wide circle of friends.

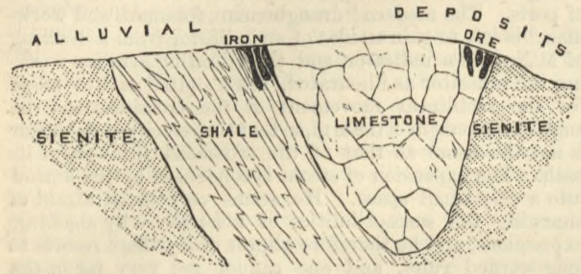
THE LATE SIR W. SIEMENS' WILL.—The will of the late Sir William Siemens, F.R.S., D.C.L., LL.D., of 12, Queen Anne's-gate, Westminster; 3, Palace-houses, Bayswater; and of Sherwood, Tunbridge Wells, was proved on December 29th, 1883, by Mr. Alexander Siemens, Mr. Joseph Gordon-Gordon, and Mr. John Wreford Budd, the executors thereof, the probate being stamped to cover personal estate in the United Kingdom of the gross value of £382,423 12s. 5d. Under the will, which is dated August 21st, 1882, Sir William Siemens gives to his widow, Lady Siemens, certain pecuniary and specific legacies, and an annuity of £4000, and a life interest in his freehold property, Sherwood, Tunbridge Wells. He gives various pecuniary and specific legacies to relations, friends, his assistants, and others; £2000 to the German Hospital, Dalston; and £1000 each to the German Society for Benevolence, the Tunbridge Wells Infirmary, the Scientific Relief Fund of the Royal Society, the Benevolent Fund of the Institution of Civil Engineers, and the Pension Fund of Siemens Brothers and Co., Limited. There are also legacies to domestic servants who have been five years in his employ. The testator makes provision by his will for the carrying on, under the same management as during his lifetime, of his civil engineering business, including his patented inventions; and his residuary estate is directed to be held in trust for such of his brothers and sisters and nephews and nieces as were living at his death, and, as being males, have attained or attain twenty-one years of age, or, being females, have attained or attain that age, or have married or marry, in equal shares.

IRON AND STEEL WORKS, RESCHITZA, HUNGARY.

No. II.

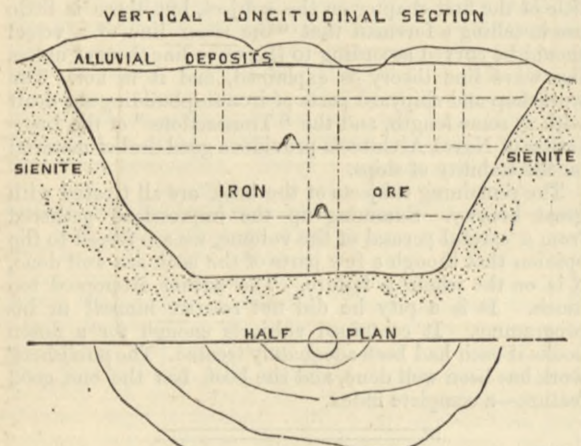
Iron mines.—The Reschitza furnaces, including that at Bogsán, are almost entirely supplied with ore from a long range of thirty iron mines in the crest of a chain of hills running north and south between Moravitza and Dognacska —see general plan, Fig. 1, p. 24 *ante*—seven miles long and about the same distance west of the town of Reschitza. It was at Moravitza that the ore was first worked, the raise in 1718 having been sufficiently important to warrant the erection of two small furnaces at Bogsán, and soon afterwards three others at Reschitza. An eruption of the sienite in the primitive rocks formed clefts which have subsequently been filled by crystalline limestone; and the iron, with its gangue of garnet, tremolite or actinolite, has been deposited in pockets, sometimes in the sienite, sometimes between the shale and the limestone, and sometimes between the sienite and the limestone. The accompanying

SECTION SHEWING IRON ORE DEPOSITS



sketch shows a vertical section through the Archangel and Elias Enoch mines, which afford typical examples of the two latter formations. The mines, which seem to have been named indifferently after Christian saints and heathen divinities, may be grouped into three well defined districts, of which the northern, containing the valuable deposits of Paulus, Franciscus and Eleonora, is by far the most important. The ore occurs in irregular masses, though more frequently in the shape of a basin having a depth equal to the breadth on the surface. The accompanying half plan and vertical section of the Franciscus mine affords a good

VERTICAL LONGITUDINAL SECTION



FRANCISCUS IRON MINE.

representative example of the form of deposit and also of the method of working. After laying bare the ore for a sufficient area, a heading is driven from the side of the hill 16 or 20 metres below the summit; and a shaft is sunk to meet it from about the centre of the deposit. The ore round the shaft is worked away, thus widening out the shaft into a funnel shape, the ore being run out by trams along the adit. A second heading, about the same distance below, is then driven, and the shaft deepened to meet it, and so on until the whole deposit is worked out. In the case of an elongated basin, more shafts than one are sunk, as shown by dotted lines in the section; and the ore round them is worked away until the enclosing rock is reached. The ore is got by hand, dynamite being brought into requisition where the stone is solid; and the miners, chiefly Roumanians, are paid by the ton. This method, though not costly, has the disadvantage of necessitating the transport, with the ore, of all the unproductive rock that is mined. The trams are run along by men, and then let down an incline where the ore is loaded on to normal-gauge wagons on a branch from Bogsán of the company's railway system. In 1872 the Adolf Adit was begun at the terminus, and driven into the hill with a slight upward gradient, for the double purpose of taking off the ore let down by a shaft 13 fathoms deep, and of proving the value of the deposits in depth. At this point also a washing floor has been established for removing the excess of impurity in the case of ores that are much impregnated with earth. Here the salutation by children is *serut muna*, or its German equivalent, *Ich küsse die Hand*; and the driver of a rough springless cart of the country, drawn by a pair of splendid mountain horses, actually wanted to kiss the hand that gave him a well-earned *trink-geld.*

The ores are very pure; they are chiefly magnetic,

Analysis of Iron Ores from Moravitza.

	Magnetite.			Hematite.		
	Juliana.	Eleonora and Theresa.	Delius and Archangel.	Franciscus.	Paulus, manganiferous stratum.	Paulus, Upper Stratum.
Silica	21·400	14·475	7·150	23·875	5·634	11·950
Alumina	1·993	1·920	1·900	5·414	0·934	1·057
Oxide of manganese	1·395	1·860	Trace	4·185	2·520	2·418
Lime	14·000	9·100	0·600	9·150	15·411	4·750
Magnesia	0·450	2·880	9·730	1·170	0·079	0·126
Copper..	0·040	Trace	Trace	Trace	0·035	0·024
Sulphur	0·014	0·021	None	0·034	0·021	0·027
Phosphorus	0·036	0·036	0·040	0·081	0·030	0·042
Iron	44·700	49·721	58·010	37·160	43·500	58·900

though there are also some brown hematites, which have a high percentage of manganese, as is the case especially at the Paulus mine. The preceding table gives representative analyses, made by Herr Anton Maderspach, the works' chemist, of the two classes of ore.

From 1855, when these mines came into the possession of the company, until 1877 inclusive, they yielded 316,082 tons of ore; and now lately the raise has been at the rate of 85,000 to 90,000 tons per annum. It is expected that a still larger quantity will have been mined during the past year; and the output could be increased fully one-half if required. The above mines are under the immediate management of Herr Hamerach, assisted by Herr Schwartz. About 2000 tons of ore are also raised annually at Tirnova, four miles to the east of Reschitza; but this is chiefly manganiferous ore, containing over 25 per cent. of manganese, aud is added to the charge for making manganiferous pig. This ore also serves as a flux; but limestone is found in the neighbourhood of Reschitza in sufficient quantity for the requirements of the blast furnaces. The following analyses of both these substances were made by Herr A. Maderspach :—

Manganiferous Iron Ore from Tirnova.		*Limestone from Reschitza.*	
Silica	38·444	Silicate of alumina	2·654
Alumina	7·826	Alumina	0·099
Peroxide of iron	16·735	Protoxide of iron	0·064
Peroxide of manganese ..	28·792	Protoxide of manganese ..	0·022
Oxide of copper	0·085	Carbonate of lime	95·020
Lime	1·720	Carbonate of magnesia.. ..	1·709
Magnesia	0·295	Sulphur	Trace
Sulphuric acid	0·070	Phosphoric acid	0·019
Phosphoric acid	0·517	Organic matter	0·160
Water..	4·850	Water..	0·175

Blast furnaces.—The company possesses altogether nine blast furnaces, viz., two at Dognacska, four at Reschitza, one at Bogsán, and two at Anina,—see general plan, Fig. 1—producing altogether about 65,000 tons of pig yearly. Internal profiles of all these furnaces are shown on page 59 with full metrical dimensions, and with the dates on which they were blown in—or out in the case of No. II. Anina—, the dotted horizontal line through the crucibles showing the tuyere level.

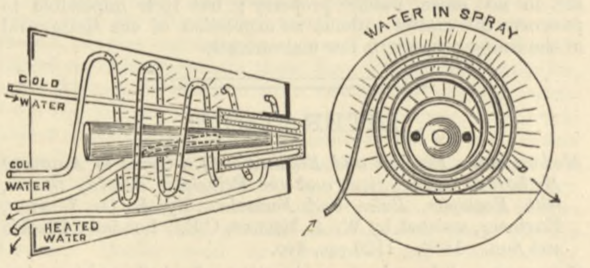
The two furnaces at Dognacska, the southernmost point of the iron-bearing crest of hills mentioned under the head of "Iron Mines," were erected in 1858. They are identically the same, both as regards form and capacity, which is 44 cubic metres, or 1554 cubic feet. The blast is supplied by two horizontal blowing engines, each of 25-horse power, and is heated to 300 deg. Cent.—572 deg. Fah.—by two Carinthian stoves fitted with an Ehrenwerth apparatus for combustion of the gases. As a rule, one furnace is kept in blast and the other out. The yearly production is about 4000 tons of grey pig suitable for steel-making.

Before the Reschitza furnaces were built, the Government founded some ironworks at Bogsán, about four miles to the north of Moravitza, the northern extremity of the iron deposits. These were transformed in 1869 by the company, who replaced the two small furnaces by a single one of 86 cubic metres—3037 cubic feet—capacity, and a yearly production of 6000 tons, which was blown in in 1879. It adjoins the small-gauge railway from Bogsán to Reschitza, so that it can receive ore from Moravitza and coke from Reschitza; but, at the time of the Iron and Steel Institute's visit, it was fired entirely with charcoal. The charge is raised by a water-balance lift; and the mouth of the furnace is closed by bell and hopper. The gases fire a Carinthian stove with heating surface of 130 square metres—1400 square feet—fitted with Ehrenwerth apparatus. The blast, at a pressure of about 9 centimetres—3½in.— of mercury, is furnished by three inverted blowing cylinders, the pistons of which are driven direct from a lay shaft by an over-shot water-wheel, while a pair of 45-horse power steam engines are held in reserve.

The Anina Ironworks, covering 13½ hectares—over 33 acres—and put in communication with the main system by the mountain line above mentioned, have two blast furnaces, marked Anina No. I. and II. on the diagram of blast-furnace profiles, page 59. Both furnaces have an outer casing of masonry erected on iron columns, so as to leave the hearth clear. The lining consists of refractory sandstone found in the lias coal measures, and will stand from three to four years' working without renewal. The charging is effected by side-tipping wagons on a circular tramway round the mouth of the furnace, discharging their contents as they are run slowly round, so as to effect an even distribution. The mouths are closed by bell and hopper; and the gases are taken off by a central flue, serving to heat the blast and also fire the boilers.

At the time of the Iron and Steel Institute's visit, only the smaller furnace, of a capacity of 85 cubic metres—3000 cubic feet—was in blast, having been blown in on 4th May, 1880. The blast is heated to 450 deg. Cent. = 842 deg. Fah., in four cast-iron pipe stoves, of a total heating surface of 280 square metres or 3014 square feet. The peculiarity of this furnace is that it is fired with beech charcoal and raw coal from the neighbouring collieries, in the proportion of 2 of the former to 1 of the latter; and 1·3 ton of this mixed fuel is the maximum required to produce a ton of pig. The charge of ore and flux for a hundred parts of pig iron is:—Magnetic ore from Dognacska, 60 per cent.; blackband from the lias measures, 40 per cent.; limestone from the neighbourhood, 30 per cent.; total, 130 per cent. Both classes of ore are roasted before being charged into the furnace, when the blackband has a content of 35 per cent. of iron. The charge, as mixed generally, contains nearly this percentage of iron when including the flux, or 45 per cent. without taking it into consideration. The limestone flux is obtained from the extensive Predet quarry, which, though not worked by the company, is connected by a tramway with the Krassova station—548½m. = 1800ft. above the sea—of the mountain line above referred to. This furnace makes daily from 25 to 28 tons of pig, its specific gravity being 7·108, and the following its average composition:—Iron, 93·519; manganese, 0·195; copper, 0·178; cobalt, 0·026; arsenic, 0·009; phosphorus, 0·204; sulphur, 0·099; titanium, trace; silicon, 2·152; graphite, 2·935; carbon, 0·351. The larger furnace, of a capacity of 169 cubic metres—over 6000 cubic feet—was blown out in March, 1876; but it is ready for being blown in again, and is to be fired entirely with coke containing 8 per cent. of ash. It has been provided with three Whitwell stoves of the newest type, 60ft. high and 15ft. in diameter, which will heat the blast to 500 deg. Cent.—932 deg. Fah.—and over. This furnace will make 35 tons of pig a day, and work up the stocks of ore that have accumulated since it has been out, there being at the present time 8000 tons of magnetic ore and 32,000 tons of blackband, sufficient to last for two and five years respectively. The Verwalter, or general manager at Anina is Herr Kalusay, the blast-furnace manager being Herr Rinkeisen, and the rolling-mill manager Herr Smidt, the two last-named bearing remarkably appropriate names.

Two of the blast furnaces at Reschitza were begun in 1767, and blown in during the month of July, 1771, in the reign of Maria Theresa, the works then belonging to the Crown. These two furnaces, marked No. I. and No. II. Reschitza, on the diagram of blast furnace profiles, remain nearly the same as when erected. Their dimensions are identically the same, giving a capacity of 60 cubic metres—2120 cubic feet. No. III. was constructed by the company soon after the works came into their possession in 1855. It is of the same height as the other two, but larger in the boshes and in the crucible, having a capacity of 80 cubic metres—2825 cubic feet. These three furnaces, built in a row, are enclosed in a shed, their mouths projecting through the roof. They are fired exclusively with charcoal, of which from 4 to 5 cubic metres—141 to 176½ cubic feet—are required to produce a metrical ton of pig iron. The charge consists of roasted magnetic ore or raw hematite ore, with the addition of manganiferous ore, having together a content of about 50 per cent. of iron with 13 per cent. of flux. The out-turn per twenty-four hours is from 36 to 40 tons of grey Bessemer pig, which is run direct into the converters. The blast is heated in cast-iron pipe stoves to a temperature of about 400 deg. Cent.—752 deg. Fah.—and leaves the tuyeres at a pressure of 8 centimetres—3¼in.—of mercury. No. IV. of the Reschitza blast furnaces, blown in at the end of 1880, is the largest of all, having a capacity of 276 cubic metres—7063 cubic feet. It is fired entirely with coke, of which 1050 kilogs., together with 2300 kilogs. of ore containing its flux, and 100 kilogs. of scrap, are required to produce 1000 kilogs., or a metrical ton, of pig iron. The furnace mouth is closed with bell and hopper; and the gas is taken off from the centre by a breeches pipe with a safety valve on the top, and is led down in a tube 1½ m. in diameter to four Whitwell stoves, a portion being sometimes used for firing the blowing-engine boilers. The stoves, 40ft. high and 18ft. in diameter, heat the blast to about 550 deg. Cent—1022 deg. Fah.—which leaves the tuyeres at a pressure of 15 centimetres—6in.—of mercury. This furnace is blown by five tuyeres of 130 millimetres—5in. —diameter, instead of six, as originally intended. Besides,



having the usual water circulation, the tuyeres are protected by a copper casing, kept cool by water from a separate pipe playing on the inside in the form of spray as shown in the accompanying sketch.

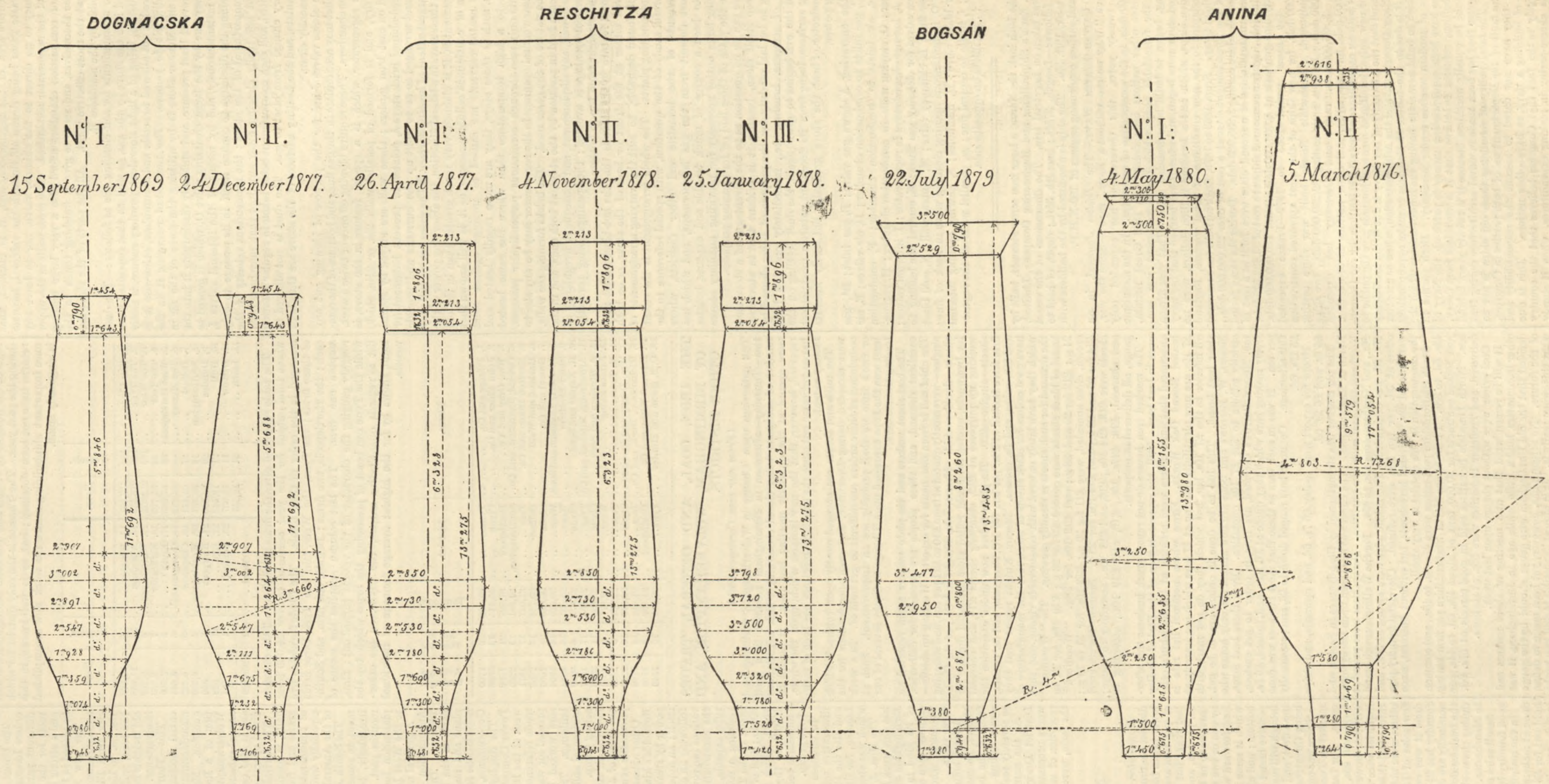
FORD AND MONCUR'S PATENT HOT-BLAST STOVE FOR BLAST FURNACES.

