## PRESTON DOCK AND THE RIVER RIBBLE.

PRESTON is a borough town and port in the county of Lancaster, situated on the river Ribble, about seventeen miles from the sea. The navigation of the port at present is confined to coasting vessels drawing about 14ft. of water. The amount of shipping entering the port is under 30,000 tons a year. The Ribble rises in the West Riding of Yorkshire, at the east foot of Whernside, and arrives at Preston after a course of fifty-seven miles. With its tributaries it drains about 800 square miles of land, a great part of which is moorland. The annual rainfall over this district averages about 37in. Below Preston the channel of the river opens out into a broad sandy estuary, four to five miles in width, the whole of which is covered at high water of spring tides, and the greater part of which is dry at low water. The course of the river after it leaves the trained portion is along the northern shore of this estuary to Lytham, whence the main navigable channel called "The Gut" bends in a south-westerly direction between the Salt-house and the Horse-shoe banks to the Irish Sea. The width of the estuary between the two forelands on the coast, Stanner Point on the north, and Southport on the south, is five miles. The sands extend four miles seaward beyond this line, and are uncovered at low water. The depth at low water spring tides on the bar, or portion of the navigable channel with deep water, is 4ft. Beyond this the depth seawards rapidly increases from 20ft. immediately beyond till at the Nelson buoy—which is two miles beyond the bar, and the first buoy belonging to the Ribble Navigation—the depth is six fathoms. The depth above the bar along the Gut channel, which is rather tortuous and narrow, being shown on the Admiralty chart as less than a quarter of a mile wide, varies from 4ft. to 24ft. This channel is buoyed out with eight buoys, which are shifted as the channel varies. There are three other channels between Lytham and the sea, called respectively the South channel, the Penfold, and the North channel. These are all more or less navigable, but the Gut is the main sea fairway. From Lytham a shallow channel runs near the shore for about a mile to "the dock," where ships can lie at anchor. Thence it winds towards the Wage through the sands. This channel is continually shifting its course, owing to gales and freshets. From this point the river has been trained by rubble stone training walls, put in about thirty-four years ago, which continue for seven miles up to Preston. These walls rise 7ft. above low water, and are 300ft. apart at the top. Spring tides rise 24ft. at the bar, and neaps 17ft., and at Preston the rise is 10ft. and 4ft. 6in. The project of constructing a dock at Preston has been agitated for some years, and had been strongly advocated by Mr. Garlick, M.I.C.E., who was the engineer to the Navigation Commissioners. It was considered that by providing deep-water accommodation to the town its trade and prospects would be very greatly increased, owing to the large manufactories by which it is surrounded, the immense population in the immediate neighbourhood, and the nearness of the Wigan coal fields.

In 1883, Mr. Garlick being then mayor of the borough, having temporarily resigned his appointment under the Corporation in favour of his partner, Mr. B. Sykes, M.I.C.E., an Act of Parliament was obtained by the Corporation for the construction of a dock at Preston, thirty acres in extent, for the diversion of the Ribble through Preston, for extending the training walls of the river, and dredging out the channel. Sir John Coode was engineer-in-chief for the line when in Parliament, Mr. Sykes being associated with him. The Bill was opposed, the opposition being based not so much on the engineering details or estimates as on grounds of general policy. The Parliamentary estimate of the works was £557,781. The amount borrowed was to be repaid within sixty years, and interest during construction was allowed to be added to the capital.

After the Act was obtained, Sir John Coode ceased to act as engineer, and Mr. Garlick resumed his duties and took charge of the works. He continued to do so until his health broke down, a short time since, when he resigned, and his partner, Mr. Sykes, became the responsible engineer, and is now in sole charge. Before the commencement of the works it was determined by the Corporation to increase the size of the dock from thirty to forty acres, to increase the depth of water on the cill from 26ft. to 29ft., involving the deepening of the diversion and the depth of the dredging in the river; also to construct a half-tide basin of 4¾ acres in extent, a quay wall in the river for coasting vessels, a gridiron for the repair of ships, and other works. These alterations have added considerably to the cost. The land also has cost nearly £43,000 more than was allowed for in the estimates.

The borrowing powers obtained under the Act of 1883 have already been exceeded, and it is proposed to go to Parliament again next session for powers to raise a further sum of £510,000. The original and proposed estimates stand as follows:—

| | Parliamentary estimate. £ | Present estimated cost. £ |
|---|---|---|
| Dock, dock entrance, berths, &c. | 250,104 | 320,105 |
| Tidal basin | — | 33,445 |
| Roads, lighting, &c. | 6,855 | 6,550 |
| Railways | 9,000 | 20,300 |
| Machinery | 24,000 | 60,500 |
| Timber pond | — | 11,700 |
| Warehouses | — | 32,400 |
| Houses for staff, stores, &c. &c. | — | 16,550 |
| Graving dock | — | 36,500 |
| Gridiron | — | 9,800 |
| River diversion | 78,867 | 122,100 |
| Land | 16,796 | 59,491 |
| Dredging | 94,766 | 232,500 |
| Training walls | 28,180 | 49,000 |
| Lighting and buoys | — | 3,450 |
| Contingencies | 49,213 | 71,607 |
| Purchase of undertaking | — | 72,862 |
| Cost of Act | — | 9,567 |
| Interest on capital to date | — | 2,678 |
| | £557,781 | £1,171,105 |

The present borrowing powers are £662,244, leaving the amount now required £508,861. The actual expenditure and liabilities on contracts incurred up to the present time are £723,628.

As regards the construction of the dock, there is no engineering difficulty. The subject on which opinions seem to differ is with regard to the possibility of gaining access to the dock from the sea by ships of large tonnage, owing to the difficulty of constructing and maintaining a channel through the sands in the estuary. It was given in evidence before the Parliamentary Committee by Sir John Coode and the other engineering and nautical witnesses that when the training works and dredging were completed there would be 30ft. at high water spring tides from the dock to the sea. The Admiralty sailing directions and chart give the rise of tide as 24ft. spring tides and 17ft. neaps. With 4ft. on the bar and in the channel up to the end of the proposed dredging, this would give 28ft. at spring tides and 21ft. at neaps. The difference of 2ft. arises probably from the varying depth on the bar. To obtain this depth the works now being carried out in the Ribble estuary consist of a continuation of the training walls to about a mile below Lytham pier, or, say, 12 miles from the dock entrance. At this point the bed of the navigable channel, although nearly dry at low water, is sufficiently deep to give the 28ft. or 30ft. at high water, and it is expected that when the dredging and training works are completed this channel will be considerably improved by the increased scour of the tidal water being sent more directly into it. The question was raised in Committee as to whether it would not be necessary to extend the training works further out; but the engineers who were examined were of opinion that it would not. Between the training walls, which are 300ft. apart, the bed of the channel is to be deepened by dredging, so as to give the full depth of 30ft. up to the dock. The borings show that the substratum of the channel, below a bed of sand, consists of boulder clay, gravel, and stones, in ridges or hummocks of an exceedingly hard character, which not only are not amenable to any scouring action of the current, but hold up in the basins formed between the hummocks large quantities of sand. The channel near Lytham will require to be lowered from 10ft. to 12ft., the depth increasing up to the dock, where 20ft. will have to be removed to give the full depth of 30ft. at high water. The quantity of material to be removed, either by scour or dredging, is estimated at eight million cubic yards. About half of this is sand, and it is expected that the greater part of the sand will scour out as the channel is deepened. It is stated that already the effect of the training walls and dredging has been to remove from the bed of the new river channel over half a million cubic yards of sand.

As a matter of comparison, it may be stated that in the improvement works which have been carried out in the river Tees, which passes through a sandy estuary of somewhat similar character to that of the Ribble, the quantity of material dredged out of the twelve miles of trained channel was 18,557,820 tons. The cost of this has been, for plant, £138,036; for dredging, £249,500; together, £357,536. The cost of dredging clay and hard material at first was 10½d. per ton; the mean cost of the whole dredging, 5¼d. per cubic yard, including depreciation. In place of two or three tortuous channels from Middlesbrough to the sea, there is now only one, with sufficient depth of water for ships of large tonnage to get up the river. The depth on the bar has increased from 3½ft. to 18ft. by scour only.

Training walls have been carried out in the Ribble from Preston downwards for a distance of about seven miles. These walls are now being extended about five miles further by depositing the rubble sandstone obtained from the excavation of the dock to a height of 7ft. above low water. The width of the channel is to be 200ft. at the bottom. The stone is simply thrown in its place from barges and allowed to take its own position, the river face assuming an inclination of 1½ to 1, the deposit of this stone forming part of Mr. Walker's contract. The south training wall has already been carried for a considerable distance, and 134,000 cubic yards of stone have been placed *in situ*. The low-water channel has become fixed for some distance below the Wage in its proper course. Two dredgers are at work on the clay where it has been exposed by the scour effected by the training walls, and a million cubic yards have been dredged and placed at the back of the stone of the walls. The dredging work is, however, much behind, and if the approach to the dock is to be ready by the time the dock is completed, the dredging will have to be pushed forward much more rapidly. For this purpose Mr. Sykes has asked the Corporation, who are doing the dredging themselves, to provide two additional dredgers. The providing of these dredgers, and the other plant required, can only be done by obtaining further borrowing powers.