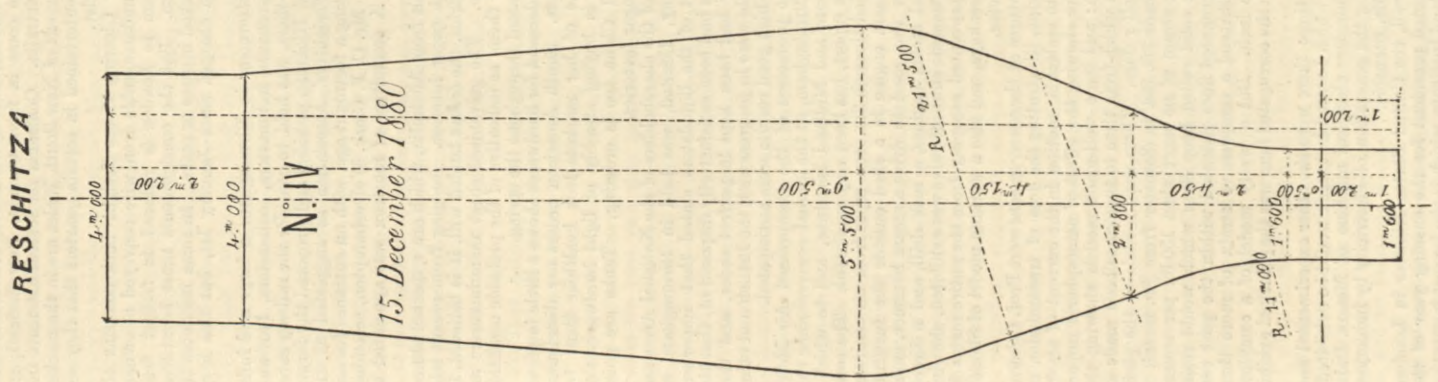
THE patentees, Messrs. Ford and Moncur, of Distington Ironworks, have endeavoured to combine in their stove the all-important function of self-cleaning with a most complete control of combustion, and a perfect diffusion of the gases and heated currents, together with a simple means of regulating the temperature and of maintaining almost perfect uniformity in the heat of the blast during the whole time the stove may be blowing, so that it is no longer necessary with their stoves to have each blast furnace fitted with three or more stoves at a large outlay in plant, three of the Ford and Moncur stoves being, it is claimed, capable of working satisfactorily two of the largest modern blast furnaces.

The following description, with reference to the illustrations on page 54, will explain the various parts and their uses. The combustion chamber F divides the regenerator H into two sections, which are again divided by the wall M, carried from the foundation to the roof. The regenerator is in this way converted into four isolated compartments, each communicating with the large horizontal flue K through the internal valves I. These valves are actuated from the outside. The gases from the blast furnace pass the flue, through the gas valve A into the flues B and B[1] and into the combustion chamber by the graduated openings, C, along both sides of the chamber. The air required for combustion enters by the valves D and D[1], passes along the flues E, and enters the combustion chamber by the graduated openings *e* and *x* placed immediately over the gas inlets, ensuring a thorough mixture of the two. It will be noticed that the air entering by the valve D supplies one-half of the combustion chamber, and the air valve D[1] the other half beyond the dividing wall M. In this way complete control of combustion is secured over the entire length of the chamber. This air in its passage along and through the hot walls of the combustion chamber, enters the stove at a high temperature.

All the compartments are heated simultaneously. The internal valve I being open, the waste gases, after parting with their heat to the regenerator, pass through the large cleaning valve O and the chimney valve L to the chimney flue. After the stove has been heated, the air, gas, and chimney valves are closed, and the cold blast is admitted by the valve N; the hot blast valve Q is now opened. If it is required to equalise the temperature of the blast over a protracted period of blowing, it can be readily done by closing one or two of the internal valves I, thereby holding a portion of the regenerator in reserve. The cold blast enters by the flue K, passes through the internal valves I, and slowly up through the hot chequerwork of the

IRON AND STEEL WORKS, RESCHITZA, HUNGARY.—BLAST FURNACE PROFILES.





Designation of Furnaces.	Dognacska I.	Dognacska II.	Reschitza I.	Reschitza II.	Reschitza III.	Reschitza IV.	Bogsán. I.	Anina I.	Anina II.
No. of tuyeres	4	4	2	2	4	5	4	3	5
Diameter of tuyeres in millimetres ...	66	66	100	100	100	130	100	90	100
Pressure of blast at tuyeres in millimetres of mercury	40	44	80	80	80	150	80	100	120
Temperature of blast at tuyeres in deg. Centigrade	100	320	350	180	350	600	350	350	250
Volume of blast per minute in cubic metres at zero Centigrade, and 760 millimetres of barometer	56·9	68·5	61·5	72·5	123	234	123	100	220
Capacity in cubic metres	44·1	47·3	56	56	80	276	82	81·6	169·4

regenerator, impinging on the many thousands of angular stay-bricks in that structure, then down through the intensely hot walls of the combustion chamber, finally passing to the furnace by the hot-blast valve. It will be seen that the combustion chamber from its shape and position commands thoroughly the entire area of the regenerator, and, it is claimed, that the waste gases being drawn off through the valves I, have no tendency to go direct to the chimney valve, nor to leave any part of the regenerator untouched. The cross walls in the upper part of combustion chambers afford also a very large heating surface themselves, and serve to give a finishing touch to the blast at the most effective point. All the parts of the stove are assessible by the manholes R.

The arrangements for self-cleaning are as follows:—The dust carried into the stove by the gas, as well as that deposited from combustion, being of a light, flocculent, powdery nature, is easily removed if not allowed to settle and accumulate, otherwise it is very difficult to remove. The method of removing it in the Ford and Moncur stove is by utilising the force of the air in the stove at blast pressure, and suddenly discharging it into the chimney flue by the large cleansing valve O, which is geared to open instantaneously, and by means of the internal valves I, compelling the discharge to confine itself in its passage to only one compartment of the stove; the tremendous velocity of the current effectually clearing away any dust that may have been deposited, and each compartment being taken in regular rotation at every change from blast to gas. The dust is not allowed to accumulate, and the heating surfaces of the stove are thus kept permanently clean.

The sluice valves J are for the purpose of blowing out any dust that may accumulate in the gas flues and bottoms of the combustion chambers. These require blowing off once or twice a week.

The regenerator, which is a special feature in the stove, is built dry, and is formed of parallel walls 2in. or 2½in. thick, carried on cast iron girders; these walls are stayed by special lozenged-shaped brick stays *h*, pointed to prevent lodgment for dust, and arranged so as to split up the currents and provide the largest extent of heating surface. The gases having full play round these stays in a lateral direction, the absorbing power of the arrangement is, it is claimed, very much greater than in the old system of continuous cellular passages, as it is well known that where heated currents are caused to impinge against solid bodies, such as these stays, they are more rapidly heated and raised to a high temperature than where the same heated currents only pass through continuous perpendicular passages. The clear vertical openings in the regenerator may be any size to suit the nature of the gases used. The bricks forming the walls, being each held in position by the stays, at both ends, and in the middle as well, any displacement, and consequent irregularity in the vertical openings is avoided; the openings being perfectly true and straight from top to bottom.

A novel feature in the stove is that the hot-blast outlet may be placed either at the front or back of the stove, or on both sides if found desirable, to suit the varying arrangements of different smelting plants. The whole arrangement is the result of a careful study of the question, with special reference to the requirements of the hematite and other districts, where the dust deposit from the gas is enormous, and which has hitherto been a source of much trouble and expense, besides rendering large outlay necessary for providing auxiliary stoves to take the place of those laid off for cleaning purposes.

There can be no question as to the advantages of a stove that will keep itself clean, because it is evident that in stoves requiring to be laid off duty for the purpose of being cleaned by means of scrapers, brushes, &c., immediately one has been cleaned the evil begins to grow again, the dust settling on the heating surfaces, being from its flocculent nature a most perfect non-conductor of heat, the stove gradually but surely loses its heating power.

In the engraving, A shows gas valve; B, gas inlet; B[1], gas flue; C, gas inlets to combustion chamber; D, air valves; E, air flue; *e*, air inlets to combustion chamber; F, combustion chamber; G, staying walls in combustion chamber; H, regenerator; *h*, lozenge-shaped stays in regenerator; I, internal valves; J, sluice valves for cleaning gas flues; K, central flue leading to chimney flue; L, chimney valve; M, central wall; N, cold blast valve; O, instantaneous opening cleaning valve in neck of flue; Q, hot blast valve; R, manholes; S, gearing opening internal valves; *i*, inlets to central flue; *m*, parallel walls of the regenerator; +, air inlets on opposite side.

ON the 10th inst. the Narva, a large iron screw steamer, built by Messrs. Earle's Shipbuilding and Engineering Company, Limited, Hull, was taken on her trial trip. The dimensions of the vessel are as follows:—Length, 275ft.; breadth, 35ft.; depth of hold to top of tank, 19ft. 3in. The ship is also fitted by the builders with compound surface condensing engines of 160-N.H.P.

THE UNITED STATES NAVY.—The *Boston Journal*, in an article on "Why we are without a Navy," says:—Since the war, nearly twenty years, this Government has expended only 3,200,000 dols. in the construction of new ships. In the meantime what have other nations been doing? In 1862 Great Britain, noting the formidable navy which our Government was constructing, began to build large ironclad ships. That year fifteen armoured ships were begun, and when it was learned that her navy of wooden ships, which cost a hundred million dollars, were no longer adapted to the new conditions of naval warfare, England threw them away. From 1863 to 1879, England built ten armoured ships of the Dreadnought class at a cost of over 23,000,000 dols., the Inflexible alone costing 2,935,925 dols. During the same period sixty-two armoured ships of a second class were built at a cost of 87,209,180 dols., eighty unarmoured ships at a cost of 33,432,525 dols. and sixty-nine gunboats at 6,008,000 dols.—total 156,000,000 dols. During the same period—1863 to 1879—France expended 88,500,000 dols. for new ships of the most approved construction and equipment. Meanwhile Russia built war ships costing 35,060,060 dols.; Italy, a navy costing 32,250,000 dols., two ships costing 3,835,000 dols. each; and Germany has expended 37,100,000 dols. for new ships, and other nations in proportion. And yet with an expenditure of only 3,200,000 dols. by our Government for new ships, intelligent men and journals give the public to understand that the inferiority of our Navy is due to the inefficiency of the Navy Department and the Administration, when as a matter of fact it is due to the failure of Congress to make appropriations with which to build new ships having the improvements which the methods of modern warfare render necessary. Both parties in Congress have been appropriating money to patch up the Navy of the Rebellion, refusing to believe that it is worthless from decay, and would be equally worthless because it is twenty years behind the progress that has been made in naval architecture during that period. The fatal policy of rebuilding these old ships is not so much the fault of the Department as of both parties in Congress, because they have not dared to assume the responsibility and expense of building a navy as have other nations. This is due very largely to the fact that Congress believes that the country demands cheese-paring in making expenditures, when it simply demands that there shall not be jobbery. The time has come for the United States to have a Navy. No nation on the face of the earth is so abundantly able to build one as the United States, and there is no longer any excuse for further delay.

TONNAGE OUTPUT IN 1883.

THE following table, compiled from published returns of the tonnage produced in the various shipbuilding ports throughout the kingdom, shows the relative position taken by each port as regards the number of vessels and the total tonnage turned out during the past year. The Thames is the only district for which returns have not been obtained; but, as is well known, in this once important shipbuilding centre the work now accomplished is singularly small.

	Vessels.	Tons.		Vessels.	Tons.
1. The Clyde	326	417,881	13. Whitby	8	13,662
2. The Tyne	159	216,573	14. Aberdeen ..	16	11,628
3. The Wear	126	212,313	15. Whitehaven ..	6	9,262
4. The Tees	44	81,795	16. Kirkcaldy ..	7	8,983
5. West Hartlepool.	39	67,065	17. Blyth	5	5,869
6. The Mersey ..	—	44,212	18. Grangemouth.	6	4,644
7. Belfast	27	41,111	19. Chepstow ..	5	4,422
8. Southampton ..	16	34,331	20. Workington ..	4	4,220
9, Dundee	20	24,386	21. Newport ..	3	850
10. Hull	21	19,542	22. Rye	11	828
11. Barrow	11	16,937	23. Penarth	1	64
12. Leith	21	16,251			
			Total.. ..	882	1,256,829

The table subjoined gives the firms throughout all the districts whose total output for the year amounts to over 20,000 tons, arranged in the order of their totals. The Clyde furnishes five of these firms; the Tyne, the Wear, and the Tees, three firms each; the Hartlepools, two firms; Belfast, one firm, and Southampton one firm. The last column supplies the means of roughly gauging the character of the vessels turned out: thus, while the Tyne can boast of possessing the firms which top the list as regards quantitative output, the Clyde, on the other-hand, shows by far the highest average tonnage of individual vessels.

Firms.	District.	Tonnage.	No. of vessels.	Average tonnage.
1. Palmer and Co, ...	Tyne..	61,113	36	1700
2. John Elder and Co.	Clyde	40,115	13	3086
3. Wm. Gray and Co..	Hartlepool ..	37,597	21	1790
4. Oswald, Mordaunt, and Co..	Southampton..	33,981	15	2265
5. Raylton Dixon and Co. ..	Tees	31,017	17	1871
6. Harland and Wolff	Belfast	30,714	13	2363
7. Russel and Co.	Clyde	30,610	28	1093
8. Joseph L. Thomson and Sons.	Wear..	30,520	16	1908
9. Short Brothers	Wear..	25,531	14	1824
10. R. Napier and Sons	Clyde	23,877	6	3980
11. Armstrong, Mitchell, and Co.	Tyne..	23,584	17	1387
12. A. Stephen and Sons	Clyde	23,020	11	2093
13. James Laing	Wear..	22,877	9	2542
14. M. Pearse and Co...	Tees	22,671	9	2520
15. Wm. Denny and Brothers ..	Clyde	22,240	10	2224
16, Richardson, Duck, and Co..	Tees	21,413	12	1784
17. Edward Withy and Co.. ..	Hartlepool ..	21,199	12	1766
18. C. S. Swan and Hunter ..	Tyne..	20,080	15	1340

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

(*From our own Correspondent.*)

THE gatherings upon 'Change in Wolverhampton yesterday and this—Thursday—afternoon in Birmingham resulted in a good number of contracts being closed concerning which negotiations were opened at the quarterly meeting last week. It cannot be reported, however, that the new business which, upon the whole, has as yet come out since the quarterly meetings has been of satisfactory extent.

The mills and forges are engaged mostly upon contracts which were accepted during December, and even specifications for the completion of these orders are difficult to get hold of. In a week or two's time we shall probably see an improvement. Such at least was the hope expressed upon 'Change to-day by several of our leading ironmasters.

The best sheet makers and tin-plate makers again reported an excellent demand, and these people are pressed for deliveries. The chief call is from merchants for export. Working up sheets—singles—were mostly quoted at from £10 to £11 per ton, and stamping sheets—doubles—£13. Messrs. John Knight and Co., of the Cookley Ironworks, quoted their cold rolled close annealed doubles for working up purposes at £12, stamping sheets £14, and charcoal sheets—singles—£20. Tin-plate orders now under execution the firm have booked at 24s. per box for I.C. charcoals, and 6s. crosses, and 20s. cokes, and 5s. crosses. Messrs. Knight report that they have good orders for black sheets of steel, into the manufacture of which they have lately entered with considerable vigour, and that the demand for such sheets is steadily growing. The "Woodford" brand of black sheets were quoted £9 for 20 g.; £10 10s. for 21 to 24 g.; £12 for 25 and 26 g.; and £12 10s. for 28g. "Woodford" crown, close annealed, were £11 for 20 g.; £12 10s. for 21 to 24 g.; £14 for 25 and 26 g.; and £14 10s. for 28 g. Siemens-Martin steel sheets were £13, £14 10s., £16, and £16 10s., according to gauge; and charcoal, £16, £17s. 10s., £19, and £19 10s., according to gauge, all delivered at outports.

The marked iron houses do not report much business this afternoon in best bars. Still, the representatives of the Earl of Dudley announced that more orders were arriving at his lordship's celebrated Round Oak Works. Firms whose nominal list rate is £7 10s. are now plentifully offering at £7 bars which are scarcely at all inferior to the £7 10s. bar, but which they do not mark with their best brand. This has to be done if orders are to be got. Messrs. W. Barrows and Sons are now almost the only house who strictly adhere to the £7 10s. quotation. Even these best firms, too, Messrs. Barrows excepted, are now, in order to get custom, freely making bars which they quote at £6 10s., and, indeed, £6 5s. per ton. It was in such bars as these that most business was done this afternoon. Common bars ranged down to £6, and occasionally £5 17s. 6d.

Hoops for export were to-day £6 7s. 6d. and upwards, and strips £6 5s. and £6 2s. 6d.

The pig market was strengthened by the advances in Scotch and North of England pigs. The effect was most seen upon Derbyshire. Northampton, and such like qualities. Derbyshires were priced at 46s., and Northamptons 43s. to 45s. For the Wellingborough brand 47s. 6d. was demanded. Thorncliffe pigs were strong at 56s., and offers at 3d. per ton less were refused. Cleveland foundry pigs were quoted 49s. delivered hereabouts, but without business, since the consumption in this district is very small.

South Staffordshire part-mines were 47s. 6d. to 45s., and common 42s. 6d. to 38s. I hear of one North Staffordshire pig firm having just booked contracts for 30,000 tons at about 43s. 6d. to 44s. per ton. North Lonsdale hematites sold in good parcels at 57s. 6d. delivered, and Tredegar hematites were 59s. at stations.

Coal prices were without change upon last week.

It will be remembered that at a meeting of sheet makers and other ironmasters held a little while ago in Birmingham, it was decided that the old Birmingham wire gauge should be the gauge of the future. No attempt has, however, yet been made to define what this gauge really is. It is almost impossible to find two works to agree as to the size or weight per foot of the B.W.G., and some of the ironmasters are now suggesting that it would be well if some definite agreement could be come to.

There is a likelihood that the question will be again considered at the annual meeting of the Ironmasters' Association, which comes off at the end of this, or early next, month. At that meeting it will be probably suggested that the gauge known as Hatton's gauge should be made the standard. This was the gauge which a while ago the Association submitted to Mr. Chamberlain as the basis for a possible Imperial flat metal standard.

The bridge, girder, and iron roofing works keep active, some good orders having of late come in from Canada, New Zealand, and different parts of Australia. Contracts for several extensive iron roofs for the Government of New South Wales are in the market, and a strong hope is entertained in certain quarters that they will be placed in the district.

The new Railway Clearing House freight book confirms the announcement that undamageable iron wire conveyed at owners' risk from Birmingham to London is reduced in freight from 19s. 2d. to 15s. per ton. But the consignments must be at least two tons, and not packed in cases or casks. In some instances the old freights have been charged since January 1st, but this is an inadvertence.

This—Thursday—afternoon in Birmingham a large and influential meeting of merchants, ironmasters, coalmasters, hardware manufacturers, and others, was held to consider the railway rates' question. Mr. Alfred Hickman presided and proposed the formation of a Railway Freighters' Association as suggested at the Wolverhampton meeting a fortnight ago, with an entrance fee and annual subscription. Mr. C. F. Clark, Wolverhampton, seconded, and it was carried. A committee of fourteen was appointed to direct operations.

The arrival of mails from Australia, which are expected almost daily, is awaited with eager interest. Judging from recent telegrams and from inquiries, the orders landed will, it is believed, be of considerable value. The galvanised sheet manufacturers are especially waiting for them, as indicative of the probable condition of the Australian demand throughout the spring.

The South African demand for hardwares shows a little improvement in some branches. South American orders are distributed irregularly, but some of her markets look healthier than for months past. India is buying steadily of light hardwares and plantation tools, and China too is ordering, Tanks are going to the West Indian sugar factories.

A general meeting of the shareholders of the National Arms and Ammunition Company, Limited, was held in Birmingham on Tuesday. The report of the liquidators stated that important parts of the business had been satisfactorily disposed of, that the plant and machinery had been kept in perfect order, and that negotiations for its sale were in progress with the British and other Governments, from which good results were anticipated.

The display by the promoters of the Compressed Air Motor Power Company for Birmingham, at the annual *conversazione* this week of the Birmingham and Midland Institute, and to which I made reference in last report, has been very successful. The compressed air was supplied through 2in. iron pipes from air compressors worked by a steam engine in a shed outside the Institute buildings. The power was used to drive a steam hammer, small horizontal and vertical steam engines, a rock drill, and a direct-acting pump. An automatic shut-off valve was exhibited, showing how the air could be prevented escaping from the entire mains in the event of a local breakage, and also a working model of Shone's pneumatic sewage ejector.

Other attractive features at the *conversazione* were Prof. Osborne Reynolds's kinetic engine, illustrating the loss of transmission of power by steam, due to molecular motion in the current of steam itself; an apparatus for showing the effect of atmospheric impact following an explosion; and some well-made models showing the various improvements which from time to time have been made in the construction of boiler flues. There were models of the plain tube, capable, when made 2ft. 9in. in diameter from ⅜in. metal, of resisting a collapsing strain of no more than 130 lb. per square inch; of the T-iron or solid rolled hoop flues which would resist 300 lb.; and of the corrugated flues patented within the past two years, which will withstand a compressive strain of more than 1000 lb. to the square inch. But a pretty model of a complete Lancashire boiler with the corrugated flues was the principal exhibit of the group.

In addition to all these there were the other experimental and illustrative machines which I stated last week would be exhibited; and also the British inductive electrical machine of Messrs. Dale, London, for illustrating the generation of electricity by induction, which was shown by Mr. Stansbie.

The Hon. J. R. Lowell, the United States Minister in London, has this week been elected president for the ensuing year of the Birmingham and Midland Institute, which is the largest institution of its kind in the United Kingdom. Mr. Lowell succeeds such eminent men as Sir William Siemens, Mr. Froude, and Sir William Thomson, who have been the respective presidents for the past three years.

A fatal boiler explosion occurred on Saturday at the works of Messrs. Thomas Bolton and Sons, metal rollers, Birmingham. The front of the boiler was blown out, and the escape of water and steam filling the boiler shed enveloped the fireman, who was so severely scalded that he died on Sunday.

At the annual meeting of the Birmingham, Tame, and Rea District Drainage Board on Tuesday, it was reported that the works necessary for the preparation of the new farm lands for the reception of sewage, and those required for carrying on the work of the farm, were being rapidly and successfully carried on.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Business in both the iron and coal trades of this district continues very quiet, and where orders have to be secured lower prices have to be taken. One or two of the district makers of pig iron are holding out for the full rates quoted at the close of last year; but there has been a pretty general giving way of 6d. to 1s. per ton, and in finished iron good local and North Staffordshire bars are to be bought at 2s. 6d. per ton under the prices still quoted by one or two of the leading makers. There is a disposition to buy long forward at the minimum prices that a few sellers are taking, which is some indication of a belief that the market has got to the bottom; and although North-country iron has scarcely been a competitive brand here, that the blowing out of furnaces at Middlesbrough will materially influence this market—it may have a steadying effect, and will certainly remove the competition which was being threatened on the part of North-country makers.

There was only a very slow business doing at the Manchester iron market on Tuesday, and lower prices were being quoted in some cases. For Lancashire pig iron quotations were reduced to 44s. for forge and 45s. for foundry less 2½ delivered equal to Manchester, without, however, bringing forward buyers. For district brands inquiries were reported at about 1s. per ton under the full quoted rates; and there were sellers of Lincolnshire on this basis, although others were not disposed to give way more than 6d. per ton. A few sales of Lincolnshire were reported, but where business was done it was on the basis of 43s. 10d. for forge and 44s. 10d. for foundry less 2½ delivered here. For Derbyshire brands quotations nominally are 47s. to 48s. less 2½ delivered. In Middlesbrough iron the business doing is of no weight; but a few lots have been sold during the week at about 45s. net cash for g.m.b. delivered equal to Manchester.

Small sales of hematites are reported at about 56s. less 2½, for good foundry brands delivered into the Manchester district.

In the manufactured iron trade there is little or no business being done at makers' list prices. One or two of the leading makers still hold out for £6 2s. 6d. for bars delivered into this district, but good brands are to be bought without difficulty. Hoops average £6 7s. 6d. to £6 10s., and sheets £7 5s. to £7 10s. per ton. One or two tolerably large lots of bars have been sold at £6, but beyond this there has not been much done.

Further reports I have received with regard to the condition the engineering trades confirm pretty much what I wrote last week. The last month's reports from the various branches connected with the engineering trades' union societies are not a very reliable index as to the actual condition of employment, as a good many men on the books have been suspended in connection with the recent holidays, which in some cases, owing to slackness of trade, have been of more than usual duration. In the Liverpool district some works were closed for a fortnight, and in several other important centres for fully a week. Apart, however, from exceptional causes the general tendency of the reports is not encouraging as indicating a continuance of the activity which characterised last year. From sources representing both the employers and the men reports show unmistakeably that work in many departments is falling off. There are, however, exceptions: locomotive builders in some cases have work in hand which will keep them going more than over the present year, and so far as special tool makers are concerned, except that extra night shifts are being discontinued, they also have in most cases still plenty of orders to keep them fully employed. Heavy tools for marine work are, however, in less demand, and there is less of the large class of engineering work giving out, stationary engine builders are only moderately employed, and the cotton machine making trade is quiet. The branch reports received by the Amalgamated Society of Engineers show, apart from the holiday stoppages, a general slackening off in the demand for men, with about 3 per cent. of the members returned for the past month as in receipt of out-of-work support. The reports received by the Steam Engine Makers' Society continue satisfactory as to the condition of employment, and show that a fair demand for men is maintained in the above branch of work, with the result that the Society has at present very few of its members drawing out-of-work support. With the exception of Bolton, work generally is returned fairly good in the principal Lancashire centres of industry.

Mr. Thos. Ashbury, C.E., who has been re-elected president of the Manchester Association of Employers and Foremen, delivered an interesting address to the members at their meeting on Saturday, on the occasion of his entering upon his second year of office. Referring to the position of the society, the president said they entered upon the new year under most encouraging circumstances. During the past year they had enrolled forty-three new members; their finances were flourishing, their library increasing, and arrangements had been completed for holding their meetings in a most suitable room in a very appropriate building—the Manchester Technical School. The retrospect of the past year augured well for an interesting and successful year to come. Proceeding with his address, the President observed that on the occasion of his election twelve months ago, he had endeavoured to direct their attention to the hard and stubborn fact that the world owed, more than it had ever acknowledged, an immense debt of gratitude to the engineer for the important part he had taken in all that concerned the world's progress, civilisation, and development. He would now turn their thoughts backwards to ages past, and glance at engineering in former days. When they came to note some of the work of the engineer in ancient days, they would find that with the aid of manual labour and the simple mechanical contrivance at his command, the ancient engineer did almost all that was possible with or in earth, stone, or wood, and his work stood comparison with some of the best of modern times. When they considered the magnificent engineering works of ancient times, the creation of ages they called barbarous, in countries which were, by comparison with the notions of the present day, sparsely populated, and subject to war, pestilence, and famine, or the ruinous consequences of frequent organic political changes, without accummulated capital or the ready means of exchanging products, to say nothing of the absence of facilities for that rapid intercommunication of discovery and of thought which had had so marvellous and beneficial an influence of late years on every department of art, science, and literature, they could not but be astonished—not at the magnitude of their own works—but that with all the immense advantages we now possessed, they should have been enjoyed only so recently, and should up to these latter days have been turned to so little profit. Let them look at the position of their own country only so recently as one hundred years ago, when England could hardly be called a manufacturing country at all, when their cotton, woollen, flax, machine, and other manufactures were only struggling into birth, when they could not keep water out of their coal pits, could not build a steam engine fit to be seen, when they had no harbours or docks, no ships fit to go to sea, and no literature worthy of their nation; when their main roads had ruts 4ft. deep, and the mail coach had just begun to run; when they had no steamboats, no railway, and no telegraphy, and every one could see the great contrast between the material conditions of to-day. During the last century or thereabouts the merely material, physical, and mechanical change in human life was greater than had occurred in the thousand, nay, even the two thousand years that had preceded. In England this material change had been more rapid than in any other country, and was beyond parallel in modern history. Yet the question had been asked, "In our day, with a thousand times the resources of any that preceded it, do we use them to a thousand times better purpose?" and this was a question which it would be well if they would ponder. I may add that arrangements have been made for holding the annual dinner of the Association at the Grand Hotel, on February 9th, and that Mr. Daniel Adamson has consented to take the chair.

In the coal trade business is very dull, and it is exceptional where the pits have resumed work after the holidays on full time, many of them not running more than three to four days a week. All classes of round coal move off slowly, and although there is a fair demand for engine fuel, a good deal of this class of fuel is in some districts being thrown upon the market by the strike in the cotton trade. The quoted prices at the pit mouth are without change and average 10s. to 10s. 6d. for best coal, 8s. to 8s. 6d. for seconds, 6s. to 7s. for common, 4s. 6d. to 5s. for burgy, and 3s. 6d. to 4s. for slack. There is however, a great deal of underselling, which is giving a downward tendency to the market.

The demand for shipment has been only very poor, and sales have been pushed at low prices, Lancashire steam coal delivered at the high-level, Liverpool, or the Garston Docks being readily obtainable at 8s. per ton.

At the meeting of the committee of the Manchester Coal Exchange, held on Tuesday, the secretary presented the financial statement for the year 1883, which showed that the income hsd amounted to £212, and the expenditure to £176, leaving a surplus of £36, which, added to the balance carried over from the previous year, leaves a balance in the hands of the committee of £135. The annual meeting of the members is to be held on the 5th February next.

Barrow.—The position of the hematite pig iron trade of this district is still in a low and unsettled condition. The expected revival with the new year has not taken place; but the trade is, if possible, in a still quieter position than in the closing months of 1883. No improvement is looked for, and any that does take place will come as a pleasant surprise. The orders which have come to hand during the past week are both few and inconsiderable. The weight of exports is decreasing. There seems to be a pretty general movement existing in this district for further reducing the output, and local furnaces have lately been blown out and damped down. The stocks of metal now warehoused at makers are very heavy, and they have not been reduced to any extent since the output has been lessened. Prices are ruinously low, but it is impossible to increase them, and makers at present are receiving next to no profit. Sales of No. 1 Bessemer have been made for prompt delivery at 46s. 6d. per ton net, which is a little lower than last week, No. 2 at 46s., and No. 3 at 45s. 6d. per ton. The steel trade is in a very low condition, such as has not been experienced for some time past. Few contracts are coming to hand. The demand for rails has fallen off considerably the last month or so. Indeed, such is the condition of the trade that many of the works have been closed, throwing the whole of the men employed out of work. In other places the men have received notice of 10 per cent., and in some instances 15 per cent., on their already small wages, which happily they have seen fit to accept. Shipbuilders are not busily employed, and few inquiries are coming to hand. The minor departments of the iron and steel trades are on the whole but indifferently employed. Iron ore is in quiet demand at last week's quotations. Large banks of ore have accumulated at the mines during the depression in the trade. Coal and coke steady, with easier prices. Shipping quiet.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

SINCE the coalowners declined to receive a deputation of the colliers to discuss the question of a 10 per cent. advance the matter seems to have dropped. The languor in trade and the continued mild weather, coupled with the immense accumulations of stock before the strike, all combine to keep the demand very low, and the tendency is still downward. The Mount Osborne collieries in the Barnsley district have been closed for the present. This will throw some eight hundred hands out of employment. Generally the time worked is not more than four days a week, and the lessened output is quite sufficient to meet the call from all markets. Under these circumstances any agitation to secure an advance of wages seems to have little chance of success. Mr. A. M. Chambers—Messrs. Newton, Chambers, and Co., Limited, Thorncliffe—has repeatedly shown that the wages of miners in South Yorkshire average from 6s. to 7s. per day; and when the miners by the use of figures show a less amount, the result is arrived at by including the trammers, whose wages are paid by the miners, and who are generally youths under twenty years of age, earning, of course, much less money than the miners themselves. The coalowners consider that for eight hours' labour a collier who earns 6s. to 7s. a day is not inadequately paid in the present condition of the coal and iron trade. When business revives and prices rise, coalowners will be quite willing to let the miners share in the advantage; but any increase in the cost of coal-getting now would simply retard prosperity in these parts, and add to the enormous losses already sustained by the coalowners. Such is the view of affairs taken by those who are in a position to judge—the colliery proprietors themselves.

The most hopeful sign at present is the readiness of the Union leaders to consider a system of regulating wages. This is what the employers have been aiming at for years, urging upon the men the adoption of a sliding scale. If an arrangement had been come to in years past, many thousands of pounds would have been saved and much misery and loss avoided. The proposal submitted by the men starts with the condition that 10 per cent. upon the present wages must be given, and this makes it inadmissable for the masters to entertain. It is probable, however, that some scheme may be devised by which the serious and abrupt—not to say brutal—method of "striking" may become a thing of the past.

It is stated in steel rail circles that efforts are being made, chiefly by the South Wales manufacturers, to secure common action so as to prevent the ruinous competition in rails. Private meetings are believed to have been held in London with the view of having the output restricted, to be followed up by an advance in prices. The promoters of the movement mean to try and induce the whole of the English rail makers to join them in the movement, as well as to solicit the co-operation of German competitors.

A "hitch," assuming the proportions of a short-lived strike, occurred among the puddlers employed at the Cyclops Works—Messrs. Charles Cammell and Co., Limited. It is the practice of the firm to keep a week's wages in hand. At Christmas the men had a fortnight's holiday, and on Saturday expected to have a "draw," according to the custom at several of the large firms. The manager in the department declined to depart from the firm's custom, and the puddlers, being unable to pay their under hands, at once declared they would not continue working. Some 300 hands were affected, but the "strike" was terminated after three days, the firm agreeing to let the men draw a portion of their earnings.

The facts brought out by the Board of Trade returns for last year are not very comforting to local manufacturers, and fully bear out the anticipations given in my review of the year which you recently published. In steel rails alone the falling off, as compared with 1882, is £444,040. A value of £450,000 was sent from this district to the United States—chiefly by Messrs. Charles Cammell and Co.—in that year, while in 1883 the quantity exported to that market did not quite reach one-third of that amount. The increasing markets are Sweden and Norway, Spain, Chili, British East Indies and Australasia; decreases are shown by Germany, Italy, Brazil, British North America, and United States. To the latter market a value of £1,151,245 was sent in 1882, and £1,332,822 in 1881, while last year it fell off to £389,121. This is simply deplorable. In hardware and cutlery—why do not the Board of Trade show the two separately?—only three markets show an increase during December—Holland, France, and Germany. On the twelve months the only market which shows any improvement is British East Indies, where the value for last year has been £349,081, as against £311,829 in 1882. Unwrought steel has fallen off to all markets during the year. South Africa shows a drop from £196,408 to £96,148. I hear, however, that there are signs of a change for the better in that direction. One or two of our local firms have obtained orders recently, and it is believed that the effects of the disastrous diamond speculations have pretty well exhausted themselves.

In pig iron Germany and Belgium show a slight improvement, and Russia has doubled her export of pig during December, but that country shows a great fall on the year, while the United States has decreased from £1,660,837 to £969,925.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE Cleveland iron market held at Middlesbrough on Tuesday last was well attended, and more animated than it has been for a long time. The change has been brought about by the announcement that the Cleveland ironmasters have unanimously decided to restrict the output of their furnaces. It is understood that twenty will be blown out almost immediately. A committee has been appointed to decide which furnaces are to be stopped, and their arrangements will be made known in the course of a few days. Meanwhile consumers are very anxious to place orders, and merchants are buying freely to cover previous sales. Prices have advanced and still are advancing. On Tuesday 9d. to 1s. a ton was paid over and above what was paid a week since. No. 3 g.m.b. could not be had at less than 36s. 6d. per ton for prompt delivery, and 37s. for forward. Grey forge iron was obtainable at 34s. 6d. per ton.