The two dredgers now at work were supplied by Messrs. Fleming and Fergusson, of Paisley. The engines are of 100 nominal horse-power, and are each capable of raising about 300 tons of hard boulder clay per hour. Twelve iron hopper barges and two tugs are occupied in removing the material. The electric light has been used for night-work. These dredgers can work from five to six hours each tide, and a day's work is about 2400 tons each. The cost of dredging amounts to about 2½d. a-yard, and including removal, 6d.; with interest and depreciation of plant the total cost is estimated at 9d. per cubic yard. The quantities of the several kinds of material to be dredged are put down in Mr. Sykes' last report to the Corporation as follows, the prices given including cost of all plant, no credit being allowed for the same at the completion of the work:—

| | | s. | d. | £ |
|---|---|---|---|---|
| 20,000 | cubic yards red rock, at | 7 | 6 | 7,500 |
| 568,100 | ,, gravel and clay, at | 1 | 1 | 30,772 |
| 1,722,000 | ,, hard red marl with stones | 1 | 6 | 129,150 |
| 1,301,500 | ,, upper stratum of sand | 1 | 0 | 65,075 |
| 3,611,600 | | | | £232,497 |

The cost of the dredging plant is as follows:—Two dredgers, £37,400; twelve hopper barges, £36,500; two steam tugs, £9780; and the amount expended in wages, coals, &c., up to the present time, £6138. The reliance of the engineers as to the maintenance of the channel is based on the supposition that after it has been once fixed and dredged the tidal currents and the drainage water from the Ribble watershed will be sufficient to keep it scoured out and free from sand. The quantity of tidal water at springs passing up and down the new channel when completed is put by Mr. Sykes at 700 million cubic feet. The channel at present is continually shifting its course over an area of from one to two miles, its course being altered by gales of wind or the prevalence of heavy freshets. By fixing the course of the tidal and fresh water in one channel the harm arising from this continual shifting will be obviated, and the full force of the scour concentrated in maintaining the channel.

The works for the dock and river diversion were commenced in 1884, and are to be completed by October, 1889. The motive for diverting the river at Preston was to place the channel of the river on the south side of the dock, and to leave the quays on the town side. The new cut is 300ft. wide at the water level, with slopes of 2½ to 1 pitched with stone. This part is completed with the exception of the earth left in at the two ends to dam the new cut off from the old river channel. The contract for the river diversion, dock and training walls was let to Mr. T. A. Walker, and is now being carried out by him under the direction of his agent, Mr. Knott. The contract amount for the several works is as follows:—River diversion, £77,000; entrance, channel staging, dams, &c., £34,934; dock, tidal basin, lock, &c., £302,176; training walls in river, £25,249; making the total amount of Mr. Walker's contract £439,359.

The dock is 3020ft. long, 600ft. wide, and 40ft. from the coping to the bottom. The lock is 550ft. long by 66ft. wide. It has three pairs of gates, being divided into two lengths of 325ft. and 225ft. The depth of water on the cill at high-water spring tides will be 29ft. The level of the dock coping is 9ft. above this, and the dock bottom slopes 2ft. from the sides to the centre. The half-tide basin has an area of 4¾ acres, and is protected by a pair of gates of similar width but stronger and higher than those in the lock. Outside the dock, and parallel with it, is a long quay wall at the side of the new river, where ships of small tonnage can lie and discharge. The channel has been made curved with the concave side next the dock, so as to keep the deep-water channel always on that side. Provision has been made for graving docks, but the work for these has not yet been let.

The material excavated from the dock consisted of 13ft. of alluvial soil, 10ft. of gravel, and below this 12ft. of red sandstone, making 35ft.; the quays being raised with the excavated material the other 5ft. The gravel is used for the concrete, and the sandstone for the rubble training walls in the river. The bottom of the dock is formed in the red sandstone, which is considered to be sufficiently water-bearing to hold the water without leakage. The walls are of concrete, but as the lower portion of the dock is in the rock, the concrete does not commence till 12ft. from the bottom. The walls are 17ft. 6in. wide at the bottom and 10ft. at the top. The concrete is of gravel and Portland cement in the proportion of 9 to 1, rubble blocks of sandstone from the excavations being mixed with the concrete in the proportion of about one-third of the whole mass. A face of concrete 12in. thick is carried up with the body of the walls in the proportion of 4 to 1. The concrete is sound, and has a very fair face, the panels being dressed with a mixture of soft soap and oil to prevent the concrete adhering to them. The concrete is all mixed by hand, Mr. Garlick objecting to the use of mixing machines. The coping is granite, and the steps of sandstone. The lock walls are of concrete, except where the gates come, when they are faced with sandstone from the Longridge Quarries. This, a stone from the Yoredale measures, is of a finer and more regular grain than the millstone grit. The cills and hollow quoins are of granite. The stonework is very well finished, and has an exceedingly workmanlike and pleasing appearance. The bottom of the lock has a bed of concrete over the sandstone 2ft. in thickness. The gates are to be entirely of greenheart, 2ft. 10in. thick in the centre, diminishing to 1ft. 9in. at the heel post, which is held in its place by anchor straps at the top, and at the bottom works on a ball 9in. in diameter, revolving in a cast iron socket lined with gun-metal. Half an inch play has been left between this ball and the socket. The roller path is of steel. The work in the dock is very forward; nearly the whole of the wall on one side is up and ready for the coping, and across the other side and end nearly all the foundation is in, and in places the wall carried up some height. The outer basin is practically completed, and the gates ready for fixing. The lock is about half finished. Out of a total quantity of 5,000,000 cubic yards of excavation there yet remain about 1,000,000 cubic yards in the dock to do, which have been kept back till the river is diverted, when it will be used to fill up the old channel.

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JUNIOR ENGINEERING SOCIETY.—On the 16th inst. a party of members and friends of this Society paid a visit to the Beckton Gasworks. They were received and conducted round by Mr. Beale, who showed them all of the many interesting apparatus and appliances contained in the process of gas manufacture. This excursion formed the last of the season, and the meetings of the seventh session are to be inaugurated with the delivery of a Presidential address by Mr. Wm. Anderson, M. Inst. C.E.

GLASS MANUFACTURE IN NORWAY AND SWEDEN.—The manufacture of bottles has, according to the *Sprechsaal*, made considerable progress of late years in the above countries. The article made is said to be good and clear, and to be making an active competition in England against home-made goods; the lower price of labour and other advantages bringing the Scandinavian article at about half the price of the English product. Fuel is cheap, many of the Swedish glass manufacturers being, at the same time, wood dealers, and the refuse from the saw-mills being available for the glass-making. The cost of living in Sweden is said to be lower than in any other country, and the condition of the workpeople is considered to be good.—*Journal of the Society of Arts.*

## RAILWAY MISMANAGEMENT IN NEW SOUTH WALES.

In dealing with the important points involved in the recent accident on the Hawkesbury Railway, near Sydney—briefly referred to in our issue of the 9th inst.—we purpose in the first place to review the primary facts connected with the accident, and the causes which led to it; in the course of which the laxity and mismanagement in the railway department will be made evident. We shall then direct attention to the injustice to individuals characteristic of the existing state of things, which this case forcibly exemplifies.

On Jubilee day, which was kept as a public holiday in the colony, and on which a more than usual demand for special trains was made on the railway department, a train of excursionists numbering nearly 400 was despatched from Sydney to the terminus at Peat's Ferry, on the Hawkesbury Railway—which had only shortly before been opened for traffic. This line rises by a number of steep inclines to the summit, whence it descends by gradients of 1 in 55 and 1 in 50, and finally by one of 1 in 40, for nearly six miles to the terminus. The engine provided by the locomotive department for the train in question, although too light for the load put upon it, as events showed, was one of a type in every-day use for the passenger trains running on the main lines of the colony, where there are frequent inclines of 1 in 40; and, at certain parts, in ascending the mountain ranges, gradients of 1 in 33 and 1 in 30 for many miles. It appears from the evidence given at the coroner's inquest, and published in the Sydney papers, that the train as first made up consisted of seven carriages; but at the last moment, and after the engine had been attached, two additional carriages were added. It should be mentioned that the vehicles of which the train was composed were fitted, in a more or less complete manner, with an automatic air-brake; the system in use in the colony being the Westinghouse. Four of the carriages had through air-pipes, but had no brake blocks, nor brake apparatus of any kind; while another carriage, although fitted with blocks, had—as it proved—its brake apparatus defective, and consequently its cylinder and brake blocks had been shut off from action. This was one of the two vehicles put on the train at the last moment, after the engine had been attached and the brake apparatus then on the train tested, prior to starting on the journey. Further, no brake van was put on the train, "because," as the station master who despatched it said, "there was not one available," although the same witness admitted that "there was always a brake van attached to the Western trains under the control of the Westinghouse brake, fitted with the necessary appliances for the use of the guard in applying the brake." Two, and two only, of the carriages were fitted with hand brakes acting in conjunction with the air brake, one of which was put at the rear of the train as a substitute for a brake van, although it was unprovided with the usual air-pressure gauge and brake valve for the information and use of the guard. Moreover, there was only one guard sent with the train, and even he, it may be here noted, had never been over the line before, and was, as it turned out, wholly unacquainted with the position, steepness, and length of the gradients. The engine was fitted with a hand brake acting on its four coupled wheels, and with the usual air pump, reservoir, valves, &c., for operating the air brakes on the carriages, as well as that with which the tender was provided. The tender had also a hand brake working in conjunction with the air brake.