Warrants are not offered for sale at any price.

The stock of pig iron in Messrs. Connal's store at Middlesbrough remains the same as at the beginning of the month, the quantity being 62,060 tons. At Glasgow they hold 587,589 tons.

Shipments from the Tees are, so far, fairly good, amounting as they do to 29,690 tons, up to and including Monday last.

Inquiries for manufactured iron are more numerous, and prices are somewhat firmer. The quotations on Tuesday were as follows: Ship plates, £5 15s. per ton; angles for shipbuilding, £5 5s. to £5 10s.; and common bars, £5 7s. 6d. to £5 12s. 6d. free on trucks at makers' works, cash 10th less 2½ per cent. Dr. Spence Watson's award as to the wages of ironworkers has not yet been received.

The strike at the Bowesfield Ironworks and the lock-out at Messrs. Bolckow, Vaughan, and Co.'s Eston Steel Works still continues, and there seems to be little prospect of an early settlement in either case. The Bowesfield men have received some slight relief from their fellow ironworkers in the district. The Eston men are sending out an appeal for help. The Iron and Steel Workers' National Association are assisting those who belong to the Union.

The value of the exports from Middlesbrough last year, excluding coal and coke, amounted to £2,341,860, as compared with £2,047,811 in 1882.

According to the accountants' certificate, under the Cumberland coal trade sliding scale, the average net selling price of coal for the quarter ending December 31st was 5s. 7·76d. per ton.

At a council meeting of the Durham Colliery Mechanics' Association, held at Durham on the 14th inst., the following resolutions were unanimously agreed to:—"That we accept no sliding scale unless fixed on a higher basis of wages than the preceding one;" and the following:—"That we abide by the claims already made upon the owners."

A meeting of the Cleveland Mineowners' Association was held at Middlesbrough on Saturday last, when a deputation from the Miners' Association was in attendance. The wages question and the sliding scale were fully discussed, but nothing definite was settled. Another meeting will be held on the 22nd, when the men's representatives will be in a position to say whether the old scale is to be renewed or not. If not, the masters will give notice for a reduction of wages. The blast furnace men are not willing to accept the old scale, but ask to be paid the present rate of wages until a new scale can be agreed upon.

The Middlesbrough Corporation intend to petition against the North-Eastern Railway Company's Bill for the purchase of the Middlesbrough Owners' Railway, unless that company agrees to insert certain clauses in the Bill which they desire to add.

The Witton Park Ironworks, belonging to Messrs. Bolckow, Vaughan, and Co., were idle last week, and are expected to be the same next week. Lack of orders at remunerative prices is said to be the cause.

The Wear Rolling Mills Company gave some time since all the workmen notice to leave, except a few required to effect certain repairs. The period of these notices having expired the men are out of employment. Nevertheless they remain in the neighbourhood, as it is not easy to find work elsewhere.

Touching the Bowesfield dispute it is stated that Mr. Trow, Operative Secretary, has intimated to Cox and his two comrades, the discharge of whom with proper notice was the *casus belli*, that any grievances of theirs or others will be considered by the Standing Committee when the rest of the men return to their work; but until they do no investigation will be entered upon. No further meeting of the Associated Manufacturers has taken place, as the ordinary rules of the Association fully provide for such emergencies. It is quite certain that the Bowesfield Company is being supported by its fellow members, and that it will remain idle until the men are prepared to allow it to discharge any employé whose services it may cease to require, after legal notice, and without rendering reasons. The money collected by the Strike Committee on Saturday last amounted to about £70. This was divided among about 400 ironworkers, yielding an average of 3s. 6d. each. On such narrow means they are not likely to persist much longer in the unreasonable course they have adopted. The Strike Committee has refused to allow anything to the mechanics incidentally thrown out, a policy which has caused great indignation among the latter.

It is announced that Messrs. Dorman, Long, and Co., of Middlesbrough, are about to put down the necessary machinery for manufacturing builders' joists in iron and steel on an extensive scale.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THERE has been a notable advance in the prices of warrants this week in consequence of the negotiations that have been proceeding at Middlesbrough for the curtailment of pig iron production. Last week the quotations were down to 42s. 6½d., the lowest figure touched for several years; and although the rise which has since taken place is considerable, there is no assurance that it will be permanent. The past week's shipments of Scotch pig iron were about 900 tons larger than in the preceding week, and the trade is again fairly in its usual condition, and there have been a number of transactions this week on the part of consumers, but the greater part of the business has been of a speculative nature. "Bears" have been covering over-sales, and there has also been some selling for holders who are tired of their operations on 'Change. The stock of pig iron in Messrs. Connal and Co.'s Glasgow warrant stores has increased by about 1300 tons in the course of the week.

The warrant market was strong on Friday, with a good business from 43s. 1½d. to 43s. 6½d. per ton for cash. On Monday forenoon transactions occurred at 43s. 10d. to 43s. 7d. and 43s. 9d. cash, the quotations in the afternoon being 43s. 8½d. to 43s. 7d. cash, and 43s. 10½d. to 43s. 9d. one month. Business took place on Tuesday at 43s. 7d. to 43s. 9d. cash, and 43s. 7½d. to 43s. 10½d. one month. Business was done on Wednesday at 44s. to 43s. 7d. cash, but to-day—Thursday—the tone of the market was again stronger, with transactions at 43s. 6d. to 43s. 10½d. cash, and 44s. 0½d. one month.

In makers' iron there has been a decided improvement, the prices now being as follows:—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 52s. 6d.; No. 3, 50s.; Coltness, 57s. and 51s. 6d.; Langloan, 55s. and 51s.; Summerlee 53s. and 49s.; Calder, 54s. 6d. and 48s.; Carnbroe, 52s. and 48s.; Clyde, 47s. 6d. and 45s. 6d.; Monkland, 45s. and 48s.; Quarter, 44s. and 42s. 6d.; Govan, at Broomielaw, 45s. and 43s.; Shotts, at Leith, 54s. and 52s.; Carron, at Grangemouth, 49s. and 47s. 6d.; Kinneil, at Bo'ness, 46s. and 45s.; Glengarnock, at Ardrossan, 52s. and 45s. 6d.; Eglinton, 46s. and 43s. 6d.; Dalmellington, 48s. 6d. and 46s. 6d.

The arrivals of Cleveland pig iron at Grangemouth in the past week amounted to 4845 tons, being 2483 tons less than in the corresponding week last year.

Upwards of 7000 tons of foreign iron ore were imported into the Clyde in the course of the past week.

The strike of steel workers in the west of Scotland has been of longer duration than was anticipated. Towards the close of last week the men requested their employers to submit the question of the reduction of wages to arbitration. After two days' delay, during which, no doubt, the matter was carefully considered, the employers, through Mr. Riley, manager to the Steel Company of Scotland, replied that, although anxious to arrive at an amicable settlement, they could not accede to the men's proposals, as they fail to see what grounds there are for arbitration in the matter. This communication having been submitted to a meeting of the men, they agreed, with but one dissenting voice, to continue the strike. It was not believed, however, that the dispute would last much longer.

The impression left in business circles by the iron trade meetings of last week is decidedly unfavourable. In the manufactured iron department the outlook—particularly in the matter of prices—is not encouraging. The iron and steel manufactures despatched from Glasgow in the past week are valued at about £80,000, these being exclusive of innumerable small articles of ironmongery, &c., sent away in parcels.

There is decidedly less animation in the coal trade, arising from various causes, among which are the strike in the steel trade, noticed above, which has greatly reduced the inquiry for furnace coal. Most other branches of the business are quiet, and the firmer quotations are only in some cases nominally maintained. The shipping department of the trade has been comparatively quiet, owing to the cargoes sent off from Glasgow in the past week having been 1200 tons for Dantzic, 700 tons for Lisbon, and 800 tons for Bordeaux. At Grangemouth the export of coal in the past week has been small, only 1661 tons while business has also been comparatively quiet at Leith.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

THE country is literally overrun with engineers, surveyors, and speculators, and in all my experience I have never seen a period of greater activity in connection with coal and railway enterprise.

The Roath sidings form as good an exhibition of railway work as I have seen. Ten lines of rails extending for a-quarter of a mile and covered with coal traffic form an unusual spectacle, and these independently of the four lines of rails which are devoted to incessant action, passenger, goods, and coal. Already this Roath siding has done good work, and we do not hear of so much congestion at docks. The rails are best steel from Browns, Sheffield.

The early signs of semi-stagnation throughout the district are to be seen at the iron and steel works, from which business, strangely enough, seems at present to retreat. Prices are low enough to tempt, and quality is unmistakeable. In the old days, when iron rails had the market to themselves, it was easy enough to get gradations of goodness, but steel is uniformly good. Last week I heard of a trial of rails for the Midland Railway, and with surprising results, in confirmation of this view.

There seems, however, some difficulty in Wales in getting special kinds of steel, crucible steel and the like, and new works to remedy this are in progress. A very promising wire works near Merthyr has been of late doomed to partial idleness on this account, makers in the vicinity not turning out the required sort of billets.

The great engineering task before the Corporation of Cardiff for the supply of the town and district with water from the Breconshire Valley is now fully agreed upon. It will cost over £300,000 and take four years to accomplish, but there is really no practical limit to the supply of pure water which will be obtained. It will come from off the old red sandstone about six miles from Merthyr, and fully thirty from Cardiff. The Breconshire authorities are taking a lively interest in the scheme, as it will affect several bridges and roads, and the Merthyr Railway and parochial authorities are also moving.

The output of coal from the house and steam districts last week was very large, and the whole of the ports from Newport around to Llanelly were as busy as at any previous high-pressure time. Prices are evidently going up, and for special conditions and qualities market quotations no longer hold in any degree. In fact things are drifting to this pass, that for the best samples of Admiralty coals, coalowners can get their own figures. The bartering that used to go on at port is pretty well at an end. Figures are named by coalowners, and the transaction is quickly settled in one way or another.

At Newport last week prices had a distinct upward character, and there and at Swansea and Cardiff the vitality of the trade was very pronounced.

I have heard of several new takings in the Rhondda Valley and fresh combinations. In a little time there will be another and a bolder effort to solve the question of good workable seams on the east of the Taff, at Pontypridd, but so far it is remarkable that no effort is made to take to the sinking of Mr. Williams' Penygraig, who proved the coal on the east, but was obliged at the time to abandon it.

Efforts are being made to repair the sunken part of the Treforest Viaduct on the Newport, Caerphilly, and Rhondda Railway, and in time this will be accomplished, but the delay is a ruinous one.

The foundations of the viaduct at Quakers Yard are now secured, and the success of this branch of the Great Western Railway is in marked contrast to the misfortunes that have befallen the other.

The colliery dispute at Caerphilly remains unsettled.

The anthracite colliers have joined the Sliding Scale Association.

I am glad to report a more peaceable condition amongst the Taff Vale Railway men. The management has perservered in its course of rigid impartiality and consideration throughout all the epoch of bluster and threat, and now the men who voted for striking are coming forward with their acknowledgment.

It is stated that the last Cardiff scheme, the Windsor Dock and Slipway share list, is closed.

The Reduction in the Iron Trade.—The ironworkers at Maryport, at a meeting held on Saturday last, after hearing the report of a deputation who had visited the ironworkers at Workington, and in which they stated that the latter men considered that the 10 per cent. reduction was too much, and that with the present low wages 5 per cent. would be sufficient, and if trade improved another 5 per cent. reduction might be made, decided to take no action until another meeting had been held at Workington. Two delegates were appointed at the close to attend a meeting of which they had received notice.

The Load-line Question.—One of the facts that is brought out by the visit of Mr. Chamberlain to Newcastle is the statement, published in advance of the visit, that a settlement of the load-line question was proposed by the Newcastle Chamber of Commerce so far back as the year 1869. It was to the effect that the builder of the vessel—as representing the owner—the underwriters, and the local surveyors of the Board of Trade, should decide upon the position of the load-line, and suggested a mode of determination if these authorities could not agree. We do not now intend to refer at length to that proposal, as in the columns of The Engineer the question of the load-line has been very fully discussed, but it is worth the reminder that from the commercial men of the North, well and intimately acquainted with the cargo ship, which is the chief vessel the determination of the load-line on which is in dispute, a proposal so long ago was made. The suggestion was publicly made, approved, and a petition embodying the proposal was presented to Parliament. The Bill of that date fell through, and with it the suggestion. The idea that it suggests is that something of the "muddle" of the merchant shipping question, and the delay in regard to a proper understanding of the needs of the shipowners, may be due to the changes in the occupants of the office from which there is oversight of shipping. It is not difficult to suggest that the course of the shipping trade would be smoother if the head of its supervision were not changed with party needs; and it is probable that if this were made the case, the load-line question would be speedily settled.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

8th January, 1884.

906. Tobacco Pipes, J. Wright, Macclesfield.
907. Finger Plates, C. H. J. Clayton, East Dulwich.
908. Brake, T. A. Segrave, Mullingar.
909. Underminining Coal, A. R. Strachan and H. Mann, Gateshead-on-Tyne.
910. Knife-cleaning Machines, J. Ellison, Leeds.
911. Fasteners, G. W. Mohrstadt, Harborne.
912. Microphotoscope, R. Galland-Mason, Douglas.
913. Cigar, &c., Boxes, J. M. Webster, Liverpool.
914. Furnaces, J. Swain, Oldham.
915. Keeping the Change Wheels of Screw-cutting Lathes in Gear, T. B. Sharp, Smethwick.
916. Fire-extinguishers, G. J. Sturt, Hailsham.
917. Match-box, &c., C. H. Cheshire, Birmingham.
918. Axle Protector, H. Parks, Northwich.
919. Ornamental Frilling, M. Jackson, Nottingham.
920. Draining Machines, R. M. Whitaker and J. Harragan, Skipton.
921. Steam Boilers, &c., W. Galsworthy, Grimsbury.
922. Beaters, W. Richardson, Oldham.
923. Laying Electrical Conducting Wires, H. J. Allison —(*J. Greives and J. H. Bleoo, Paterson, U.S.*)
924. Grinding, &c., Machinery, A. W. L. Reddie.—(*W. Decker, Mittweida, Germany.*)
925. Protecting the Soles of Boots, S. Setter, Redland.
926. Measuring and Surveying Instrument, R. Whitaker, Birmingham.
927. Electro-gilding, J. Record, Walsall.
928. Tip Vans, C. Batten, London.
929. Checking Apparatus, C. Davies, Liverpool.
930. Steam Boilers, D. H. Lowry, Widnes.
931. Tongs, Shears, &c., F. Taylor, Whitchurch.
932. Carding Engines, C. Alder, Thrupp.
933. Dynamo-electric Machines, L. Groves, Glasgow.
934. Changing Dissolving Views, W. H. Duncan, Coalbrookdale.
935. Water-level Gauges, F. R. de Wolski, Gosport.
936. Stop Valve, W. Whiteley.—(*R. Pratt, Hartford, U.S.*)
937. Looms for Weaving, J. Dyson, Marsden.
938. Carding Wool, &c., R. C. Sykes and W. Hodgson, Cleckheaton.
939. Cast Steel Hatch Coambing Corners, J. Smith, Wallsend.
940. Making up Woollens, &c., E. Haigh, Bradford.
941. Crank Shafts, &c., H. Foster, Newcastle-on-Tyne.
942. Tipping Wagons, &c., R. and S. Wadsworth, Halifax.
943. Ball Valves, J. Hemmings, Brighton.
944. Preserving Roads, &c., T. Craddock, London.
945. Safety Sash Fastening, F. R. Wildegose, London.
946. Warping, &c., Frames, P. Brimelow, Bury.
947. Tennis Shoes, H. Harris, Northampton.
948. Writing Slate Frame, W. Lewis, Tanygrisian.
949. Lock Screw Nuts, S. H. James, Tottenham.
950. Tricycles, W. R. Pocock, Porchester.
951. Transfers, Trambars, &c., T. Martin, Guernsey.
952. Cooking Ranges, J. Napier, Kirkintilloch.
953. Plastering Machines, W. E. Baker, Aldershot.
954. Air Engines, W. Ross, London.
955. Chimney Tops, &c., J. D. Wright, London.
956. Cylinders, &c., J. H. Johnson.—(*Messieurs Flécheux, Flécheux, and Jantot, France.*)
957. Stopping Looms, F. Williamson, Haworth.
958. Spinning Machinery, F. Williamson, Haworth.
959. Protecting Ships, &c., J. Brown, Coventry.
960. Latitude Indicators, P. M. Justice.—(*P. Boyhan, New York, U.S.*)
961. Ammoniacal Phosphates, W. Martin, Pembroke.
962. Supplying Air for Combustion with Gas, T. Thorp, Whitfield.
963. Buckles and Stirrups, J. S. Crowley, Manchester.
964. Opening, &c., Cotton, J. Cronkshaw, Haslingden.
965. Skips, Hampers, &c., T. Harden, Manchester.
966. Earthenware-lined Smoking Pipes, J. E. Walsh. —(*A. Burkaard and P. Galmark, Antwerp.*)
967. Miners' Safety Lamps, W. Tape, Andennshaw.
968. Chimney Clocks, A. Oberle, Manchester.
969. Safety Buttons, I. J. Plaskett, London.
970. Rollers for Carrying Tune-bands or Music Sheets, J. Maxfield, London.
971. Miners' Safety Lamps, G. W. Elliott, Swansea.
972. Turning Music Leaves, J. W. Leigh, Bexley.
973. Washing Wool, E. de Pass.—(*E. Patry, Paris.*)
974. Electro Motors, S. Pitt.—(*L. W. Stockwell, U.S.*)
975. Cocks or Taps, T. Wilkins, London.
976. Kitcheners, E. Lloyd, London.
977. Compressed Air Engine, J. Purcel, Acton.
978. Chains, T. C. Sargeant, Stowe, Weedon.
979. Tipping, &c., Carts, T. C. Sargeant, Stowe.
980. Registering the Distance Travelled by Bicycles, A. H. Sternu, London.
981. Binitro-Hydrocellulose, H. J. Haddan.—(*J. Hagemann, St. Anton, Austro-Hungary.*)
982. Lithographic Press, A. Schapiro, Berlin.
983. Permanent Way, J. Cook, Glasgow, and D. Atkinson, Wednesbury.
984. Machine Belting, R. Watson, Selkirk.
985. Kitchen Ranges, A. Walker, Falkirk.
986. Packing for Stuffing-boxes, P. McKellar, Govan.
987. Carding Machines, E. Senior, Tillicoultry.
988. Arc Lamps, J. Brockie, Brixton.
989. Bricks and Tiles, C. Schlickeysen, Berlin.
990. Automatic Brake, C. Coleman, London.
991. Coating, &c., Tin Plates, W. A. Johns, London.
992. Tinning, &c., Tin Plates, W. A. Johns, London.
993. Letter Clips, H. Bawcombe, London.
994. Amalgamating Machines, M. P. Gosset.—(*H. Moon, Thomasville.*)
995. Steam Traps, P. Jensen.—(*J. Keidel, Germany.*)
996. Looms for Weaving, E. Wilson, Preston.
997. Iron Manufacture, P. Barry, London.
998. Gas Furnaces, W. R. Lake.—(*P. Ehrlich, Vienna.*)
999. Heating Vehicles, W. Lake.—(*M. Walsh, U.S.*)
1000. Covering the Hammers of Pianofortes, J. H. Schucht and J. Schönewald, London.
1001. Lamps, &c., J. Rogers, London.
1002. Electric Signalling, A. M. Clark.—(*J. P. Rogers and J. C. Upham, Canada.*)
1003. Supporting, &c., Blinds, H. C. Collier, London.
1004. Way-bill for Checking the Number of Persons Travelling in Vehicles, H. Lyon, London.
1005. Taper Metallic Tubes, T. Warwick, Aston.
1006. Bicycles, &c., T. Warwick, Aston.
1007. Bedsteads, B. Ford, Birmingham.
1008. Floorcloths, J. Hands, London.
1009. Lamp Extinguisher, H. Wellborne, London.
1010. Drilling Apparatus, H. S. Price and M. Belsham, London.
1011. Dumb-bells, W. A. Woof, Cheltenham.
1012. Steam Hammer, S. Hindley, Sheffield.
1013. Flushing Doors for Sewers, F. Newman, Ryde.
1014. Raising Trouser Ends, H. F. Richardson.—(*R. Siecke, Berlin.*)
1015. Governing Engines, J. M. Hall, Patricroft.
1016. Iron Battens, W. Rockliffe, Sunderland.
1017. Press, J. Urbain, France.
1018. Power Gear for Tricycles, W. G. F. Webster, Folkestone.
1019. Stoves, A. H. Smith, Bristol.
1020. Tiles, T. Jones and S. Griffin, London.
1021. Cornets, J. H. Johnson.—(*L. Cousin, Lyons.*)
1022. Movable Venetian Blinds, E. Edwards.—(*A. Cheneval, Maffe.*)
1023. Centre Valves for Gas Purifiers, G. Dawson and W. Froggatt, Thorncliffe.
1024. Explosive Material, E. Edwards.—(*L. Heusschen, Montjean, France.*)

9th January, 1884.

1025. Vehicle-calling Apparatus, A. Rochford, Dublin.
1026. Name Plates, R. W. Tayler, Bury St. Edmunds.
1027. Cask Bushes, R. W. Tayler, Bury St. Edmunds.
1028. Picking Strap for Looms, J. W. Crowther and W. Atherton, Ovenden.
1029. Parquet Floors, F. F. Brown, Chester.
1030. Fire-lighters, J. Cowan and A. J. W. Samuel, Liverpool.
1031. Colouring Matter, W. P. Thompson.—(*M. E. Savigny, New York, U.S.*)
1032. Colouring Matter, W. P. Thompson.—(*M. E. Savigny, New York, U.S.*)
1033. Axle Bearings, T. R. Summerson, Darlington.
1034. Water Taps, R. Hallimond, Escomb Bridge.
1035. Convertible Riding Saddle, G. Lebois, Paris.
1036. Straw-parting Apparatus, C. Barrett, Wisbech.
1037. Causing the Whistle of a Locomotive to Sound Passing Signals at Danger, G. W. Jenkins, Leeds.
1038. Dresser and other Hooks, T. Smith, Rrockley, and J. Drewitt, Peckham.
1039. Moulding, &c., Bread, A. Harvey, Glasgow.
1040. Lubricators, R. Arrol and J. T. Hedley, Newcastle, and R. Curry, Gateshead.
1041. Regulating Electric Currents, S. D. McKellen, Manchester.
1042. Photographic Exposing Apparatus, S. D. McKellen, Manchester.
1043. Jointing Tubes, M. Gill, Huddersfield.
1044. Self-centreing Chuck, B. Blunt, Birmingham.
1045. Meat and other Pies, J. H. Marston and W. Dunmore, Leicester.
1046. Water-closets, H. Sutcliffe, Halifax.
1047. Attaching Organ Pedals to Pianofortes, W. Hopley, Liverpool.
1048. Igniting Gas, F. Render, Manchester.
1049. Power Meters, W. Ashton, Manchester.
1050. Wheels, W. I. Chadwick, Manchester.
1051. Winding Yarn, F. Rosskothen, Accrington.
1052. Superheating, &c., Water, W. Collins, Copley.
1053 Looms, J. Barlow and T. Taylor, Bolton.
1054. Drilling Apparatus, S. Houghton, Devonport.
1055. Counteracting, &c., the Effect of Variations of Temperature on Railway Signal Pulls, W. King, Houston.
1056. Boxes, R. Ferguson, Glasgow.
1057. Gas Generators, L. A. Groth.—(*W. Bäcker, Bohemia.*)
1058. Coupling, L. A. Groth.—(*W. Hartmann, Berlin.*)
1059. Engines, L. A. Groth.—(*G. Daimler, Cannstatt.*)
1060. Bill File, &c., H. J. Allison.—(*P. Peckham, U.S.*)
1061. Water-closets, J. Fagan, Skipton.
1062. Automatic Tubes for Hot-air Heating, T. Morris, Bolton.
1063. Looms, T. Grimshaw, Witton.
1064. Locking the Actions of Small-arms, H. A. Silver and W. Fletcher, London.
1065. Regulators for Dynamo, &c., Machines, H. J. Haddan.—(*The Bain Electric Company, Chicago, U.S.*)
1066. Preventing the Forcible Shutting of Doors, G. W. von Nawrocki.—(*R. E. Kobligk, Berlin.*)
1067. Drawing, &c., Rollers, C. Moseley, Ardwick
1068. Preparing Textile Materials, J. E. and A. Pickard, Leicester.
1069. Boots and Shoes, L. Waterman, Bristol.
1070. Bootjacks, L. Cailleaud, France.
1071. Blocking on Card for Advertising Purposes, A. J. Barnes, London.
1072. Treating Punched or Cut Metals, J. H. Johnson.—(*A. G. Considère, France.*)
1073. Points and Switches of Tramways, &c., C. Blagburn, Newcastle-on-Tyne.
1074. Colouring Matters, J. Griess, Burton-on-Trent.
1075. Preserving Paperhangings, M. Warner, London.
1076. Filling Bottles, H. W. Hennes, London.
1077. Telephone Transmitters, G. Anders, London.
1078. Furnaces, S. H. Knott, London.
1079. Strainers, G. Tidcombe, jun., Watford.
1080. Perambulators, &c., W. Dunkley, Birmingham.
1081. Stoppering Bottles, J. Blocksidge, Birmingham.
1082. Steam Engines, J. P. Lea, Handsworth.
1083. Tricycles, R. Wheels and T. Wallen, Coventry.
1084. Boot Protectors, B. Bloomer, Stourbridge.
1085. Furniture Castors, A. Skinner and F. J. Rumney, Manchester.
1086. Furnaces, J. Burch, Stockport, and R. Allen, Manchester.
1087. Trays for Bakers' Ovens, R. Morton, Wishaw.
1088. Ventilators, J. Beckett, Crosshill.
1089. Perambulators, T. H. B. Hitching, London.
1090. Plough Breasts, J. Woods, Wells.
1091. Carriages, T Coward, Brixton.
1092. Separating Ores, &c., O. G. Bolitho, Penzance.
1093. Metal Toe Caps for Boots, C. Hamilton, Acton.
1094. Brake Apparatus, S. Carlton, Wilts.
1095. Preventing Disease in Game, Poultry, &c., T. Cank, near Preston.
1096. Turning Over the Leaves of Music, E. Guattari, London.
1097. Integrating the Indications of Measuring Apparatus, J. C. Mewburn.—(*M. Deprez, Paris.*)
1098. Regulating the Speed of Dynamo-electric Machines, J. C. Mewburn.—(*M. Deprez, Paris.*)
1099. Colouring Matters, J. Griess, Burton-on-Trent.
1100. Primo-secondary Batteries, G. André, Dorking.
1101. Signalling Barometers, H. Christensen, Cowes.
1102. Indicator or Gauge, R. Baird, Glasgow.
1103. Towelling Cloth, R. T. Webb, Randalstown.
1104. Fixing the Cords or Ropes of Lawn Tennis Nets in the Posts, K. S. Murray, London.
1105. Shoeing Horses, &c., G. Tamiotti and D. Mairano, London.
1106. Tappet-block Fastenings, T. Higham, Stockport.
1107. Horse, &c., Shoes, J. H. Selwyn, London.
1108. Telephone Exchange Systems, W. R. Lake.—(*J. W. Duxbury and H. W. Breckenridge, U.S.*)

10th January, 1884.

1109. Paring Hats, J. Fogg, Hyde.
1110. Woven Belting, F. Reddaway, Pendleton.
1111. Belting for Driving Machinery, F. Reddaway, Pendleton.
1112. Ventilating Soil Pipes, T. S. Wilson and H. T. Johnson, Manchester.
1113. Photographing, T. S. Davis, Halifax.
1114. Guiding Locomotives, &c., J. O'Keeffe, and G. Robson, Liverpool.
1115. Ordnance, G. Quick, Chipping Campden.
1116. Filter Presses, J. Pedder, Lancaster
1117. Driving Velocipedes, E. Hoffmann, Sydenham.
1118. Perambulators, G. P. Lee, Manchester.
1119. Bending, &c., Wire, G. P. Lee, Manchester.
1120. Floats for Fishing Nets, T. Fisher, Birmingham.
1121. Scissors, A. Lloyd and W. Glydon, Birmingham.
1122. Obtaining Perfect Consumption of Smoke, &c., D. Cockshaw, Glass Houghton.
1123. Neckties, &c., E. J. Johns, London.
1124. Galvanic Batteries, R. Charlton, Newcastle-on-Tyne.
1125. Window Blind Fittings, J. Everard, Sparkbrook.
1126. Gangway Ladders, W. P. Thompson.—(*R. Sullivan and Co., New Brunswick.*)
1127. Portable Hand Pumps, S. Wilkins, Edinburgh.
1128. Dispatch Box, J. Gurr, Brighton.
1129. Treating Jute, R. J. Gibson, Dundee.
1130. Ships, W. B. Thompson, Dundee.
1131. Filing Documents, B. W. Spittle, Wednesbury.
1132. Metallic Bedsteads, S. H. Whitfield, Hollywood.
1133. Keyboards of Pianofortes, &c., M. Snow, Kidderminster.
1134. Tobacco Smoke Purifier, A. H. Smith and S. Hebert, London.
1135. Grinding two Sides of a Flat Surface at the same Time, J. Mounsey, Bolton and J. W. Mitchell, Manchester.
1136. Vermin Poison Guard, J. Wood, Lancashire.
1137. Testing Damp Beds, J. Wood, Lancashire.
1138. Balanced Thermometers, T. P. Watson.—(*H. C Kirk and J. T. Brayton, New York.*)
1139. Fans, J. M. Lamb, London.
1140. Rock Drills, J. Stocks, Ilkeston.
1141. Adjustable Curtain and Shade Rods, J. Haux, Munich, Bavaria.
1142. Oilcloth Covers, W. Higson, Little Hulton.
1143. Lamp Wicks, H. J. Hart, Birmingham.
1144. Stop-motion for Steam Engines, B. Dyson, York.
1145. Belting, R. L. Kirlew, Manchester.
1146. Attracting Attention to Advertisements, T. McGrah, Sheffield.
1147. Springs, W. T. Stephens, London.
1148. Tachometers, A. Budenberg.—(*Schaffer and Budenberg, Germany.*)
1149. Washing Machines, R. Margrett, Gloucester.
1150. Pencil, &c., Holders, J. Downs and T. Sloan, London.
1151. Attaching Handles to Brooms, &c., C. Gant, Nottingham.
1152. Bait Cans, B. Field, London.
1153. Cover for Lawn-tennis Balls, J. Neville, London
1154. Fishing Floats, J. Gillet, London.
1155. Centripedal Cowls, F. L. Merrill, London.
1156. Mats, &c., J. Wilson, Blackburn, and W. S Sugden, Preston.
1157. Induction Cowls, J. Swinburne, St. John's.
1158. Covering the Core of Submarine Telegraphic Cables, H. G. Baker, London.
1159. Trap for Waste Pipes, J. Parrott, Wallington.
1160. Ventilating Apparatus, J. B. Wootton, Wolverhampton.
1161. Adjustable Slide Apparatus, L. A. Groth.—(*P. Brennicke, Berlin.*)
1162. Torsion Pendulum Clocks, A. M. Clark.—(*C. Stahlberg, Corsicana, U.S.*)
1163. Bottle Protectors, W. A. Blakeney, Glasgow.
1164. Fastening Door Handles, W. A. Gill, London.
1165. Fire-escapes, &c., G. Bray, Deptford.
1166. Advertising, R. H. Scales, London.
1167. Plugs for Tobacco Pipes, A. Clarke, Meadowland.
1168. Stoppers for Bottles, E. Edwards, London.
1169. Ruling Machines, W. R. Lake.—(*Messieurs Barton and Lanby, France.*)
1170. Steering Apparatus of Velocipedes, H. Thresher, London.
1171. Velocipedes, H. Thresher, London.
1172. Pencil, &c., Holders, S. Moore, Manchester.
1173. Cutting Slate, &c., F. W. Turner, London.
1174. Spring Clips, J. Knight, London.
1175. Lubricating the Bearings of Sheaves of Pulley Blocks, J. Bond, Longridge.
1176. Dynamo-electric Machines, J. Swinburne, St. John's.
1177. Engines worked by Steam, R. Welford, Sunderland.
1178. Incandescent Lamps, J. Swinburne, St. John's.
1179. Heating Apparatus, J. H. Loch, South Norwood.
1180. Pipe Cutters, E. Johnson, Rotherhithe.
1181. Opening Aerated Water Bottles, C. L. Watchurst, Lee.
1182. Boots and Shoes, A. H. Valda, London.
1183. Checking Apparatus, H. Lyon, London.
1184. Bottle Stoppers, A. Longbottom, Driffield.
1185. Paving Tiles, R. & J. Walsham, Birmingham.
1186. Road Sweeping Machines, R. W. Taylor, Bury St. Edmunds.
1187. Boxes, &c., G. F. Griffin, London.
1188. Reservoir Writing Instruments, G. R. Hughes, London.
1189. Scarf Fastenings, G. R. Hughes, London.
1190. Coupling for Railway Vehicles, A. J. Boult. —(*S. J. Harry, Isphemlng, U.S.*)
1191. Operating Furnace Doors, A. J. Boult.—(*E. Miksch, Austria.*)
1192. Winding Yarns, T. Thorpe, New Basford.
1193. Gas for Lighting, &c., J. H. Johnson.—(*F. Hembert and E. Henry, Paris.*)
1194. Horseshoes, C. A. Floyd, Eastbourne.
1195. Gas Retorts, C. D. Abel.—(*A. Niermeyer, Holland.*)
1196. Knitted Hose, C. Hall, Loughborough.
1197. Utilisation of Electricity, W. R. Lake.—(*N. de Kabath, Paris.*)
1198. Treating Carbonaceous Substances in Ovens, H. Stier, Germany.

11th January, 1884.

1199. Distilling Water, J. K. Farnworth, Bath.
1200. Fireproof Floors, P. Scholes, Bury.
1201. Corn Crusher, — Rutherford and — Lambert Langholm.
1202. Joining Lead Pipes, J. Jakens, Bury.
1203. Reservoir Fountain Penholders, E. Jackson and G. G. B. Place, Blackburn.
1204. Gas, H. J. Rogers, Watford.
1205. Wet Spinning Frames, J. Erskine, Wolfhill.
1206. Shutters, L. Warnerke, London.
1207. Burners, L. Warnerke.—(*C. W. Muchall, St. Petersburgh.*)
1208. Cooking Stoves, A. Kohlhofer and P. Gerlach, London.
1209. Looms for Weaving, R. L. Hattersley, J. Hill, and J. Asquith, Keighley.
1210. Invalid Carriages, J. Furley, Ashford.
1211. Window Blind Rollers, E. Purkis, Birmingham.
1212. Cutting Tea, A. Ody, Gloucestershire.
1213. Fastening Railway Carriage Doors, E. W Brown, Lower Edmonton.
1214. Life-saving Machine, F. H. Smith, Belfast.
1215. Umbrella Sticks, C. Bromhall, Moston.
1216. Propelling Bicycles, &c., E. Marsh, Leeds.
1217. Playing Music on Bells, W. H. Duncan, Coalbrookdale.
1218. Safety Railway Keys, J. Dixon, Bedlington.
1219. Voltaic Batteries, A. Clark, Glasgow.
1220. Invalid Writing Tables, S. Wallace, Southsea.
1221. Brake Apparatus, W. Corteen, Sheffield.
1222. Rail Fasteners, W. Corteen, Sheffield.
1223. Producing Yellow Metal, T. Parker, Wolverhampton.
1224. Door Locks, G. H. Bratt, Wolverhampton.
1225. Safes and Iron Doors, R. Davies, Sedgley.
1226. Window Blind, J. Relph, Liverpool.
1227. Suspension Tramcar, D. Ellis, Aberystwith.
1228. Penholder, T. K. Clark, Crieff.
1229. Castors, A. Thom, Edinburgh.
1230. Carts, S. J. V. Day.—(*D. D. Goath, Rangoon.*)
1231. Cart Axles, S. J. Day.—(*D. D. Goath, Rangoon.*)
1232. Shuttles for Weaving, W. Landell, Glasgow.
1233. Smoke Burners, T. Lowe, Radford.
1234. Winch Holders, J. Richardson, London.
1235. Line Reels, J. Richardson, London.
1236. Keeping Scarves, &c., in Position, L. B. Bertram, London.
1237. Lock-up Liquor, Frames, R. Murray, London.
1238. Boilers, A. Gage, London.
1239. Enriching Gas, T. F. Wiley, London.
1240. Bookbinding, E. de Pass.—(*F. Schwarz, Germany.*)
1241. Cocks, Taps, &c., J. Pilbrow, Worthing.
1242. Electric Machines, W. S. Frost, London.
1243. Velocipedes, J. L. Bramley, London.
1244. Cigarettes, F. Hipgrave, London.
1245. Cleaning Bottles, M. Pierce, Wexford.
1246. Steam Engines, E. C. Blackstone, Stamford.
1247. Hair Wash, A. J. Boult.—(*H. Rothe, Paris.*)
1248. Picking Motions for Looms, J. McLeod, Wilton.
1249. Permanent Way, J. Morison and R. Armstrong, Dalkeith.
1250. Window Blinds, I. C. R. Lindenzweig, London.
1251. Producing Coloured Photographic Transparencies, G. Rydill, London.
1252. Lubricant, J. Batson, Stafford.
1253. Shaping Sheet Metal, E. H. Burt, Birmingham.
1254. Fish Hooks, J. F. Milward, Redditch.
1255. Newspaper Stands, S. Harris, Birmingham.
1256. Electric Primary Batteries, W. M. Andrew.—(*S. Dreifuss, Munich.*)
1257. Trusses, T. and J. Briggs, Burnley.
1258. Roads, E. Hill, Sheffield.
1259. Cases for Protecting Goods, F. Marsden Sheffield.