In this condition as regards brake arrangements, and with the guard, at this stage of the journey, in the last vehicle, the train started on its way a few minutes late. Owing to its being, as we have stated, in excess of the power of the engine, it lost much time, and ultimately, shortly after leaving a wayside station called Ryde, came to a stand when ascending an incline of 1 in 40. At Ryde some passengers had been taken on, amongst whom, it should be mentioned, as he played an important part in subsequent events, was one named Mr. Rennie. This gentleman, who was engineer and overseer to the contractors, rode on the engine, an act which, unfortunately, cost him his life. On the train coming to a standstill it was backed to Ryde, and after making several attempts by racing at the bank to surmount it, it succeeded, and ultimately reached a station called Beecroft, which it passed, but soon afterwards again came to a stand in a cutting, where the driver informed the guard that he could not "lift" the train any further. Here, as we are told, "one of the three on the engine suggested that the train should be parted." This the guard proceeded to do, and after putting, at the suggestion of Mr. Rennie, "a pole through the wheels of the last two vehicles," he—the guard—divided the train, cutting the first seven carriages from the other two, and forwarded them to Hornsby, a station near the summit of the line, "in charge of Mr. Rennie," as he says, he himself remaining behind with the two carriages. Some doubts exist as to whether Mr. Rennie went in charge of the train. The evidence rather points to the fact that, although he consented to go, he really remained with the cut-off carriages, and that the train proceeded on its way without anyone in charge. That Mr. Rennie was selected and used as an unofficial guard is, however, the official guard's version of the story. On their arrival at Hornsby, the seven carriages were detached, sprags in the wheels being again used, and the engine returned and took up the remaining carriages to Hornsby, where they arrived three hours and sixteen minutes after leaving Sydney, a distance of twenty-one miles. These carriages were then backed and put on to the former head of the train, leaving the four carriages which were without brakes of any kind at the rear. The guard coupled up the two newly arrived carriages to the other seven in the presence of the "officer in charge" of the station, who then—after himself making a very cursory examination of the train, because, as he said, he "had very little time to examine the carriages on that day, as he had other things to attend to," and without ascertaining whether the guard had examined the train—gave the order, "All right; get away." The guard thereupon, without trying the brakes, as required by rule 368, "because he was anxious to get on the journey owing to the delay and the conduct of the passengers," gave the signal to the driver, and the train, with Mr. Rennie once more on the engine, started again on its journey. The guard was then in the fifth carriage from the engine, one of the two carriages with hand brakes, and in front of the four before-mentioned carriages which were without brakes of any kind. Soon after leaving Hornsby, the train again stuck on an incline of 1 in 40. The guard then got down and went towards the engine, when he noticed that the wheels of one of the carriages between him and the first carriage on the train—although as to which he' is not positive—were skidding by the action of an air brake. He released the air "by a tap at the side," and as the train then started, he jumped on the second carriage from the engine, which happened to be one with a hand brake, but from which, as he confesses to the jury, he could not see anything that occurred in the rear. From this point there was no further stoppage, and all went well until the train, after reaching the summit, passed through a tunnel—No. 1—between which and a subsequent one—No. 2—on a descending gradient, the guard noticed the speed of the train increasing. He then applied the hand brake, and the driver soon after began to sound the whistle—a long continuous whistle—during which time the speed increased. The guard then "hung on to the hand brake with all his might." It appeared to him to have some effect at first, but the speed soon became greater, until at length the carriage gained a speed of forty or fifty miles an hour, and ultimately turned over, on coming into collision with some vehicles in a siding at the foot of the incline at Peat's Ferry.

In the meantime, the driver—as given in evidence by the fireman—had, on reaching the top of the incline from Hornsby, and commencing the descent to the ferry at a speed of about twelve miles an hour, shut off steam. Before entering No. 1 tunnel he, with 90 lb. of air-pressure in the reservoir, had applied the air-brake to the wheels of the tender, and—so far as he was able to do so, in the condition of the brake-fittings, as subsequently revealed—to the vehicles in the train, while the fireman had applied the hand-brake on the engine. This seemed to hold the speed of the train in check for a time, the line there being curved. But as, on coming out of No. 2 tunnel on the straight and on the sleeper incline, the speed increased, the driver, as before stated, opened his whistle to call the attention of the guard, and put the air-brake fully on. This, however, did not seem to those on the engine to have any effect on the speed. The driver thereupon remarked: "She has got away from us; this is dreadful, we shall all get killed;" and at the same time reversed his engine; while Mr. Rennie waved his handkerchief from the side of the tender in the hope, apparently, of attracting the attention of those in the train. The engine wheels forthwith began to skid, and the fireman slackened the hand-brake to free them, when they revolved again, and he once more applied the brake. He saw that the air-brake from the engine was in proper and full action, not only from the reading of the pressure-gauge, which never showed a less pressure in the main reservoir than 75 lb., but also from the action of the spindle of the hand-brake on the tender, working in connection with the air-brake, which rose out of its socket, and remained so during the descent, until, to his knowledge, within a very short distance from the end. He further observed that the air-pump was working the whole way down the incline. Having thus done all, as the fireman said in his evidence, that could be effected by those on the engine to control the speed, nothing was left to them but to await the collision at the terminus, where the engine was overturned into the river, and the first and second carriages were "telescoped" one into the other.

An examination of the engine after the accident entirely confirmed the account given by the fireman. The engine was found reversed in full gear; the hand brake hard on, and the steam regulator partly open. The lever of the air brake was also open, showing that that brake had been applied by the driver, and the air pump was found working, although the engine was then immersed in water, while everything about the engine showed that the driver had done all in his power to stop the train. On the other hand, an examination of the train showed that the brake blocks of the third and following carriages were hanging loose, and that their tires were "as cold as could be" owing to running without the brake being on; and, on separating the second carriage from the first one in the train, it was found that the air tap of the main pipe at the hind end of the first carriage was closed. The handle of this tap, although turned in an unusual direction, being away from, in place of towards, the end of the vehicle, was parallel with the pipe—which was of larger diameter—and was without marks of any kind to show that it had been affected by the collision. The fact of the guard having had to apply the hand-brake in the second carriage, in which he rode at the time of the accident, showed conclusively that the air brake was not operating in that vehicle any more than in the following ones; while a passenger gave evidence showing that the wheels of the first carriage were skidded by the air brake whilst the train was running away.

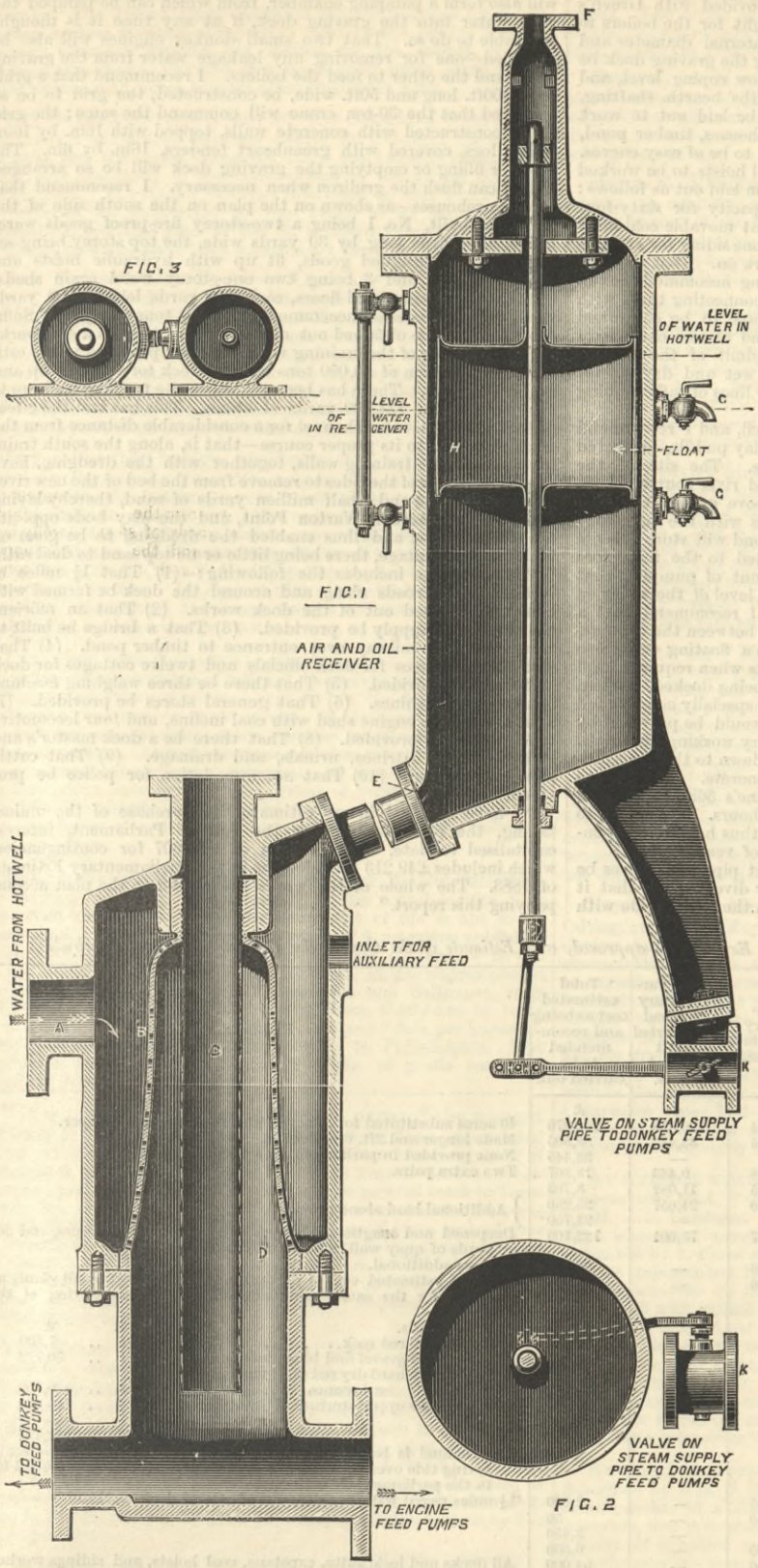
In view of these facts, in regard to which the evidence is clear and ample, there can be but one opinion with practical railway men as to the cause of the accident. The closed tap at the end of the first carriage, which was not discovered on leaving Hornsby owing to the omission, admitted by the guard, to try the brake apparatus before starting, prevented the air passing along the main pipe beyond the first carriage and charging the reservoirs under the other carriages, the pressure in which had been greatly, if not wholly, reduced by the long delay in the siding at Hornsby, or by other means. The coupling up of these more or less exhausted reservoirs to that of the second of the two carriages brought up from Beecroft naturally affected the distribution of pressure in the train pipe to the extent which caused the brake on one of the carriages—the one of course which happened to retain the higher pressure—to go on, as was discovered by the guard. The closed tap further prevented the driver from operating the brakes on the second and following carriages when he applied the air brake to the tender and the first carriage. The brake power available for keeping the train in check was accordingly overmatched by the weight of the train, with the result which followed in the wreckage of the engine and two carriages, and the death of the driver, Mr. Rennie, and four or five passengers, with injury to many others.

If the matter had here ended it would have called for little notice at our hands, beyond referring to it as an instance of culpable negligence in the making up of a continuous brake train, having only four vehicles out of nine with effective brakes, and as showing the need for constant vigilance on the part of those in charge of trains in seeing that the brake apparatus is tested before leaving a station where the train has been divided or shunting operations have been gone through. The incidents connected with this case, however, bring it prominently into notice, as affecting an important body of public servants in our Australian colonies, as well as the safety of the travelling public. The impression produced on the public mind by the accident and the loss of life it entailed led, on the one hand, to the appointment of a departmental Board of Inquiry to investigate the case for the information of the Government; and, on the other hand, to a public inquiry before a coroner and jury. The inquiry before the coroner, simple as the essential facts of the case were, proved a lengthy one, involving the examination of over forty witnesses, many of whom were frequently recalled. In the end, the jury came to the conclusion, which, on the evidence given on oath, and published in the Sydney press, substantially meets, in our opinion, the justice of the case. Their verdict was:—"We attribute the accident to the great want of supervision on the part of the officials in the railway department in not carrying out the instructions laid down for their guidance, thereby endangering the safety of the railway travelling public. We consider the driver did all in his power to control the excessive speed of the train. We are of opinion that the engine was not sufficiently powerful to take the train safely to its destination. We are further of opinion that the train was not properly inspected before leaving Sydney. We are likewise of opinion that the train was not properly inspected on leaving Hornsby. We are of opinion that the air coupling and taps, on leaving Hornsby, were not complete. We are of opinion that the brake-power on the train was not sufficient. Rider: We earnestly request the Government, on behalf of the public generally, to appoint a commission to inquire into the management of the different branches of the Railway Department, so that an organised and more complete system be adopted."

In the meantime, the Board of Inquiry had conducted its investigation, and, strange to say, gave birth to a report embodying an almost diametrically opposite view of the case. They, in substance, put all the blame on the unfortunate engine-driver, who was past defending himself, and was rather the victim of discreditable mismanagement than anything else, and wholly whitewashed the traffic officials of blame for the accident. Their version of the case is summed up as follows:—"That the accident arose from a sudden failure of the brake-power; that this failure was not owing to either the insufficiency or imperfect condition of the brake appliances, but—and this is the only conclusion consistent with the whole of the facts—to the injudicious use of them by the unfortunate driver. The air reservoirs of the carriages became exhausted, in which condition the application of the brake was impossible, and there was not time enough for the driver to re-charge the reservoirs and bring them into use before the accident took place."

In regard to the closed tap—which no sane person, in view of the facts established by the evidence given at the coroner's inquest, and with the most elementary knowledge of the working of the brake system in use on the train, can for a moment doubt was the cause of the accident—it is only fair to the Board that we should here give their explanation. They say:—"It will be seen from the evidence that when, on the morning following the accident, it became possible to examine the brake connections between the two cars which telescoped, the tap at the rear end of the first one was found closed. There is, in our opinion, however, not the slightest room for doubt, from the position in which the tap was found, that it was the telescoping which turned it. In fact, under the circumstances the handle could not have been found otherwise; it was turned just in the direction which the act of telescoping was bound to effect" (the Board here omit to add: "Or as an unpractised hand in the hurry and confusion which attended the dispatch and progress of this unfortunate excursion train may very well have turned it") "being the reverse of the position in which it would have been found had it been closed by hand; added to which it was in a part of the train where there had been" ("or ought to have been" the Board might reasonably have added) "no interference during the journey, either with the coupling or brake connections." Did it never occur to the Board that if this cock happened to be turned when the carriage left Sydney—when it was the last but one in the train, and the cock would therefore cut off only one brake carriage—the point of their concluding remarks entirely falls to the ground? Moreover, as a set-off to their plausible, but entirely uncorroborated suggestion, the Board were constrained to make this very significant admission:—"We must also observe that the formal test of the air-brake connections, which, according to the rules of the department, should have been made by both the driver and the guard before leaving Hornsby, was not carried out; the operations, however, gone through"—the Board are significantly silent as to what they were—"afforded undoubted proof that all was correct in this respect."

## MACLAINES' FEED-WATER HEATER.




## MACLAINES' FEED-WATER HEATER.

THIS combined feed-water heater, air and oil extractor, and automatic feed regulator, which we illustrate, is the invention of Mr. MacLaine, of Belfast. It is usually attached to the condenser between the engine pumps and the hot well, and the ordinary feed-water current enters it at *a*, Fig. 1, passing round the outside of the brass cone *b*, and is projected inwards towards the centre in jets through the perforations all round in the cone; *c* is a central tube of brass, through which the steam supply intended for heating the feed-water comes, and expands outwards in jets through perforations in and all round the tube, forming opposing jets of steam and feed-water, which meet and commingle together in the space *d*, producing an instantaneous condensation of the steam and the heating of every atom of the feed-water to the maximum at which the feed pumps will work. The sectional area of the feed-heater is eight times that of the feed pipes, so that the feed-water has time to consolidate, and the oil therein ascends into the recess at the top of the casing above the level of the incoming feed-water, and from thence ascends by the pipe *e* into an air and oil receiver, placed on the condenser above the level of the feed heater, and fitted with a gauge glass and cocks placed at different levels for conveniently drawing off the recovered oil at intervals.

The atmospheric air so detrimental to boilers is, it is claimed, simultaneously released by the rapid condensation of the steam, and rises freely between and among the horizontal feed-water jets in the space *d*, escaping through small apertures in the top of the brass cone *b* into the recess at the top of the feed heater, from which it ascends through the pipe *e* into the air and oil receiver, whence it is drawn off by the air pipe *f* and conveyed to the upper part of the hot well, or to some other convenient place of discharge.

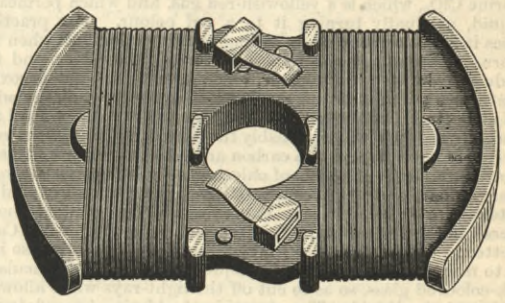
Fig. 2 is a plan of the valve with a lever on the steam supply pipe to the donkey feed pumps, and Fig. 3 is a sectional sketch of the feed heater and oil receiver, with brackets attached to the back of the condenser, but the shape of both feed heater and oil receiver and their attachments may be materially varied to suit any convenient position.

This feed heater forms no impediment to the feed-water current, with steam either turned off or on, and in many cases the value of the recovered oil alone would, it is claimed, soon recoup the cost of the combined apparatus.

When independent donkey feed-pumps are used, their working is regulated by a float *h* placed in the receiver and connected by rod and lever with a valve *k* on their steam supply pipe, so arranged that when the level of the oil or water in the receiver falls, the valve opens, and when it rises the valve closes, resulting, it is stated, in the main boiler feed being automatically regulated with the utmost precision, and the time and attention of the engineer being devoted to other and perhaps important duties.

It was to avoid the necessity of belting and at the same time to do away with the presence of an auxiliary machine on the board for driving, that Mr. Philip Diehl, of Elizabeth, N.J., several of whose ingenious devices we have already described, conceived the idea of combining the motor and sewing machine into a practical unit. The simple and elegant manner in which he has accomplished this is shown in the engraving, Fig. 1. The motor, it will be seen, is completely housed within the fly-wheel of the machine and connected directly with the driving shaft, so that all gearing is obviated. The details of the arrangement will be readily understood from Figs. 2 and 3, which show respec-

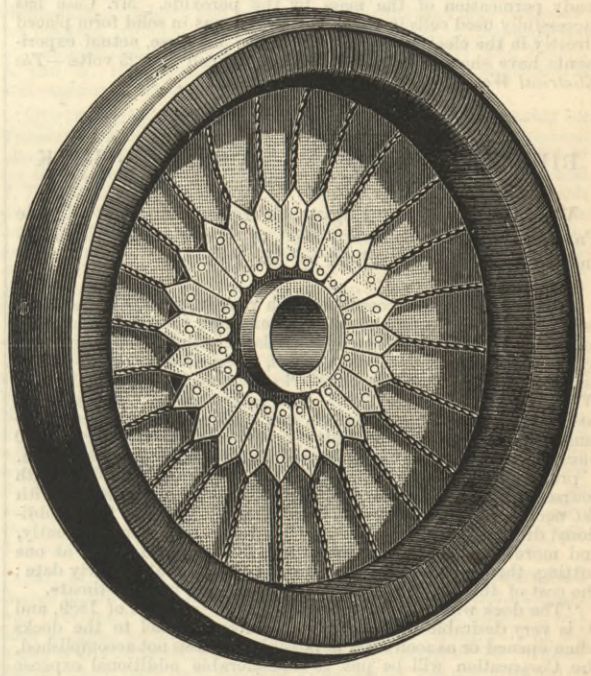
Fig. 2



FIELD MAGNET

tively the field magnet and armature of the motor. The magnet, which consists of a single piece, is wound with wire connected to the two terminal brushes shown. This magnet is permanently fixed to the hub through which the shaft passes. The armature shown in perspective in Fig. 3 is of the Gramme type, and is held in position within the rim of the wheel. The wires leading from the periphery connect to the commutator at the hub, and the brushes on the magnets bear against the segment.

Fig. 3



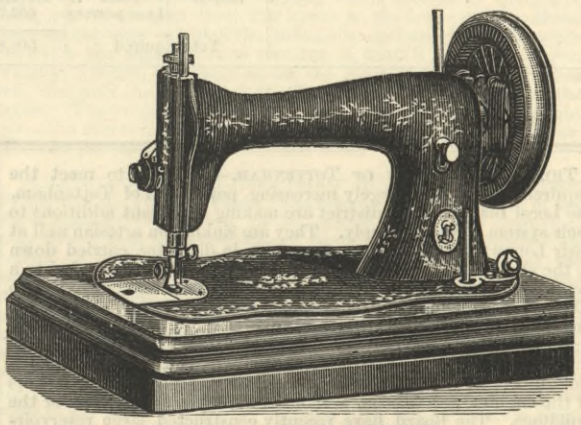
ARMATURE.