1260. SECURING HANDLES of TABLE CUTLERY, W. T. Wheatley, Sheffield.
1261. FURNACES, T. Barlow-Massicks, Millom.
1262. BOOTS, &c., H. C. Harrison, Birmingham.
1263. PREVENTING ACCUMULATION of DUST, L. Hermanson, Sheffield.
1264. RAZORS, A. B. Ball, Sheffield.
1265. SOCKETS for PICK SHAFTS, T. Brown, Sheffield.
1266. WOVEN HOSE PIPE, H. Lord, Bacup, and T. Midgley, Halifax.
1267. COOKING by STEAM, J. J. Royle, Manchester.
1268. HAND STAMPS, A. Weylandt, Berlin.
1269. TREATING GRAIN, E. R. Southby, London.
1270. COMBINING WOOL with COTTON, &c., W. A. Barlow.—(*C. Leconte and Sons, Paris.*)
1271. ELECTRICITY, E. P. Chaimsonovitz, Leytonstone.
1272. HEATING ROOMS, &c., W. H. Tooth, London.
1273. ELECTRODES, T. Rowan, London.
1274. METAL LAMPS, &c., J. Kaye, London.
1275. LOCKING RAILWAY POINTS, C. Adams, London.
1276. WEIGHING MACHINES, C. Reuther, Germany.
1277. WINDING YARN, &c., W. R. Lake.—(*R. Priebsch, Austria.*)
1278. ELECTRICAL BATTERIES, F. Maxwell-Lyte, Putney.
1279. TREATING SEWAGE, F. Hille, Chiswick.
1280. OPENING, &c., ELECTRIC CIRCUITS, F. H. Varley, W. Beale, R. H. Padbury, and J. Shearer, London.

12*th January*, 1884.

1281. VALVES, J. Auld, Glasgow.
1282. SUBMARINE CABLES, E. W. Beckingsale, Newport.
1283. TRAMWAYS, R. Harding, Janeville.
1284. RAILWAY, &c., SWITCHES, J. T. King.—(*R. H. Isabell, New York, U.S.*)
1285. BOOT-CLEANING MACHINE, G. J. F. Tate, London.
1286. HEATING APPARATUS, E. Brooks, Birmingham.
1287. DRIVING SPINDLES, S. Brown, Macclesfield.
1288. SPINDLES, G. L. Scott, Manchester.
1289. WHEELS, J. McQueen, Manchester.
1290. CHIMNEY-BREASTS, &c., A. Foley, Salisbury.
1291. ARMATURES, W. A. Leipner, Clifton.
1292. OIL MILL MACHINERY, M. L. Sykes, Pendleton.
1293. ENGINES, G. T. Dickinson, Newcastle-on-Tyne.
1294. ARTIFICIAL STONE, C. R. Cowie, Glasgow.
1295. ENVELOPE, &c., OPENER, C. Toft, Sunnyside.
1296. HEATING FLAT-IRONS, J. C. Bayley, Parkstone.
1297. MALT TEA, W. Kloen, Birmingham.
1298. FIRE-ESCAPES, H. R. Meyer, Liverpool.
1299. BOOTS, H. W. H. and E. W. Lulham, Brighton.
1300. FLYERS, R. Simpson and J. McFie, Glasgow.
1301. SUPPORTING a PAN or KETTLE OVER a KITCHEN FIRE, S. Green, Oldham.
1302. SAILS for VESSELS, I. A. Storer, Newport.
1303. DATING STAMPS, J. McGill, Ayr.
1304. GLOVE FASTENER, P. Ockenden, Walthamstow.
1305. DOUBLE CHAIN GUIDE, J., R., A., J. W., and E. F. H. Barnsley, Netherton.
1306. GENERATING, &c., MOTIVE POWER by MAGNETS, J. E. F. Ludeke, Peckham.
1307. PADLOCKS, C. Dean, Willenhall.
1308. CALCINING FURNACES, G. Hitchen, Darwen.
1309. SUBSTITUTE for CORK, H. P. Scott, London.
1310. COLLAPSIBLE BAG, O. R. Barnicott, Cambridge.
1311. OPEN STOVES, T. Warne, London.
1312. COLLAR, &c. STUD, D. C. Mercer, Aldershot.
1313. PREPARING MILK, W. H. Thew, Liverpool.
1314. TENNIS BATS, W. E. Bussey, London.
1315. BREECH-LOADING GUNS, H. A. Poole, Rochdale.
1316. SPRING CUTLERY, A. B. Ball, Sheffield.
1317. CONSTRUCTING CARTS, &c., W. Holt and H. Tongue, Bolton.
1318. CLOTHS for CLAY PRESSES, A. Beech, Longton.
1319. LAMPS, I. Blake, Birmingham.
1320. PORTABLE LAMPS, F. Bosshardt.—(*L. Bodin, Paris, France.*)
1321. BRAKES, F. Bosshardt.—(*G. Chanier, France.*)
1322. SLIDING WINDOWS, F. Oldfield, Hyde.
1323. SPRING MATTRESSES, &c., I. Chorlton, jun., Manchester.
1324. FACILITATING DRAWING, H. Stephens, London.
1325. BOTTLE STOPPERS, M. Haymans, London.
1326. FASTENING the ENDS of COTTON WOUND on SPOOLS, K. J. Seaton, Sunbury.
1327. GLOBES, SHADES, &c., J. Somerville, London.
1328. WINDMILLS, S. O. Ferry, Leeds.
1329. VELOCIPEDES, C. F. Henwood, London.
1330. SOLE-SEWING MACHINES, G. Pennick, London.
1331. MOTIVE POWER, C. J. Griffith & M. Low, London.
1332. CALMING AGITATED WATERS, J. Gordon, jun., Dundee.
1333. CALMING AGITATED WATERS, J. Gordon, jun., Dundee.
1334. SIZING and POLISHING THREAD, H. Haddan.—(*A. Hieronmus, Strassburg.*)
1335. SPANNERS, H. J. Haddan.—(*G. Gontier, Cognac.*)
1336. CONNECTING the ENDS of RAILS, T. W. Bunning, Newcastle-upon-Tyne.
1337. GALVANIC BATTERIES, C. W. Harrison, London.
1338. FANCY BASKETS, E. A. Renaudin, London.
1339. SASH FASTENERS, J. Hodgson, Birkenhead.
1340. COKE and PEAT, R. S. Casson, Brierley Hill.
1341. PHOSPHATES, S. G. Thomas, London.
1342. ALKALIES and PHOSPHATES, S. Thomas, London.
1343. ALKALINE SILICATES, S. G. Thomas, London.
1344. FLOWER HOLDERS, J. Jones, Dundee.
1345. CUTTING and GILDING the EDGES of MOUNTS, C. A. Marriott and H. Barsdorf, Salford.
1346. NAVIGATIONAL SOUNDING APPARATUS, J. A. Briggs, London.
1347. SUPPORTING STOCKINGS, G. Clark, Leicester.
1348. FLOATING BREAKWATER, J. Bidder, London.
1349. SECURING SHUTTERS, H. H. Lake.—(*E. A. Stoffl, M. J. Reichermoz, and S. Mérandon, Paris.*)
1350. SECURING LIDS, &c., F. Grosvenor, Glasgow.
1351. MINING TOOLS, C. Burnett, Hartlepool.
1352. SAFETY APPARATUS for GAS BURNERS, J. W. Plunkett, Dunstall Priory.
1353. CUTTING APPARATUS, J. Brown, London.
1354. PREVENTING EXPLOSIONS in STEAM BOILERS, A. Budenberg.—(*Schäffer and Budenberg, Germany.*)
1355. KEYLESS WATCHES, W. Müller.—(*C. Löschner, Bohemia.*)
1356. CONNECTING VALVES to PIPES, D. T. Bostel, Brighton.
1357. MEASURING TAPES, L. G. Ram, London.
1358. REGULATING HEAT, A. C. Churchman, Fulham.
1359. FASTENINGS FOR SAFES, &c., W. Smith, Leicester.
1360. BUTTONS, J. Manton and W. Manison, Warwick.
1361. METALLIC FRAMES, W. J. Lovett and F. W. Evans, Birmingham.
1362. STOPPER for BOTTLES, G. T. Neville, Lichfield.
1363. SELF-INKING POCKET STAMP, E. Richford, London.
1364. ROASTING COCOA BEANS, &c., H. H. Lake.—(*G. Stollwerck, Germany.*)
1365. STUDS, T. H. Rochford, London.
1366. CUPBOARD FASTENER, E. Baxter, Birmingham.
1367. SLICING, &c., TURNIPS, W. Brenton, Cornwall.
1368. SAFES, C. S. P. Wood, Birmingham.
1369. ELECTRIC SIGNALLING, T. R. Brailsford, London.
1370. VELOCIPEDES, S. Chandler, jun., and J. Chandler, London.
1371. BRICK MOULDS, J. T. Bower, Sittingbourne.
1372. SEWER VENTILATORS, J. McK. Knight, London.
1373. ENSURING the SILENT EXHAUST of GAS ENGINES, L. Sterne, London.
1374. PREVENTING WATER-WASTE, E. Howard, London.
1375. VENTILATING APPARATUS, P. Jensen.—(*J. Keidel, Germany.*)
1376. DRILLING MACHINES, A. M. Clark.—(*J. J. Fontanie, Paris.*)

14*th January*, 1884.

1377. ROAD VEHICLES, J. McQueen and W. H. Carmont, Manchester.
1378. ADVERTISING, W. H. Duncan, Coalbrookdale.
1379. CONNECTING RAILWAY VEHICLES, C. G. Clarke, Kingston-upon-Hull.
1380. SPIRITS, &c., F. McNamee, Liverpool.
1381. WRITING CASE, J. Hall, Sheffield.
1382. CASES for COLLECTING RENTS, J. Hall, Sheffield.
1383. STOPPERING BOTTLES, H. Parker, Birmingham.
1383. DRIVING BELTS, F. Fleming, Halifax.
1385. DRIVING BELTS, F. Fleming, Halifax.
1386. CASED, &c., TUBES, J. Hudson, Birmingham.
1387. STOPPERS for CANS, &c., H. G. Hellier, London.
1388. PIPES for SMOKING, W. P. Bruce, Midlothian.
1389. COMBINATION PEN, &c., F. Cade, Alphington.
1390. LOOMS for WEAVING, W. H. Hayhurst, Blackburn.
1391. DRILLING ROCKS, A. Harvey, Camborne.
1392. WAGON to UNLOAD COALS, W. Dorman, Hull.
1393. GAS, &c., GENERATOR, J. Sinclair, Govan.
1394. JACQUARDS, H. Swift, New Basford.
1395. RAILWAY SLEEPERS, &c., W. Hindson, Gates head-on-Tyne.
1396. VALVES, D. R. Ashton, London.
1397. DIAL INSTRUMENTS, D. McGregor, Liverpool.
1398. PENHOLDER, H. H. Lake.—(*A. H. Spencer, U.S.*)
1399. CASES, T. and J. Brooke, Sheffield.
1400. LOAM MOULDING APPARATUS, W. H. Baker, Manchester.
1401. STRAINING THICK FLUIDS, C. Bonne, Manchester.
1402. STEAM-TRAP, &c., L. Dove, London.
1403. STUDS, W. Pearson, Birmingham.
1404. TOBACCO PIPES, J. B. Cooke, Great Malvern.
1405. SEWING MACHINES, J. M. Sellers, Keighley.
1406. HAMMOCK SUSPENDER, W. Marsh, Colchester.
1407. CORRUGATED METAL ROLLING SHUTTERS, S. P. Wilding.—(*J. G. Wilson, New York.*)
1408. WASHING and WRINGING, J. Griffiths, Putney.
1409. BOOT-CLEANING, G. J. F. Tate, London.
1410. BAGS, F. Wirth.—(*S. Horn, Germany.*)
1411. TREATING DISEASES of LUNGS, &c., W. H. Tayler, Anerley.
1412. CEMENT, L. Roth, Wetzlar, Prussia.
1413. SCOOPS of ELEVATING APPARATUS, &c., H. J. Haddan.—(*C. Jaquet, Strasburg.*)
1414. CARDING WOOL, J. Clough, Bradford, and R. Thornton, Cleckheaton.
1415. FILTERS, F. Grosvenor, Glasgow.
1416. PRESSING GARMENTS, W. Beecroft, Leeds.
1417. SUCTION VALVE, J. Leman, Radcliffe-on-Trent.
1418. PREVENTING ESCAPE of SEWER GAS, G. Brockelbank, South Penge Park.
1419. PENCIL CASES, A. H. Woodward, Birmingham.
1420. STEAM GENERATORS, H. H. Lake.—(*E. F. Gordon and H. Hobbs, Concord, U.S.*)
1421. FRAME for VELOCIPEDES, D. A. Salamon, London.
1422. TEMPLES for LOOMS, T. Yates, Preston.
1423. RING SPINDLE APPARATUS, T. Coulthard, Preston.
1424. FILLING, &c., BOTTLES, F. G. Riley, London.
1425. ORDNANCE, H. H. Lake.—(*H. Gruson, Germany.*)
1426. HEATING FOOT-WARMERS, W. R. Lake.—(*A. Ancelin, Paris.*)
1427. WINDOW SASH FASTENERS, F. Brown, Luton.
1428. PACKING, J. H. Smith and R. Marshall, London.
1429. PIPE GUARDS, G. C. Gamble, Bradford.
1430. STEREO, &c., BLOCKS and CATCHES, J. H. Clayson, Nunhead.
1431. CHASING SCREWS, W. Niblett, Bristol.
1432. ORNAMENTING WALKING-STICKS, &c., J. Howell and J. W. Anderson, London.
1433. FISH-HOOKS, R. B. Marston, London.
1434. WASH-HAND BASINS, &c., A. Makins, Brixton.

ABSTRACTS OF SPECIFICATIONS.

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

2285. STEAM PUMPS, *F. and S. Pearn and T. Addyman, Manchester.*—5*th May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to means for actuating the slide valve of the main steam cylinder which regulates the admission and exhaustion of the steam to and from the main steam cylinder.

2350. ELECTRIC CELLS OR BATTERIES, *N. C. Cookson and J. Swinburne, Newcastle-on-Tyne.*—9*th May*, 1883.—(*Not proceeded with.*) 2*d.*

To obviate local action the lead supports for the electrodes are made of lead containing peroxide of lead, the affinity for oxygen being reduced by combining it with sulphur. Or the support may consist of iron which is gilded. The supports may be made as gauze or as a cage. To make peroxide of lead sufficiently porous it is made by oxidising a bulky salt and mixing it with a fibrous substance. For the positive electrode lead is used as the anode in a solution of a chloride or an alkaline carbonate or sulphide; when the lead is thus sufficiently acted upon the current is reduced and the compound reduced to spongy lead. Various combinations suitable for primary batteries are described.

2359. CONSTRUCTION OF TRAMWAYS AND APPARATUS FOR FACILITATING THE HAULING OF VEHICLES THEREON, *W. P. Hope, Leith.*—9*th May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the construction of tramways, and to apparatus for facilitating the hauling of vehicles thereon, by means of cables or ropes arranged within a tube placed under the ground and forming part of the tramway, motion being imparted to the said cables or ropes from a stationary engine or engines.

2375. COMBINED NET HAULING MACHINE AND BOATS' CAPSTAN, *J. D. Jack, Elgin.*—10*th May*, 1883. 6*d.*

This relates to the combination of the net hauler and capstan with the hauling sheaves arranged either horizontally or vertically.

2395. CONTACT BOXES ON ELECTRIC RAILWAYS, *W. E. Ayrton and J. Perry, London.*—11*th May*, 1883. 1*s.* 2*d.*

Various contrivances are described and illustrated for working the contact boxes, the object being to dispense with the blow given by the passing train, as used in patent No. 783, 1881. The appliances now described are adapted for the series and the parallel systems. An electro-magnet placed in the main circuit attracts an armature in opposition to a spring, and makes contact with a stud. When the train passes over the brake of rail the electro-magnet is short-circuited by the first wheel, the armature is released, and so opens the circuit; the current then passes by, and works the motor. The circuit is then completed by either having a high resistance between the stud and the armature so that the circuit is never entirely broken, or by having wound on the electro-magnet high resistance coils, which act as a shunt between the ends of the rails. A contact box is described, which is actuated by a temporary current flowing to earth, when the train connects an insulated section with a fixed collector. In blocking for the series system a section of the line is electrically connected through a contact box with a section in the rear, thus short-circuiting an advancing train. A method of blocking for the parallel system is also described.

2438. MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS, &c., *J. H. Guest, Brooklyn, N.Y., U.S.*—15*th May*, 1883. 6*d.*

To remove the atmospheric air from the globe, it is provided with a nipple, through which an inert gas is introduced. The filament is then rendered incandescent, and the expanded gases allowed to escape, the nipple being then sealed. The sealing is effected in a vessel having a movable cover, the joint of which is made in water or mercury. A gas is introduced into this vessel to displace the air, a burning gas being introduced into an annular space around an opening at the top of the cover, and ignited.

2444. FASTENERS FOR WINDOWS AND CASEMENTS, &c., *H. Charters, London.*—15*th May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to a spring fastener operated by a key.

2458. MANUFACTURE OF METALLIC PACKING OF PISTONS FOR CYLINDERS AND ROTATING MACHINES, PUMPS, BLOWERS, FLUID AND WATER METERS, &c., *A. Spagl, Munich.*—16*th May*, 1883. 6*d.*

The construction of the metallic leathern or caoutchouc packing of pistons consists of several wedges overlapping one another, and being symmetrically pressed by steam in their whole circuit on or against the inner sides of the cylinder or outer casing, and so ensuring steam tightness of the piston in cylinders and rotating machines.

2461. MACHINERY FOR PERFORATING AND PRINTING UPON PAPER, *W. R. Lake, London.*—16*th May*, 1883. —(*A communication from S. Wheeler, Albany, U.S.*) 10*d.*

This relates to improvements in machines for printing and perforating paper as it is continuously fed into the machine from a roll, and rewinding the finished paper in rolls while in the machine.