The wires leading to the motor pass up through the hollow casting of the frame, and are connected to a switch by which the machine can be started and stopped at will. The fly-wheel is provided with a clutch or stop motion in connection with the shaft, so that it may be connected with the latter, or turned loose, as is common in sewing machines, the wheel being disconnected from the shaft when winding bobbins. This is accomplished by a turn of a thumb-nut at the rear end of the machine. By unscrewing this nut entirely, the armature may be slid out completely, so that it may be examined should necessity require. This also exposes the field magnets and brushes so that they can be easily got at for examination and attention. The entire device is put together in most compact and neat form, and adds greatly to the value of the sewing machine as a labour-saving device.—*Electrical World.*

## DIEHL'S COMBINED SEWING MACHINE AND ELECTRIC MOTOR.

THERE is to-day probably no domestic labour-saving device in more general use than the sewing machine, and it ranks rightly as one of the prominent inventions of this century. While, however, it saves a vast amount of manual labour, its continuous use for hours entailing the employment of a treadle has called for methods of driving the machines by auxiliary power, and in large factories they are frequently coupled to lines of shafting. This method of driving has not been applicable to the case of isolated machines,

Fig. 1

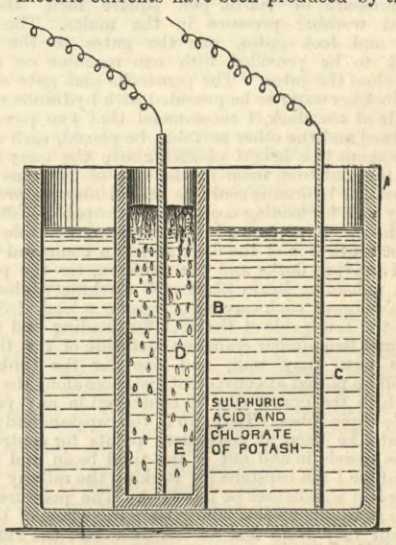


ELECTRIC SEWING MACHINE.

whether in shops or private dwellings, and hence the advent of the electric motor, which permitted each machine to be independent of any other, was welcomed because it offered a ready means of accomplishing in a convenient manner what was heretofore impracticable. The small motors have, as a rule, been attached to the board on which the sewing machine is mounted, and then belted to the shaft of the latter.

## A NEW PRIMARY BATTERY IN WHICH CARBON IS CONSUMED.

THE high cost of the zinc consumed in the primary battery has always stood in the way of its more general adoption as a source of electricity, and hence it has been the endeavour of many to find a substitute less costly. Carbon in its different forms evidently presents a number of advantages, principal among which is its cheapness. Electric currents have been produced by the union of




carbon and oxygen in the past, but the methods employed have required a high temperature, and hence entailed considerable loss of energy in the form of heat. It is to avoid this that Mr. Willard E. Case, of Auburn, N.Y., already known to our readers by his work in this field, has devised a form of cell in which the oxidation of carbon is effected without the application of heat. In the usual styles of battery, carbon constitutes the insoluble or negative elec-

It is the manifest wrong-headedness of the Board's report, as misleading the public from the real source of the disaster, and as doing the driver, in our opinion, an injustice, that gives the importance to the case, and has led to our calling special attention to it. Regarding the technical question touching the working of the brake raised by the Board, little remains to be said, the solution of the matter being so simple and self-evident. The theory of the Board is but a repetition of the old story that when an accident of the kind happens to a train the blame is put on the brake by the officials in fault. Here it is not a question involving the merits of one system of brake as against another. In this instance it happens to have been the Westinghouse system; but had it been the vacuum, or any other system involving a pipe connection throughout the train, the result would have been the same. A plain duty was, by their own confession, neglected by the officials in charge of the train in not testing the brake before leaving Hornsby station; hence the stoppage in the pipe by the closed cock was not discovered, and the full brake power on which the safety of the train depended was, as we have already said, unavailable when the time for its use arrived. The theory of "a sudden failure of the brake power . . . . . not owing either to the insufficiency or imperfect condition of the brake appliances, but to an injudicious use of them on the part of the driver," is so far-fetched an explanation in view of the closed tap, and so contrary to every-day experience of the working of the brake—as well as of the fact proved in evidence that the driver was a careful man and experienced in the use of the brake—that we are astonished that the Board could have had the temerity to advance it, and can only suppose that in doing so they were either the victims of their own inexperience and credulity, or that they placed implicit faith in the ignorance and credulity of the public in such matters, and of those to whom their report was addressed. It is to be hoped that the matter will not be permitted to end here. A considerable section of the public already condemn the management of Australian railways.

trode, but in the new cell carbon is the positive or soluble electrode. The accompanying illustration shows one form of the cell, which consists of the glass jar A, containing a porous cup B, in which is placed a conducting body of hard carbon D, such as coke. The negative electrode is a sheet of platinum C. In the porous cup is placed a quantity of carbon E, in comminuted form, previously moistened with sulphuric acid. In the outer vessel A is placed sulphuric acid. A cell thus arranged will give substantially no current, inasmuch as both elements resist the action of the acid. To the acid, however, chlorate of potash is gradually added in small quantities. The result of the reaction of the sulphuric acid and chlorate of potash is the formation, among other things, of peroxide of chlorine $ClO_2$, which is a yellowish-red gas, and which permeates the liquid, gradually turning it to a red colour. For practical purposes it is sufficient to cease adding chlorate of potash when the acid turns a distinct red. A re-action between the carbon and the peroxide of chlorine will, however, begin as soon as the peroxide permeates the porous cell and reaches the carbon, and if the addition of chlorate be suspended, this re-action will continue until the acid loses its red hue, when probably the chemical affinities between the peroxide present and the carbon are satisfied. More chlorate may then be added. Peroxide of chlorine is a very unstable oxygen compound, decomposing under the action of sunlight and exploding at a temperature of 140 deg. Fahrenheit. The cell is shown uncovered in the illustration, but in practice, according to Mr. Case, it is better to cover it, so as to prevent escape of gas. So also it is better to make the outer vessel of opaque material, and particularly of dark-coloured glass, so as to cut off the light-rays while allowing inspection of the liquid. The peroxide of chlorine formed in the cell apparently decomposes into chlorine and oxygen. The oxygen attacks the carbon, producing apparently carbonic acid. The other products of the re-action of the chlorate of potash and sulphuric acid are seemingly inert in the cell. A certain amount of polarisation occurs, which may be reduced by agitating the liquid or otherwise mechanically removing the gas, or by chemical means. The presence of the porous cup is not essential to the operation of the cell, but it is used because it retards the access of the peroxide of chlorine to the carbon, and so diminishes the rapidity of attack upon the carbon. So also the reduction of the carbon to comminuted form is not material, but preferable in order to allow of ready permeation of the mass by the peroxide. Mr. Case has successfully used cells in which the carbon was in solid form placed directly in the electrolyte. According to Mr. Case, actual experiments have shown that the E.M.F. of the cell is 1·25 volts.—*The Electrical World.*

## RIBBLE NAVIGATION AND PRESTON DOCK ACT, 1883.

We give here the Engineer's report to the Ribble Parliamentary Sub-Committee of the Preston Corporation, referred to else where by Mr. Sykes:—

"Gentlemen,—

"In accordance with your instructions, and after careful consideration of the entire scheme and the works necessary to carry out the undertaking in accordance with the plans approved by the Ribble Committee and Council, I beg leave to report to you as follows, viz.:—The following works are being carried out by Mr. Walker, your contractor, viz.:—The forty acre dock, locks, tidal basin, guide wing, river diversion, and training walls. I propose to lengthen out the present guide wing with a timber staging, 580 lineal feet in length, with bull-nosed end forming a lay-by berth. I propose to pitch the river face for a distance of 500ft. with coursed ashlar. I recommend that two additional dredgers with the necessary tugs and barges be obtained forthwith. These additional dredgers would enable the work to be done more efficiently, and more economically, by excavating out the full depth at one cutting, thus insuring a tidal way up to the dock at an early date; the cost of this dredging plant I have included in my estimate.

"The dock works will be completed in the autumn of 1889, and it is very desirable to have a deep water channel to the docks when opened or as soon after as possible; if this is not accomplished, the Corporation will be put to considerable additional expense caused by the filling up of the bed of the river, and also the bed of the river diversion, and the consequent large additional dredging which will be required. After the channel is dredged to the full depth there will be about 700,000,000 cubic feet of tidal water brought up and down the river every spring tide, this will have the effect of scouring out and keeping the bed of the river clean, provided the Corporation keep out the refuse and solids from the sewage of their own town and of those towns lying above Preston situate in the watershed of the river Ribble. I propose to fix a gas lighted fairway buoy, called Nelson buoy, on the site of the old Nelson, and to fix on the bar on each side of the main channel a can buoy on the starboard and a conical buoy on the port side of the channel, and continue this method of buoying up to the west end of the south training wall. At the end of the south training wall I propose to fix a permanent screw pile lighthouse, using the lens out of the present lighthouse. From this point forward to the dock, I propose to have the walls well defined with good perches, with a light every half mile. The entrance to the dock to be lighted up with a good white light on the end of the lay-by berth on the port side, and a good red light on the bull-nose on the starboard side. I propose to light up the dock, locks, tidal basin, and quay wall, with sixteen arc lights of about 2000 candle power each. I propose to work all the gate machinery, sluices, capstans, coal hoists, and cranes, by hydraulic power stored in three accumulators, each having rams 20in. in diameter and 23ft. stroke, supplied by high-pressure condensing steam engines, each capable of delivering into the accumulators 260 gallons of water per minute against a pressure of 700 lb. per square inch, that being the proposed working pressure in the mains. The four sets of entrance and lock gates, and the gates to the proposed graving dock to be provided with one machine on each side to open and close the gates. The penstocks and gate sluices for passing the lockage water to be provided with hydraulic rams. On the north side of the dock, I recommend that two powerful coal hoists, one fixed and the other movable, be placed, each capable of raising the wagons to a height of 22ft. above the quay level, and discharging the coal from them at the rate of 240 tons an hour. Two small balance hydraulic coal tips should also be provided on the new quay wall for loading coasters, each capable of discharging 200 tons an hour. I recommend that a 30-ton movable crane be placed on the south side of the dock so as to command vessels in the wet and graving docks and the gridiron, for the purpose of loading and unloading heavy plant and machinery, also that six small movable cranes, each capable of raising a load of 30 cwt., be provided on the south side of the dock for loading and unloading the vessels, and two similar cranes on each side of the tidal basin, two on the new quay wall, and one for the timber pond. Hydrants will be placed at convenient distances along the hydraulic mains, to which the cranes can be connected in any position by means of telescopic tubes. That two 11-ton capstans and seventeen 5-ton capstans be fixed at convenient points for controlling and directing the vessels in and out of the tidal basin and dock and that twenty-four 1-ton capstans for working the railway wagons at the coal tips and warehouses be provided. The pressure mains to to be laid so as to convey the power over the whole of the works, and they will vary from 2in. to 6in. diameter, the return main being in each case a little larger. That in order to provide against fire, hydrants and stand pipes be placed at intervals of fifty yards throughout the whole length of the pressure mains, fitted with Greathead and Martindale's patent injector.

"I recommend that the engines for charging the accumulators emptying the graving dock and working the electric light be grouped together in one building placed near the proposed graving dock and having under the same roof workshops and store-room, the latter being so arranged that it will form an extension of the boiler house if it is found necessary at a future time to increase the number of boilers. That provision be made for four Lancashire boilers, each 30ft. long by 8ft. diameter, provided with Green's patent fuel economiser. The necessary draught for the boilers to be obtained by means of a chimney 11ft. internal diameter and 180ft. high. That the sump well for draining the graving dock be 16ft. internal diameter, and carried 33ft. below coping level, and that the workshop be fitted up with lathe, smiths' hearth, shafting, and all necessary appliances. That railways be laid out to work the dock—coal hoists, grain, and goods warehouses, timber pond, tidal basin, and graving dock, the main lines to be of easy curves. The sidings for coal trucks and feeding of coal hoists to be worked by 1-ton capstans. The siding accommodation laid out as follows:—That one fixed coal hoist has a siding capacity for sixty-four trucks, allowing one siding for empties. That movable coal hoist has a siding capacity for 220 trucks, allowing one siding for emptics and one siding for the travelling crane to work on. That there be two fixed coal tips to quay wall with a siding accommodation of 194 trucks. That there be two lines of rails connecting these with the incline near the Victoria warehouses, these to be continued forward along one side of the 40 acre dock, and also on one side of the graving dock and river diversion, to admit of the 30-tons movable hydraulic crane commanding both wet and dry docks, and also gridiron. That there be three single lines of rails running into the two-story goods warehouse.

"The plan has been approved by the Council, and I recommend that the slopes of the sides be covered with clay puddle, protected with 6in. of gravel, and pitched with stone. The site of the timber pond forms part of the bed of the old river course. I do not propose any additional works to the above except that the entrance be fitted up with a pair of gates with the necessary sluices worked by hydraulic power. This pond will store a large amount of timber, and the large area added to the forty acre dock will dispense with a considerable amount of pumping that would otherwise be required to keep up the level of the water in the dock, and to keep the vessels afloat. I recommend that a graving dock be built 550ft. long, 82ft. wide between the copings, with an entrance 66ft. wide, provided with a floating caisson so that it may be divided into two compartments when required, and thus save pumping when a small vessel is being docked. When not in use the caisson could be berthed in a specially constructed chamber, access to the bottom of the dock would be provided by five sets of stairs with slides for the necessary working materials. The foundations of the dock to be carried down to the red sandstone rock, and the walls constructed of concrete. The dock to be emptied by means of two sets of Gwynne's 36in. centrifugal pumps capable of emptying the dock in 2½ hours. The water to be discharged into the forty acre dock, and thus help to compensate for the loss of water due to the docking of vessels.

"I recommend that a 4ft. cast iron outlet pipe with valves be provided from the graving dock into the river diversion, so that it will be possible to empty the graving dock on the ebbing tide with very little assistance from the pumps. The outlet culvert will discharge on to the floor of the proposed gridiron, and thus provide a desirable means of flushing and cleansing the gridiron; and it will also form a pumping chamber, from which can be pumped the river water into the graving dock, if at any time it is thought advisable to do so. That two small donkey engines will also be provided—one for removing any leakage water from the graving dock, and the other to feed the boilers. I recommend that a gridiron, 400ft. long and 50ft. wide, be constructed, the grid to be so arranged that the 30-ton crane will command the same; the grid to be constructed with concrete walls, topped with 16in. by 16in. Baltic logs, covered with greenheart fenders, 16in. by 6in. The pipe for filling or emptying the graving dock will be so arranged that it can flush the gridiron when necessary. I recommend that three warehouses—as shown on the plan on the south side of the dock—be built, No. 1 being a two-storey fire-proof goods warehouse, 150 yards long by 30 yards wide, the top storey being set apart for unconsigned goods, fit up with hydraulic hoists and cranes; Nos. 2 and 3 being two one-storey wood grain sheds, slated, to have concreted floors, each 150 yards long by 30 yards wide, and will together accommodate 10,300 tons of grain. Sufficient rock will be obtained out of the site of the dock and works for the hearting of the training walls. I have provided in my estimate an addition of 50,000 tons of hard rock for topping up and facing the walls. There has been placed in the training walls up to the present time 134,000 yards of stone. This has had the effect of fixing the low-water channel for a considerable distance from the Naze westward to its proper course—that is, along the south training wall. These training walls, together with the dredging, have caused the scour of the tides to remove from the bed of the new river channel over one and a-half million yards of sand, thereby laying bare Cobbler's Acre at Warton Point, and the clay beds opposite the Guide House, and thus enabled the dredging to be gone on with great advantage, there being little or no top sand to deal with.

"My estimate includes the following:—(1) That 1¼ miles of boulder paved roads along and around the dock be formed with boulders obtained out of the dock works. (2) That an efficient gas and water supply be provided. (3) That a bridge be built to carry road and railway over entrance to timber pond. (4) That suitable residences for dock officials and twelve cottages for dock labourers be provided. (5) That there be three weighing machine houses and machines. (6) That general stores be provided. (7) That locomotive engine shed with coal incline, and four locomotive tank engines be provided. (8) That there be a dock master's and general offices, latrines, urinals, and drainage. (9) That cattle pens be provided. (10) That accommodation for police be provided.

"I have included in my estimate the purchase of the undertaking, the cost of obtaining the Act of Parliament, interest capitalised to date, and the sum of £71,607 for contingencies, which includes £49,213 provided for in the Parliamentary Estimate of 1883. The whole of the works are shown on the plan accompanying this report."

*Statement as to Contracts entered into, Expenditure approved, and Estimate of the Cost of the Unexecuted Works required.*

| Description of work. | Parliamentary estimate Act of 1883. | Cost if Parliamentary plans had been carried out at contract prices. | Total estimated cost as being and recommended to be carried out. | Remarks. |
|---|---|---|---|---|
| | £ | £ | £ | |
| Dock | 181,144 | 126,575 | 222,970 | 40 acres substituted for 30 acres, and made 2ft. 6in. deeper. |
| Locks and entrance | 50,885 | 33,432 | 69,505 | Made longer and 2ft. 6in. deeper. |
| Tidal basin | — | — | 33,445 | None provided in parliamentary scheme. |
| Lock gates, &c. | 8,368 | 9,433 | 18,867 | Two extra pairs. |
| Lay-by berth and stagings | 10,075 | 11,082 | 8,763 | |
| Training walls | 28,180 | 24,657 | 25,250 | Additional hard stone provided. |
| Ditto | — | — | 23,750 | |
| River diversion | 78,867 | 75,001 | 122,100 | Deepened and lengthened, slopes pitched with hard stone, and 500 yards of quay wall, with two hydraulic coal tips. |
| Land | 16,796 | — | 59,491 | 85 acres additional. |
| Dredging | 94,766 | — | 232,500 | Detailed estimated cost of dredging, including cost of all plant, no credit for the same being allowed on the completion of the work:— Cubic yards. s. d. £ 20,000 red rock .. 7 6 .. 7,500; 568,100 gravel and blue slutchy clay .. 1 1 .. 30,772; 1,722,000 hard dry red marl with gypsum and stones .. 1 6 .. 129,150; 1,301,500 upper stratum of sand .. 1 0 .. 65,075; 232,497 |
| | | | | The channel is being dredged so as to admit of 29ft. of water at spring tide over the dock sill instead of 26ft. 6in. as provided for in the parliamentary estimate. |
| Roads | 67,805 | — | 2,000 | 1¼ miles paved with boulders out of site of dock works. |
| Head lights | 50 | — | 50 | |
| Lighting and buoys | — | — | 3,450 | |
| Engine and boiler-houses | 9,000 | — | 6,500 | |
| Hydraulic engines and boilers | 15,000 | — | 54,000 | All docks and lock gates, capstans, coal hoists, and sidings worked with hydraulic power. |
| Railways, sidings, &c. | 9,000 | — | 20,300 | 9 miles with points and crossings. |
| Timber pond | — | — | 11,100 | 25 acres. |
| Graving dock | — | — | 36,500 | 550ft. long in two compartments. |
| Gridiron | — | — | 9,800 | For painting and slight repairs to hulls of vessels; 400ft. long, 50ft. wide. |
| Water and gas supply | — | — | 2,000 | |
| Electric light | — | — | 2,500 | |
| Bridge over timber pond entrance | — | — | 600 | |
| Warehouses | — | — | 32,400 | One two-stories for goods, two one-story sheds for grain. |
| Residences and cottages | — | — | 3,000 | |
| Weighing machines and houses | — | — | 1,750 | Three houses and machines. |
| General stores | — | — | 1,500 | |
| Engines (locos.) and sheds | — | — | 6,900 | Engine shed with coal incline and 4 tank engines. |
| Offices, &c. | — | — | 2,000 | |
| Cattle pens | — | — | 1,000 | |
| Police accommodation | — | — | 400 | |
| Contingencies | 49,213 | — | 71,607 | |
| Purchase of undertaking | — | — | 72,862 | |
| Cost of Act | — | — | 9,567 | |
| Interest capitalised to date | — | — | 2,678 | |
| | 558,149 | Total | 1,171,105 | |
| | | Less powers | 662,244 | |
| | | Yet required | 508,861 | |

I am, Gentlemen,
Your obedient servant,
Benjamin Sykes.