2462. APPARATUS FOR USE IN THE MANUFACTURE OF ILLUMINATING GAS OR VAPOUR, *W. R. Lake, London.* 16*th May*, 1883.—(*A communication from E. J. Frost, Philadelphia.*)—(*Not proceeded with.*) 4*d.*

This relates to improvements in that class of carburetters in which the air current is compelled to travel through a continuous and uniform passage usually of a spiral form, in which course it takes up a volatile hydrocarbon from the surface of capillary material.

2464. GAS STOVES, &c., *J. Adams, Glasgow.*—17*th May*, 1883.—(*Not proceeded with.*) 4*d.*

This relates partly to an arrangement for controlling, by the action of one stopcock or lever, the supply of gas in a "gas fire," together with a proportionate supply of air for its combustion.

2466. MECHANICAL TOY OR APPARATUS FOR PLAYING A GAME, *T. Borham, London.*—17*th May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to a model racecourse game.

2474. PRESSES FOR PRESSING VENEERS, *E. G. Brewer, London.*—17*th May*, 1883.—(*A communication from R. Goff, St. John's, Newfoundland.*)—(*Not proceeded with.*) 2*d.*

This relates to the general construction of a steam press.

2479. PROCESSES AND APPARATUS FOR OBTAINING USEFUL PRODUCTS IN THE TREATMENT OF GALVANISERS' FLUX, &c., *H. Kenyon, Altrincham.*—17*th May*, 1883.—(*Not proceeded with.*) 2*d.*

The object is principally to utilise galvanisers' flux and dross and similar matters, and thereby to obtain zinc, paint, and other useful products.

2482. ELECTRIC-MOTIVE ENGINE, *A. Browne, London.* —17*th May*, 1883. 6*d.*

The armature is formed of T-shaped bobbins, arranged radially around a hub attached to the shaft, the field magnets being arranged as a ring, the pole pieces enveloping the T ends of the bobbins. The sections of the field magnets are wound and connected, so that the poles shall alternate.

2484. MACHINERY KNOWN AS JACQUARDS AND DOBBIES, *W. Davenport and W. Crossley, Failsworth.*—18*th May*, 1883. 6*d.*

This consists in the use of an additional or auxiliary set of short needles, which are acted upon by a separate pattern barrel or cylinder, placed at the side of the machine above the ordinary needles, and which correspond in number, and are connected therewith, by short levers depending therefrom.

2488. SEWING MACHINES, *H. J. Allison, London.*—18*th May*, 1883.—(*A communication from C. Wuterich, New York.*)—(*Not proceeded with.*) 6*d.*

The object is to produce a machine for sewing both the insole and outsole of a shoe with the same machine, using either two or three waxed threads, and forming the seam in each instance on the outside, thereby obviating the difficulty of wearing shoes with waxed thread seams inside of them, the tendency of inside seams being to draw and cramp the foot, in consequence of the perspiration or heat of the foot acting injuriously upon the waxed thread.

2491. EXPANSION VALVE GEAR FOR STEAM AND OTHER MOTIVE POWER ENGINES, *W. E. Rich, London.*—18*th May*, 1883. 6*d.*

This consists of a right and left-hand screw of dissimilar pitch, actuating two expansion valves or plates on the back of the main slide valve or valves.

2493. APPARATUS FOR MEASURING ELECTRICITY, *J. D. F. Andrews, Glasgow.*—18*th May*, 1883. 6*d.*

An electroscope consists of a vertical solenoid, the iron core of which is enlarged at its lower end where it is immersed in mercury. A thread attached to the top of the core passes round a spindle and carries a counterweight. An index finger attached to the spindle moves before a graduated dial. The current may be measured by providing two vessels containing mercury, the one situated above the other and having a pivoted beam between them. To one end of the beam is linked the core of a solenoid, having its lower enlarged end immersed in the mercury of the lower vessel. To the other end of the beam is linked a cup having an overflow leading to the lower vessel, and having inserted in it one limb of a syphon, the other limb of which is immersed in the mercury of the upper vessel. When a current passes the core is attracted upwards and the cup is lowered so that mercury flows into through the syphon from the upper vessel, the overflow passing into the lower vessel, the total flow of mercury being the measure of the current. Various modifications are described and illustrated.

2495. MANUFACTURE AND TREATMENT OF PHOTOGRAPHIC PAPER, *J. Imray, London.* — 18*th May*, 1883.—(*A communication from C. Cros and A. Vergeraud, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to the manufacture and treatment of photographic paper for the purpose of reproducing by the action of light the dark lines of designs drawn on transparent surfaces such as tracing paper, glass, and the like, or the images of flat objects that can be applied to the prepared paper.

2496. MANUFACTURE OF TEXTILE FABRICS, *W. R. Lake, London.*—18*th May*, 1883.—(*A communication from L. Chaux, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to the manufacture of close woollen or other woven fabrics by means of threads made of wool or the like and cotton, the cotton being afterwards removed.

2498. NON-CONDUCTING COVERINGS, APPLICABLE FOR COVERING STEAM PIPES, &c., *A. J. Boult, London.* —18*th May*, 1883.—(*A communication from G. Kelly, Chicago.*) 6*d.*

The object is principally to provide an improved enclosing casing for containing slag cotton, mineral wool, or other analogous fibrous, non-conducting material; the construction being such as to admit of the ready removal or replacement of the completed section of covering upon or around the article to be covered.

2501. USING STEAM AND HOT AIR COMBINED, AND CONSTRUCTION OF ENGINES IN CONNECTION THEREWITH, *W. Turnbull, New Hampton.*—19*th May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the general construction of an engine which will be driven by the combined forces of steam and hot air.

2502. MANUFACTURE OF SULPHITE OF LIME, &c., *R. Powell, Liverpool.*—19*th May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to withdrawing one atom of oxygen from the sulphate by a de-oxidising agent, as for instance by intimately intermingling the sulphate of lime with necessary proportion of carbon or sulphur, and heating it in a closed or partially closed vessel until the process is complete.

2503. MECHANISM TO BE EMPLOYED FOR DELIVERING CONSECUTIVELY NUMBERED TICKETS TO PERSONS RIDING IN PUBLIC VEHICLES, &c., *J. M. Black, London.*—19*th May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements upon patent No. 941, dated 4th March, 1881.

2504. APPARATUS EMPLOYED IN THE MANUFACTURE OF IRON AND STEEL, *T. Griffiths, Abergavenny.*—19*th May*, 1883. 6*d.*

This relates to means and apparatus for effecting the closing and opening of the passage through the tuyeres.

2506. EXTRACTING OR SEPARATING IRON FROM SOLUTIONS CONTAINING THE SAME, *G. W. von Nawrocki, Berlin.*—19*th May*, 1883.—(*A communication from Loewig and Co., Goldschmieden, Silesia.*) 2*d.*

A metal, or compound, which forms insoluble, or nearly insoluble, salts with the acid of the metallic salts, preferably lead in the case of metallic sulphates, and silver for metallic chlorides; any suitable metal is used for the cathode. The anode has a large surface, or a high resistance is placed before it to prevent as much as possible the evolution of oxygen.

2507. CONSTRUCTION OF CHIMNEY PIECES, AND ORNAMENTING AND FIXING THE SAME, &c., *A. Diss, West Bergholt.*—19*th May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to chimney pieces in which encaustic tiles are used for ornamentation.

2510. SPINNING SPINDLES AND THEIR BEARINGS, *A. M. Clark, London.*—19*th May*, 1883.—(*A communication from A. R. Sherman, Pawtucket, U.S.*) 8*d.*

The object is to provide an improved construction and arrangement of the spindle, bolster step, bolster case, locking device for the bolster and whirl in a spinning spindle, which will enable the spindle when in action to find its own centre when unequally loaded, and which will ensure easy running with the least possible noise and highest speed, and facilitate oiling.

2511. MACHINERY FOR OBTAINING MOTIVE POWER, *A. Vacherot, Sutton.*—19*th May*, 1883. 6*d.*

The object is to obtain a motor by which the inventor is enabled to employ the prime mover (be it fluid, air, or gas) over again by establishing a cycle of the said prime mover.

2513. FRENCH HORNS, *M. Bauer, Paris.*—19*th May*, 1883.—(*A communication from B. G. Heidrich, Breslau.*)—(*Not proceeded with.*) 2*d.*

The object is to construct French horns capable of sounding notes an octave higher than those of ordinary construction.

2517. GAS ENGINES, *W. B. Haigh and J. Nuttall, Oldham.*—21*st May*, 1883. 6*d.*

This relates to so constructing gas engines as to allow of introducing a combustible mixture of air and gas into a cylinder in front of the motor cylinder during the outstroke of its piston, and expelling the combustible mixture on its return stroke into a passage leading between the two pistons, such passage being utilised as a compression chamber and the contents being ignited at every revolution of the engine.

2518. COMPOUND STEAM ENGINES, ESPECIALLY APPLICABLE TO COMPOUND LOCOMOTIVES, *C. Pieper, Berlin.* —21*st May*, 1883.—(*A communication from E. Onkley, Insmel, Prussia, and Dr. Proell and Scharowsky, Dresden.*) 6*d.*

This relates to steam engines having two cylinders of different capacity, and provided with valve gear, operated by link motion, the steam, after having worked expansively in the small cylinder, being caused to act on the piston of the large cylinder, and thereupon to be exhausted.

2519. IMPROVEMENTS IN OBTAINING AMMONIA SALTS FROM GASES GENERATED BY THE COMBUSTION OR DESTRUCTIVE DISTILLATION OF COAL OR OTHER BITUMINOUS SUBSTANCES, *G. Chapman, Glasgow.*—21*st May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the whole process.

2522. COWLS FOR CHIMNEYS, &c., *A. Snelling, London.*—21*st May*, 1883. 2*d.*

This relates to a rotating drum provided with vanes.

2523. APPLIANCES FOR EXTINGUISHING FIRES, &c., *T. von Trotha, Hecklingen.*—21*st May*, 1883.—(*A communication from V. von Schlippe, Moscow.*) 6*d.*

This consists of a means of extinguishing fires, which is stored up in the form of a cartridge, that is laid in the water used for putting out the fire.

2524. MANUFACTURE OF LAUNDRY BLUE, *M. H., T. L. Hargreaves, Hull, and J. E. Hargreaves, Isle of Wight.* 4*d.*

This relates to a composition of a disinfecting blueing and bleaching compound.

2526. APPARATUS TO BE USED IN BLASTING ROCK, *H. N. Penrice, Norwich.*—21*st May*, 1883. 6*d.*

This relates to the use in blasting rock of a metal charge holder, confining the charge longitudinally, and thus resisting by its tensile strength the escape of the gases generated by the explosion.

2528. HOLDERS FOR INCANDESCENT ELECTRIC LAMPS, *A. Swan, Gateshead.*—21*st May*, 1883. 6*d.*

The holder consists of two parts, so arranged and provided with fastening device that the lamp can be removed from the one part, or it and the lamp together may be removed from the other part.

2530. EMBROIDERING MACHINES, *W. L. Wise, London.* 21*st May*, 1883.—(*A communication from F. Martini and Co., Frauenfeld.*) 10*d.*

This relates to continuous thread embroidery machines, and has reference more particularly, First, to a brake which, upon the stoppage of the machine, comes automatically into action, and arrests the motion of the pantograph; Secondly, to means for operating the cloth presser; Thirdly, to means for drawing out or stretching the thread; Fourthly, to the construction of the thread catcher or hook; Fifthly, to means for operating the catcher or hook; and Sixthly, to the application of a boring or piercing apparatus to the back carriage of the machine.

2531. APPARATUS FOR THE MANUFACTURE OF TYPES, SPACES, AND QUADRATS, *F. Wirth, Frankfort.*—21*st May*, 1883.—(*A communication from J. M. Hepburn and the firm of Bauersche Giesserei, Frankfort.*) 6*d.*

This relates to apparatus for the manufacture of types, spaces, and quadrats, that is to say, for casting the types, spaces, and quadrats in a mould, and the subsequent operations of breaking off, setting up, rubbing, cutting out, and dressing the same.

2532. WASHING MACHINES, *H. H. Lake, London.*—21*st May*, 1883.—(*A communication from K. Wik, Austria.*)—(*Not proceeded with.*) 4*d.*

An outer tube contains the soap water, and an inner tube, which is perforated, is caused to move up and down therein.

2533. ROTARY BRUSHES USED FOR POLISHING GOLD, SILVER, &c., *H. R. Rauber, Stuttgart.* — 21*st May*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the means of setting the wires, bristles, or fibres in the stock.

2534. PUMPS, *F. H. F. Engel, Hamburg.*—21*st May*, 1883.—(*A communication from C. Zimmerman, Hamburg.*)—(*Not proceeded with.*) 2*d.*

This relates to the construction of pistons for pumps, and to the construction of pumps generally, for the purpose of using a pump temporally as suction pump only, and at other times, as desired, as a pressure pump.

2535. MANUFACTURE OF ARTIFICIAL STONE, *F. H. F. Engel, Hamburg.*—21*st May*, 1883.—(*A communication from E. Murjahn, Hamburg.*) 2*d.*

The object is to manufacture artificial stone out of clay and peat.

2536. CASKS OR VESSELS FOR CONTAINING BEER, &c., *J. Watts, Birmingham.*—21*st May*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to isolate from the external atmosphere beer and other liquids contained in casks and vessels.

2537. APPARATUS FOR PREVENTING DRAUGHT HORSES, &c., FROM FALLING WHILST AT WORK IN HARNESS, &c., *W. G. Kite, Romford.*—22*nd May*, 1883. 6*d.*

The shafts or pole are supported by the aid of a spring or springs so disposed as to take the weight of the horse and vehicles with its contents, or of the horse alone in a four-wheeled vehicle, in case the animal stumbles, thus preventing it from falling to the ground, whilst also assisting it by the reaction of the springs in immediately regaining its feet.

2539. ARC REGULATOR LAMPS, *R. E. B. Crompton, London, and T. Crabb, Chelmsford.*—22*nd May*, 1883. 6*d.*

The feed of the carbon rod is controlled by gearing to it, either by a cord or toothed rack, a pinion having fixed on its axis a wheel of greater diameter than itself. A vibrating lever actuated by a solenoid is so placed that in one position the pressure of the rod with its pinion and wheel is borne by a support connected with the axis of the pinion; while in its other position the pressure is transferred to a point on the surface of the lever, which thus presses firmly against the periphery of the wheel. Various methods of effecting this are described and illustrated.

2538. SCISSORS AND SHEARS, *A. Wheeler, Darlington.—22nd May*, 1883.—*(Not proceeded with.)* 2d.
This relates to the means of fastening the blades together.

2540. NEGRO-POTS, DUTCH STOVES, CAMP OVENS, &c., *J. Millington, Wolverhampton.—22nd May*, 1883. 6d.
The object is to substitute for the ordinary cast iron legs wrought iron or steel legs.

2541. KNITTING MACHINERY, *H. J. Haddan, London.—22nd May*, 1883.—*(A communication from W. W. Clay, Paris, Canada.)* 6d.
This relates to improvements in knitting machines known as loop spring barb circular knitting machines.

2542. PENCIL-CASES, *H. J. Haddan, London.—22nd May*, 1883.—*(A communication from J. H. Knapp, New York.)* 6d.
This relates to the construction of extensible pencil-holders.

2547. FASTENING CHESTS AND NESTS OF DRAWERS, WARDROBES, &c., *R. Mander, Birmingham.—22nd May*, 1883. 6d.
This consists partly in fastening or unfastening the sum of a series of adjacent sliding boxes or trays called "drawers" within a case or chest, the said drawers being disposed in rows placed one above another.

2548. SADDLE-BARS, *S. Davis, London.—22nd May*, 1883.—*(Not proceeded with.)* 2d.
The object is to release the rider when falling in any position.

2549. MANUFACTURE OF TANNIC BLACK AND ITS APPLICATION FOR PAINTS, *W. G. Gard and T. H. Cobley, Dunstable.—22nd May*, 1883. 4d.
This consists in a process for manufacturing tannic black from substances containing tannin, either free or in combination with other substances or matter.

2550. MICROPHONES OR TELEPHONES, *P. Jensen, London.—22nd May*, 1883.—*(A communication from L. M. Ericsson, Stockholm.)—(Not proceeded with.)* 2d.
The invention relates to a microphone and to a complete telephone arrangement, with its receiving instrument and signalling appliance, and is suitable for use as a table instrument.

2551. FISHING REELS, *D. Slater, Newark-upon-Trent.—22nd May*, 1883. 4d.
This relates to the employment of a guard-plate.

2552. SIZING MACHINES, *J. Dugdale, Blackburn.—22nd May*, 1883. 6d.
This relates, First, to the addition of an improved slow motion to sizing machines when the belt is moved from the driving or fast pulley to the loose pulley; Secondly, to an improved strap fork or guide; Thirdly, to an arrangement for levelling and crossing the yarn as it is being wound on the weaver's beam, and also for pressing the yarn; and Fourthly, the application of valves to regulate the admission of steam into the size box.

2553. DYNAMO-ELECTRIC MACHINES AND ELECTROMOTORS, *T. T. Vernon, Uttoxeter, Staffordshire.—22nd May*, 1883.—*(Not proceeded with.)* 2d.
To prevent the leakage of current into the metal framing, the frames are constructed of non-conducting material. The ordinary field magnets are replaced by one or more coils of wire.

2554. MACHINERY FOR SPINNING AND DOUBLING COTTON AND OTHER FIBROUS SUBSTANCES, *G. A. Helliwell and J. H. Waller, Tormorden.—22nd May*, 1883. 6d.
This relates to improvements in the parts known as Ashworth's tubes.

2557. MANUFACTURE OF BARBED WIRE FOR FENCES, &c., *H. H. Lake, London.—22nd May*, 1883.—*(A communication from P. Miles, Brooklyn.)* 10d.
This relates to improvements in the mode of manufacturing barbed wire and the machinery employed therefor.

2558. WEIGHING MACHINES, *W. P. Thompson, Liverpool.—22nd May*, 1883.—*(A communication from J. Stevens, Neenah, U.S.)* 1s. 2d.
This relates to several improvements in the general construction of the machine.

2559. FEEDING BOTTLES FOR BABIES, *A. Horne and J. Mancor, Liverpool.—22nd May*, 1883. 6d.
The object is to admit air simultaneously with the extraction of fluid.

2560. HATCH COVERS FOR BARGES, &c., *H. Roscoe and W. H. Dugdale, Liverpool.—22nd May*, 1883.—*(Not proceeded with.)* 2d.
This relates to a sliding cover and appliances connected therewith.

2562. APPARATUS FOR THE MANUFACTURE OF GAS FROM LIQUID HYDROCARBONS AND STEAM, *A. M. Clark, London.—22nd May*, 1883.—*(A communication from M. Gross, New York.)* 8d.
This relates to the general construction of the retort.