6th September, 1887.

The Water Supply of Tottenham.—In order to meet the requirements of the largely increasing population of Tottenham, the Local Board of that district are making important additions to their system of water supply. They are sinking an artesian well at their Longwater pumping station, 12ft. in diameter, carried down to the chalk; and a 24in. boring in the chalk will be extended to a depth of 450ft. from the surface. The new works include two 50-horse power engines, pumps, boilers, water tower, and engine house. The scheme was designed by Mr. W. A. H. de Pape, chief waterworks engineer, and is being carried out under his personal supervision. Mr. W. Brown, of Tottenham, is the contractor for sinking the well, Messrs. Wood Bros., of Sowerby Bridge, makers of the engines, and Messrs. Wilkinson Bros. the contractors for the buildings. The Board have recently constructed large reservoirs and a water tower at Mount Pleasant from their waterworks engineer's plans. The works in their entirety will cost about £25,000. Tottenham water, which is drawn direct from the chalk, stands very high in the official reports of Dr. Frankland to the Registrar-General, and when the works now in progress are completed, it is confidently anticipated that the parish will possess a system of supply far superior to that in many other neighbourhoods near the metropolis. A singular feature in connection with the sinking of the well is the variance in actual strata with those shown by the trial boring—in one instance, a layer of limestone rock, fifteen feet thick, being met with.

Scientific Education.—Commenting on some of the remarks of Sir Henry Roscoe in his British Association address, the *Contract Journal* says:—Manchester is only a type of our great industrial centres; and in none that we know of is their inferiority to Manchester due in the least degree to ignorance of or indifference to the services which science can render to manufacture and industry. Not less questionable is the statement that "the appreciation of the value of science" is less a characteristic of the English people "than of some other nations." It may be so; we are often told from the same platform that it is so; but we are never told who are these "other nations." Even if the statement be true, it does not prove much for the contention; for whereas "other nations" have remained comparatively poor, this nation has somehow gone on for nearly a century past growing richer and richer. And if latterly there have been signs that she has passed the zenith of her prosperity, these signs are simultaneous with her awakening—so it is alleged—to the value of scientific education. On the other hand, other nations who have been alive to it all along, have apparently not even yet learnt how to turn it to useful account, or, if they have, it has only enabled them to make plausible but worthless imitations of Britannia's best products.

## RAILWAY MATTERS.

SOME good orders are now on the market for the Indian railways. The Indian State Railways require ironwork for goods wagons, besides shafting and pulleys; and by the Bengal Nagpur Railway Company tenders are invited for the supply of 100 wrought iron tanks, 100 cast iron connecting pipes, sixty pillar water cranes with pipes, besides other important work.

THE Geneva correspondent of the *Standard* telegraphs that after a conference between Comte Fé d'Ostiani, the Italian delegate, and the Swiss delegates, Italy has formally declined to participate financially in the construction of the tunnel through the Simplon. The Italian localities interested in this tunnel will, nevertheless, be authorised to vote funds in its favour. The Federal Council has gone to the St. Gothard Tunnel, to visit the fortifications which have been constructed there for its defence.

THE Pennsylvania Railway Company, it is said, will equip a number of its important passenger trains this winter with steam heating appliances. The *American Engineer* says that the late tests show that a pressure of from 4 lb. to 5 lb. of steam from the locomotive is sufficient to maintain a uniform degree of heat in a train of eight coaches, and that the new system is really less expensive in requiring less labour. The removal of the dangerous car stove is only one degree more necessary than the removal of the big suspended oil lamps peculiar to American cars.

THE following bridge accidents are reported in the American *Engineering News*. On August 24th a bridge carrying the Union Pacific Railroad across Sand Creek, ten miles east of Denver, Col., was washed out. The engine and baggage car of an express train fell into the gap, and two men were killed. The bridge of the Burlington and Missouri River Railroad, which is close to that of the Union Pacific, was badly injured by the flood, but the trains were flagged in time. On August 25th a railroad bridge at Atchison, Kan., was burned, the cause being a collision in which a car loaded with kerosine was set on fire.

THE *New York Sun* says:—Everybody is talking about the extraordinary number of railroad disasters, crossing slaughters, collisions, and runaway engines reported in the daily newspapers during the past two or three weeks. It does not indicate that railway men are becoming more reckless or that the average of risk is increasing. Casual events of any class distribute themselves in groups and not at regular intervals, and just now we are passing through an uncommonly thick group of incidents of this sort. The effect is somewhat startling, however. It looks very much as if an epidemic of acute locomotivitis had attacked the railroads of the country.

THE public has become so accustomed to the facilities for business offered by the railroads that the actual service they have done toward cheapening the necessities of life is apt to be overlooked. The *Alta Californian* says:—"A magazine published in Philadelphia in 1818 gave the following as an item of news: In the course of the twelve months of 1817, 12,000 wagons passed the Alleghany Mountains from Philadelphia and Baltimore, each with from four to six horses, carrying from thirty-five to forty hundredweight. The cost of carriage was about 7 dols. per hundredweight, in some cases as high as 10 dols. to Philadelphia. The aggregate sum paid for the conveyance of goods exceeded 1,500,000 dols."

"IT is probable," says an American paper, "the present tendency to increase boiler pressure would have been appreciated by one of the old Erie engineers. 'Yankee Dan' was something of a character, and while running on the Falls Branch used to overtake and pass the Central trains on the then parallel track to Tonawanda in a way that surprised their runners; and while Dan was quietly sitting in his cab waiting for time, one of them crossed over to investigate. A glance at the gauge seemed to satisfy him, and he was quietly edging away with the remark: 'You carry pretty good steam here, don't you?' when Dan, who had followed his look, replied in an assuring tone, 'Oh, that's nothing, it's only the second time around.'"

THE Brake Committee of the Master Car Builders' Association, referring to the recent Burlington tests, says:—"Your committee believe from these experiments that the following figures represent the frictional resistance of long trains of freight cars, in good repair, running over a track in good condition, the weather being fine and warm, and the wind light. The resistance appears to be constant at speeds of from 12 to 25 miles per hour, and does not appreciably increase with an increase of speed within these limits. The following give the frictional resistance in pounds per ton of 2000 lb.—speed, twelve to twenty-five miles per hour:—

| | New cars. | Old cars. |
|---|---|---|
| On tangent .. .. .. .. .. .. .. .. | lb. 8·00 .. | lb. 6·00 |
| On 3 deg. curve .. .. .. .. .. .. .. | 10·50 .. .. | 8·30 |

Good lubrication and carefully fitted boxes and journals may, with cars that have been running some time, decrease this resistance to a minimum of 4 lb. per ton on the tangent; while brake shoes rubbing against the wheels, and other unfavourable conditions, may increase the friction on the tangent to 12 lb. per ton, and to considerably more on curves. The use of outside-hung shoes seems to increase the resistance on curves when the shoes are very near the wheels."

THE recent railway accident near Doncaster, and that at Chatsworth in America, though dissimilar in their circumstances, were alike in being productive of great loss of life and of an incalculable amount of human suffering. Railway accidents accompanied by loss of life and suffering will from time to time occur in spite of all precautionary measures. But careful considerations of the direct causes of personal injury plainly points to some means being adopted for the reduction of at least some of the dangers to which railway passengers are at present exposed. Those who have witnessed railway accidents, or who have examined the wrecked trains afterwards, must have been struck with the remarkable amount of shivering or splintering undergone by the interior woodwork of the coaches, especially of the third-class carriages or compartments. We have seen floors, partitions, lining, and seats, transformed into a mass of murderous spikes, while the framework remained comparatively undamaged. There can be no doubt whatever that a large proportion of the injuries received in railway accidents is due solely to this splintering of the woodwork, and the difficulty often experienced in extricating the wounded is greatly increased from the same cause. Apart from this, the presence of wood flooring, seats, and partitions, greatly increases the disastrous effects from any outbreak of fire. A remedy for the state of things here described would be found in substituting some non-splintering and less inflammable material for the inside fittings and floors of the third-class compartments. It has been more than once proposed, indeed, that carriages wholly constructed of some such ductile metal as mild steel should take the place of the carriages now in use. There are of course many practical objections to this idea, but without entirely advocating it, it may be said that mild steel would answer admirably for the floorings and perhaps also for the partitions in the form of thin and minutely corrugated sheets. For the seats, door linings, &c., the railway companies, in our opinion, have an excellent substitute for wood in compressed paper, which is every day finding new and unexpected application. With this material it would be possible to make the seats sufficiently strong and rigid for all practical purposes, and yet capable of yielding horizontally in case of closing together without amputating or even breaking the legs of passengers. The adoption of these simple and inexpensive measures would unquestionably do much towards removing some of the worst features in railway accidents, and they seem to us well worth the attention of all railway companies.

## NOTES AND MEMORANDA.

THE French population returns for 1886 have been issued. The births exceeded the deaths by 52,560, the smallest excess known of late years. In 1881 the excess was 108,000; in 1882, 97,000; in 1883, 96,000; in 1884, 78,000; and in 1885, 85,000.