2563. OPENING DOORS BY MEANS OF ELECTRICITY, &c., *G. F. Redfern, London.—22nd May*, 1883.—*(A communication from A. Gautier, Cannes.)* 6d.
Relates to mechanism operated by electro-magnets for opening doors, which, on being released, are closed again by a suitable spring.

2564. BALLING HEADS OF GILL BOXES EMPLOYED IN THE DRAWING AND CARDING OF WOOL, &c., *P. Smith, jun., S. Ambler, and J. Lund, Keighley.—22nd May*, 1883. 6d.
The inventors claim the construction and employment of standards or uprights having recesses and tongues, and with weights sliding up and down, the said weights being retained on the tongues during the changing or removal of the built balls, which removal is effected by simply bringing the ball forward without having to lift the same.

2568. APPARATUS FOR EXTRACTING PARAFFINE, &c., FROM MINERAL AND OTHER OILS, *J. Siddeley, Liverpool.—23rd May*, 1883. 6d.
This relates to the treatment of oil after it has been reduced to a low temperature.

2571. CHENILLE AND APPARATUS EMPLOYED IN THE PRODUCTION THEREOF, *B. J. B. Mills, London.—23rd May*, 1883.—*(A communication from J. Baverey, France.)—(Not proceeded with.)* 4d.
This consists in the union on the same length of parts alternately cut or terry, the diameter of which is varied at will during the manufacture.

2572. STEAM GENERATORS IN COMBINATION WITH APPARATUS FOR THE MANUFACTURE OF INFLAMMABLE GAS, *G. G. Rhodes, Liversedge.—23rd May*, 1883.—*(Not proceeded with.)* 2d.
The object is the introduction of gas-making retorts into the flue tubes of steam boilers, in such a manner that the heated gases from the under furnace or furnace tube, which are being used for heating the said boiler, are also used in the heating of the retorts, and the heat radiating from the retorts, in which coal or other gas-producing substance is carbonised, generates steam.

2574. APPARATUS FOR CONVERTING RECIPROCATING INTO ROTARY MOTION, *H. Burt, Southampton.—23rd May*, 1883. 6d.
This relates to the arrangement of a reciprocating disc or its mechanical equivalent, levers, connecting rods, and a crank shaft.

2575. APPARATUS TO ELECTRICALLY INDICATE THE MOVEMENTS OR PASSAGE OF TRAINS ON RAILWAYS, *E. G. Warburton and R. R. Harper, London.—22nd May*, 1883. 8d.
Relates to an electrical contact maker formed as a treadle.

2576. CONSTRUCTION OF FLOORINGS, PLATFORMS, DADOS TO WALLS, FRAMINGS OF DOORS, &c., *J. Garlick, Birmingham.—23rd May*, 1883. 6d.
This relates to the joining together of a number of pieces.

2578. APPARATUS EMPLOYED IN CLEANING THE FLUES OF STEAM BOILERS, *R. Sutcliffe, Idle.—23rd May*, 1883. 6d.
This relates to the use of T and + couplings in combination with the curved perforated pipes and "Galloway" and other similar tubes.

2580. CARTRIDGE HOLDERS FOR EXPEDITING THE LOADING OF RIFLES, *S. Pitt, Sutton.—23rd May*, 1883.—*(A communication from H. Throusen, Holland.)* 6d.
This relates to a cartridge holder by which the cartridges contained in a case are pressed forward by a spring against an incline, the end of the cartridge opposite to that bearing on the incline thus being caused to project through an opening in the case ready to the hand.

2582. MACHINERY FOR THE PREPARATION AND REFINING OF FULLERS' EARTH, *C. R. Dames, Bath.—23rd May*, 1883. 6d.
This relates to an apparatus for extracting the moisture and extraneous matters from fullers' earth.

2583. MERCHANT BAR ROLLING MILLS, *G. G. M. Hardingham, London.—23rd May*, 1883.—*(A communication from J. Roberts, Reading, U.S.)—(Complete.)* 6d.
This relates to the use in merchant bar rolling mills of stepped rolls void of collars adapted for mounting in roll housings in sets of two, three, or more high.

2584. STEAM ENGINES, *A. M. Clark, London.—23rd May*, 1883.—*(A communication from W. F. Goodwin, Stelton, U.S.)* 8d.
This relates to improvements in balancing and lubricating the valves of steam engines, and to combinations and arrangements of mechanism for actuating the induction valves so as to obtain a variable cut-off, automatic or otherwise.

2585. MANUFACTURE OF SPRING MATTRESSES, *W. H. Beck, London.—23rd May*, 1883.—*(A communication from J. F. G. Soisson, Paris.)—(Not proceeded with.)* 2d.
This relates to an application of spiral springs of galvanised and tinned iron wire forming a tissue or grating which composes the mattress.

2587. SOFA BEDSTEADS, *C. A. Barber, London.—24th May*, 1883.—*(A communication from R. W. Taylor, San Francisco.)—(Not proceeded with.)* 4d.
This relates to several improvements in the details of construction.

2588. STEAM ENGINES, *A. Hoyois, Clabecq, Belgium.—24th May*, 1883. 6d.
This relates to that class of steam engines in which there are two inlet and two exhaust valves, the cylinder covers forming chambers through which the steam is admitted to the engine, and it consists in improvements in the construction and arrangement of the inlet and exhaust valves, and in the means and devices or apparatus for operating the same.

2589. RANGE FINDER, *F. Weldon, Farnham.—24th May*, 1883. 6d.
This consists in the arrangement of a prism or prisms.

2591. MANUFACTURE OF COLOURING MATTER, *C. D. Abel, London.—24th May*, 1883.—*(A communication from Messrs. L. Durand and Huguenin, Bâle, Switzerland.)—(Not proceeded with.)* 2d.
This relates to the manufacture of yellow colouring matter suitable for dyeing and printing.

2593. STEAM BOILERS, *J. Withingham, Birmingham.—24th May*, 1883.—*(Not proceeded with.)* 2d.
This relates to an arrangement of chambers and tubes.

2594. PAPER FASTENERS AND FILES, *W. J. Brewer, London.—24th May*, 1883.—*(Not proceeded with.)* 2d.
This relates to the arrangement of the prongs.

2595. HAULING OR WINDING ENGINES, *D. and A. Greig and R. H. Shaw, Leeds.—24th May*, 1883. 6d.
This relates to the combination of driving gear for giving motion to the winding drum of hauling or winding engines at either one or other of two different speeds as may be required.

2596. APPARATUS EMPLOYED IN GENERATING STEAM FOR USE IN MARINE AND OTHER ENGINES, *H. Tipping, London.—24th May*, 1883. 6d.
This relates to improvements in the general construction of the apparatus.

2597. EMBROIDERING MACHINES, *W. E. Gedge, London.—24th May*, 1883.—*(A communication from E. Cornely, Paris.)* 10d.
The object is to constitute an embroidering machine which is capable of producing an overseaming stitch on both sides of the material by winding a thread around the seams of two or more chain stitches, which are produced from a single thread by means of several needle hooks.

2598. WRENCHES, *H. W. Atwater, Orange, U.S.—24th May*, 1883. 6d.
This relates to the employment of a spring to act through a lever and keep the teeth of the excentric in contact with those on the bar of the fixed jaw.

2599. STOPPERING OF BOTTLES FOR AERATED LIQUIDS, *W. W. Macvay and R. Sykes, Castleford.—24th May*, 1883. 6d.
This relates to the construction of internal stoppers.

2601. FIRE-PROOF SCREEN OR SHUTTER FOR SEPARATING THE STAGE FROM THE AUDITORIUM OF THEATRES, *A. Clark, London.—24th May*, 1883. 6d.
This relates to the construction of an iron or steel curtain or screen.

2603. MANUFACTURE OF LADIES' NECKLETS, &c., *J. Mason and T. H. Hambleton, Macclesfield.—25th May*, 1883.—*(Not proceeded with.)* 2d.
This relates to weaving into the main fabric at intervals (or continuously) ornamental trimmings.

2604. CONSTRUCTING APPARATUS USED FOR DOUBLING OR TWINING YARNS OR THREADS, *W. H. Jones, Middleton.—25th May*, 1883. 6d.
The object is to obtain an extended drag or tension upon the yarns or threads whilst twining or doubling them.

2605. CHRONOGRAPHS, *W. H. Douglas, Stourbridge.—25th May*, 1883. 4d.
This relates to improvements in chronographs which have an additional minute hand.

2607. SPINNING MULES, *J. Newton and J. Leech, Oldham.—25th May*, 1883.—*(Not proceeded with.)* 2d.
This relates partly to apparatus for controlling the movements of the faller in the formation of the cops.

2608. CONSTRUCTION OF METALLIC FELLOES FOR RUBBER TIRES, *T. Fox, Sheffield.—25th May*, 1883.—*(Not proceeded with.)* 2d.
The object is to construct the felloes so as to hold the rubber tires firmly without cement.

2611. SADDLE BARS, *H. Born, London.—25th May*, 1883. 4d.
The object is the releasing of the rider should he fall or be thrown.

2613. TRAPS OR APPLIANCES FOR FLUSHING AND INSPECTING DRAINS, *F. Newman, Isle of Wight.—25th May*, 1883. 6d.
This consists in constructing traps and other parts of drain pipes with a seating for the reception of a removable valve, introduced through a vertical extension of the trap or drain above the seating, into which extension the liquid flows.

2615. DEVICE FOR SECURING CANDLES IN CANDLESTICKS, &c., *W. R. Lake, London.—*—*(A communication from J. F. Taberlet, Paris.)* 6d.
The device comprises a movable clamping piece and a screw, or its equivalent, placed inside the socket which receives the candle, and is either fixed to or independent of the candlesticks, chandelier, candelabrum, or the like to which the device is applied.

2618. PRODUCING WARMTH BY ABSORBING WATER VAPOUR, &c., *F. Wirth, Frankfort.—25th May*, 1883.—*(A communication from M. Honigmann, Aachen, Germany.)* 6d.
The inventor claims the use of caustic soda or potash to absorb water vapour in the form of exhaust steam, and the use of the heat caused by this process for the production of water vapour.

2619. MACHINERY FOR WINDING, DOUBLING, AND TWISTING YARN OR THREAD, *J. Boyd, Shettleston, N.B.—26th May*, 1883. 10d.
This relates to several improvements in the general construction of the machinery.

2620. MONEY BOXES, LEATHER BOXES, &c., *E. A. Jahncke and H. W. Herbst, London.—26th May*, 1883. 6d.
The object is to prevent the extraction of the contents of the boxes.

2624. WATCHES, *W. H. Spence, London.—26th May*, 1883.—*(A communication from A. Droz et Fils, Saint Imiers, Switzerland.)* 6d.
The object is the construction of a watch hermetically sealed or closed, so as to exclude damp and foreign matters.

2629. POWER LOOMS TO BE USED IN THE MANUFACTURE OF PILE FABRICS, *S. C. Lister and J. Reixach, Bradford.—26th May*, 1883. 8d.
This relates to weaving a double piled fabric, that is, two distinct cloths connected by the piled threads, which have to be split or severed to produce two piled fabrics, when such double piled fabrics are woven with two shuttles thrown simultaneously for each cloth.

2642. BILL FILES OR LOOSE PAPER BINDERS, *C. H. Brampton, Birmingham.—28th May*, 1883. 6d.
The principal feature of novelty is the addition to the binders of end clasps, which are ⊔ shaped, with the two wings or sides slightly tapered inside in such a manner as to naturally bind the flaps or back of the case to portions of the covers.

2646. BREECH-LOADING "ROOK" AND OTHER RIFLES, &c., *W. Field, Birmingham.—28th May*, 1883. 6d.
This relates partly to the mechanism for cocking, and partly to the mechanism for operating the extractor.

2647. PREPARING A FOOD FOR INFANTS AND INVALIDS FROM MILK, MEAL, AND MALT, *W. R. Barker and A. L. Savory, London.—28th May*, 1883. 4d.
This relates to improvements in the general treatment of the food.

2655. APPARATUS FOR FACILITATING THE SINKING OF SHAFTS, PITS, OR BORINGS IN AQUEOUS STRATA OR UNDER WATER, *C. D. Abel, London.—29th May*, 1883.—*(A communication from F. H. Poetsch, Germany.)* 6d.
This relates to the method of forming solid enclosures through water or water-bearing strata, by freezing the water or aqueous strata by means of tubes or equivalent appliances, through which a fluid refrigerating medium is made to circulate, such tubes being so arranged in the water or strata as to freeze the mass into a solid continuous wall.

2657. MANUFACTURE OF ELASTIC WATERPROOF COMPOUNDS, *W. Burnham, Chicago, U.S.—29th May*, 1883. 4d.
This consists essentially of a mixture of the sap of the mangrove tree with caoutchouc, effected either by the use of solvents or by mechanical means.

2679. CREEL PEGS, USED IN MACHINERY FOR PREPARING, SPINNING, AND WINDING COTTON, &c., *P. Coonan, Blackburn.—30th May*, 1883. 2d.
The foot of the creel pegs is provided with metal hips instead of wood.

2691. ARTIFICIAL FERTILISERS, &c., *J. Richards, jun., Norfolk, U.S.—30th May*, 1883. 4d.
The compound consists of night soil, mixed with either dry fish scrap, bone phosphate of lime, or phosphate guano, the whole being treated with sulphuric acid after such mixing.

2726. APPARATUS FOR CUTTING CORNS ON THE FEET, &c., *H. W. Sharpin, Bedford.—1st June*, 1883.
This relates to the construction of the blade.

2746. LUBRICATOR, *J. Imray, London.—2nd June*, 1883.—*(A communication from H. Zweiffell, Cologne.)* 4d.
This relates to the construction of a lubricator by which doses of tallow or other lubricant can from time to time be supplied to a valve, &c.

2790. GAS MOTOR ENGINES, *W. P. Thompson, Liverpool.—5th June*, 1883.—*(A communication from S. Marcus, Vienna.)—(Complete.)* 6d.
This relates to improvements in the distributing mechanism, and in the magneto-electric igniting apparatus of a gas engine patented May 23, 1882, No. 2425.

2808. PENS, *W. Brierley, Halifax.—6th June*, 1883.—*(A communication from A. F. J. L. Scholz, Transylvania.)* 6d.
This relates to the construction of the points of the nibs.

2873. SPITTOONS, *W. Vale, Birmingham.—8th June*, 1883. 6d.
The object is to make the spittoon self-draining.

3063. FLY-WHEEL, *H. Blank, Berlin.—20th June*, 1883. 6d.
This relates to a fly-wheel having its rim composed of wire or strips of metal wound in layers around the frame.

3073. ABSTRACTING HEAT IN LARGER QUANTITIES FROM STOVES, &c., *C. J. Henderson, Edinburgh.—21st June*, 1883. 2d.
This consists in passing a confined current of air over the hot surface.

3202. CARRIAGE BRAKE APPARATUS, *W. Corteen, Sheffield.—27th June*, 1883. 8d.
The chief object is to employ or utilise the power created by the resistance or backing of the horse or horses.

3858. FASTENERS FOR GLOVES, BELTS, BOOTS, &c., *E. K. Dutton, Manchester.—8th August*, 1883.—*(A communication from C. A. Pfenning, Barmen-Rittershausen.)—(Complete.)* 4d.
This relates to a spring fastener.

3929. ISOMETER OR DYNAMIC SECTOR, *H. J. Allison, London.—14th August*, 1883.—*(A communication from H. Glover, New York.)* 6d.
This relates partly to the combination with the fixed needle and a vernier scale, each of whose units is one-half of the circle upon which it is formed, and is subdivided into tenths, of a free swinging needle mounted on a support that is provided with a vernier subdivided into elevenths of the unit for the vernier scale.

4304. LUBRICATING THE CYLINDERS OF AIR OR OTHER ENGINES OR PUMPS, *W. R. Lake, London.—7th September*, 1883.—*(A communication from F. J. Weiss, Basle, Switzerland.)—(Complete.)* 6d.
This relates to a method of and means and apparatus for lubricating cylinders in which air or some other incondensable gas actuates a piston, or in which such gases are actuated by means of a piston.

4382. APPARATUS FOR CARRYING AND DELIVERING WIRE, *H. J. Haddan, London.—13th September*, 1883.—*(A communication from L. P. Johnson, New York.)—(Complete.)* 4d.
The object is to provide a carriage upon which the reels of wire may be readily mounted in such manner as to pay off the wire as it is secured to the supports.

4567. BOILERS, FLUES, AND CYLINDRICAL VESSELS, *H. J. Haddan, Kensington.—25th September*, 1883.—*(A communication from J. Prégardieu, Germany.)—(Complete.)* 4d.
This consists in making boiler shells, flues, and other cylindrical vessels of wrought metal in such a manner that the connecting ends of two sections are flanged outand lap-jointed to form a concave or convex circular groove, in which the rivet heads are countersunk.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

290,229. ART OF RIVETTING METALS TOGETHER, *John M. Griest, Chicago, Ill.—Filed January 22nd*, 1883.
Claim.—An improvement in the art of attaching metallic plates or sheets to one another—to wit, preparing the plates by partially removing the metal from one of them, so as to produce on its surface a number of projecting studs, and by making holes corresponding thereto in the other, superposing the

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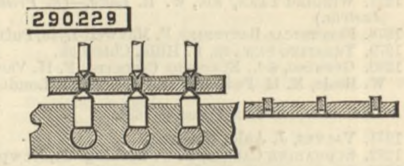

plates one on the other, the studs on the one extending into and through the holes in the other, and then rivetting the plates together by means of rivetting tools that shall simultaneously spread the metal and form heads on both the outer and the still engaged inner end of each stud.

290,236. MACHINE FOR SHARPENING MOWING MACHINE KNIVES, *Robert R. Isaac, Trenton, N.Y.—Filed July 2nd*, 1883.
Claim.—The machine, consisting of frame A and grinding wheel G, in combination with wheels B and

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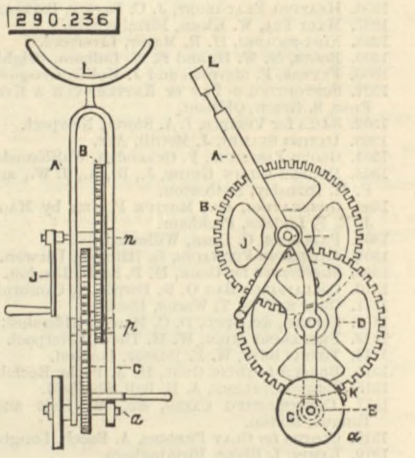

C, crank J, projecting brace K, brace L, pinions D and E, and shafts *n p* and *a*, as and for the purposes stated.

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