HERR C. V. NEUMANN has constructed a battery with nickel and carbon as galvanic elements. The exciting solution is either dilute nitric acid or aqua regia or sulphuric acid, whilst lead dioxide is the depolarising agent. The E.M.F. of this battery is said to be 0·75 volt.

HERR R. EISENMANN recommends the use of tungstic acid as an exciting agent for galvanic elements. Its action is similar to that of chromic acid, but it has the advantage of being rapidly oxidised after reduction, whilst the addition of a small amount of phosphoric acid suffices to keep the tungstates in solution in the acid liquid.

WRITING upon the failure reported in the Aberdeen Harbour Works, a correspondent of the *Contract Journal* says it "seems to be a warning to be apprehensive of cement bearing an extravagantly high tensile strain at short date, and to teach that beyond the three tests customary to be relied upon, viz., tensile strain, weight per bushel, and fineness of grinding, specific gravity and an analysis should be required in order that an over-limed cement may be avoided."

THE North China *Herald* says that the population of fifteen provinces of the Chinese Empire amounted in 1885, according to a document emanating from the Board of Revenue, to 318,383,000. This is exclusive of five provinces with an estimated population of about 60 millions. The total population is, therefore, estimated at about 380 millions, and these figures the *Herald* does not consider likely to be too large, since the conscription and fear of taxation are reasons for understating the population. Previous estimates have ranged from 300 millions to 450 millions.

A PAPER on "Measurement of Luminous Sensations in Function of the Quantities of Light" was recently read before the Paris Academy of Sciences by M. Ph. Breton. Since the invention of Bouguer's photometer it is known that if a dull white surface be disposed in contiguous zones receiving equi-different quantities of light, the perceptible contrasts between such zones are very far from being equal. To explain this phenomenon it has been suggested that the eye perceives the relation between two contiguous lighted surfaces. But the law—attributed to Fechner and Weber—based on this assumption, to the effect that, if several contiguous luminous surfaces are in geometrical progression, the sensations of the contrasts are equal, is shown to be incorrect by the experiment described.

THE report of Mr. William Crookes, F.R.S., Dr. William Odling, and Dr. C. Meymott Tidy, on the London river water supply during August states that the water supply of the month was characterised by the smallness and uniformity of the proportion of organic matter present, even to a more marked degree than was noticeable in the previous month's supply. Thus, in the case of the water of the companies taking their supply from the Thames, the mean amount of organic carbon was ·134 part, and the maximum amount ·147 part in 100,000 parts of the water, as against a mean of ·146 part and a maximum of ·169 part met with in the supply for July. Several samples of the East London Companies water had to be recorded as "slightly turbid;" but the supply of the other six companies was without exception clear, bright and singularly free from other than a bluish tint of colour.

AT a recent meeting of the Paris Academy of Sciences, a paper was read, "On the Variations of the Telluric Currents," by M. J. J. Landerer. During the last nine years the number of days when the current flowed north-east and south-west being indicated by 1, those on which it flowed in the opposite direction will be represented by 6·7. Several changes of direction very seldom occurred on the same day, and they were nearly always connected with violent atmospheric disturbances. From 8 a.m. to 9 p.m. the intensity of the current going north-eastwards attained a maximum towards ten o'clock and two minima about four and nine o'clock, the mean intensity of the maximum being 0·000124 ampère, that of the minima 0·000073 and 0·000074. For the opposite current this maximum and these minima become respectively one minimum and two maxima at about the same hours, with mean intensities 0·00064, 0·000122, and 0·000138 ampère.

AN electric couple with carbon elements has been described by MM. D. Tommasi and Radiguet. The positive element consists of a stick of carbon covered with a layer of lead peroxide, and is contained in a canvas bag. The negative element consists of a hollow cylinder of carbon pierced with holes. Into this the positive element is thrust, and the whole is placed in a glass cell, which is then packed with lumps of gas carbon, and finally a concentrated solution of sodium chloride poured in until the level of the liquid is about half way up the cell. The electromotive force of this couple is from 0·6 to 0·7 volt, and no action occurs in it until the circuit is closed. It, however, polarises rapidly, and is only suitable for intermittent work, but when thus used it lasts for an almost illimitable time, being in as good condition after two years as when first put up. The chemical action which occurs is an oxidation of the carbon at the negative pole, and a reduction of the lead peroxide at the positive pole.

A NEW method of determining the density of the earth is being experimented upon at Berlin by Dr. F. Richarz and Dr. A. Konig, who, *Science* says, are using a sensitive balance with a double pair of scales, one swinging above, the other below, a heavy parallelopipedic mass of lead, which consists of a number of blocks which are exactly measured and weighed. The blocks are perforated, and the wires connecting the upper and lower scales pass through the shaft formed by these perforations. By an ingenious arrangement, the weights, which consist of spheres of lead, can be changed from the upper to the lower scales without opening the case in which the balance is enclosed. The principle on which the experiment is founded is, that if one of two equal weights is below, the other above, the mass of lead, its attraction will diminish the weight of the former and increase that of the latter. The proportion between the increase and the total weight gives the means for determining the proportion between the attraction and masses of the lead and the earth.

A PAPER ON "Photochronography applied to the Dynamic Problem of the Flight of Birds," was read at a recent meeting of the Paris Academy of Sciences, by M. Marey. Having in a previous note shown that the kinematics of flight may be completely illustrated by photochronography, the author here proves that the same process contains all the elements necessary for solving the dynamic problem of flight; that is to say, for measuring the muscular forces and the work performed by the bird. Here is applied the mechanical principle that, if the mass of a body and the movements animating it be known, it is possible to deduce the value of the forces by which those movements are produced. On the photochronograph are measured all the displacements of the mass of the bird on the wing, together with the velocities of these movements. On the other hand, the weight, that is, one of the forces to which the mass is submitted, is also known, while the resistance of the air, another of these forces, may be determined experimentally. Consequently the unknown quantity to be eliminated will be the muscular force of the bird with its momentum of action, and the value of its two components, one acting vertically against the weight, the other horizontally against the inert resistance of the mass and of the air. In these experiments the displacements of the bird are successively measured according to these two vertical and horizontal elements.

## MISCELLANEA.

MESSRS. HENRY POOLEY AND SONS have been awarded the gold medal for weighing machines at the Adelaide Exhibition.

MESSRS. CHARLES CAMMELL AND CO. have ordered two large Gresham and Craven's patent self-acting re-starting injectors to feed the range of steam boilers at their Derwent Steel Works, Workington, exactly the same size as are now at work feeding the range of ten Galloway boilers at the Manchester Jubilee Exhibition.

THE highest prize, namely, a first-class silver medal, has been awarded to Messrs. A. Shirlaw and Co., of Birmingham, by the Royal Cornwall Polytechnic Society, for the Spiel's patent petroleum engine, exhibited at the society's annual exhibition this year. The engine was shown driving a dynamo and electrical installation.

THE question of the superiority of the gelatine cartridge over the water cartridge has been exhaustively discussed by the North Staffordshire Mining Institute. The discussion was resumed at the monthly meeting at Stoke-on-Trent on Monday, but no definite decision on the relative merits of the cartridges could be made. Mr. J. Lucas, the chairman, however, stated that, as the result of experiments, it had been decided at Shelton collieries to adopt the gelatine cartridge in preference to the water cartridge.

THE Institution of Mechanical Engineers meets this evening, at 25, Great George-street, Westminster, by permission of the Council of the Institute of Civil Engineers. The discussion will be resumed on the paper read at the spring meeting on 17th May last, on "Experiments on the Distribution of Heat in a Stationary Steam Engine," by Major Thomas English, R.E., of the War-office, and a paper will be read and discussed, as far as time permits, on "Irrigating Machinery on the Pacific Coast," by Mr. John Richards, of San Francisco.

THE awards have just been made by the Havre Exhibition jurors, and the following honours have been conferred on firms on the North-east coast:—Consett Iron Company, diploma of honour; Messrs. Sir W. G. Armstrong, Mitchell, and Co., for shipbuilding, diploma and gold medal; Darlington Forge Company, for forgings, diploma and gold medal; Messrs. H. S. Edwards and Co., shipbuilders, Howdon, diploma and silver medal; and Messrs. R. and W. Hawthorne, Leslie, and Co., Hepburn, shipbuilders and engineers, diploma and silver medal.

QUITE a display was made in the streets of Manchester on Tuesday by a large consignment of iron roof-work, boilers, chemical plant, engines, pumps, exhausters, &c., which were being despatched for the Toronto, Japan, and Australian markets, by Messrs. R. and J. Dempster, of Newton Heath. This consignment of goods, which weighed altogether over 200 tons, was conveyed through the streets on sixty drays, forming a procession three-quarters of a mile in length, and was sent from Manchester to Liverpool by the Manchester Ship Canal Co., being the first consignment of ironwork or gas plant in any weight which has been conveyed to Liverpool by the new company.

"ABOUT the 1st of October," says the *Nevada Transcript*, "the hoisting and pumping machinery at the Banner quartz mine near this city will be run by electricity instead of by the direct water power now used. The power will be transmitted from the Electric Light and Motor Company's plant at the Charonnat mill, a mile distant. At Upper Shatora, Otage, New Zealand, a quartz mill on the Phœnix mine has been run for two years past by electricity. At a creek down the mountain, three miles away, two Pelton wheels, played upon by two streams of water directed by pipes under a vertical pressure of 120ft., run the dynamos. The electrical current is carried by a thin copper wire to the mill, where it is reconverted into moving power and drives thirty stamps."

Mr. HANBURY, of Manchester, who for fifteen years had charge of the rolling mills of the Bolton Iron and Steelworks, and was previously connected with the Cyclops Works, Sheffield, has been engaged to take the entire charge of the rolling mills at the works of the Johntson Steel Street Rail Co., Johnston, Pa., United States, which have been specially fitted up for the manufacture of girders and rails of all descriptions; and the order for the mill engines has, we understand, been given to Messrs. C. and J. Galloway and Co., Manchester. Mr. W. H. Booth, another Manchester man, has also received an appointment with the Strong Locomotive Co., of New York, which is making a new type of locomotive.

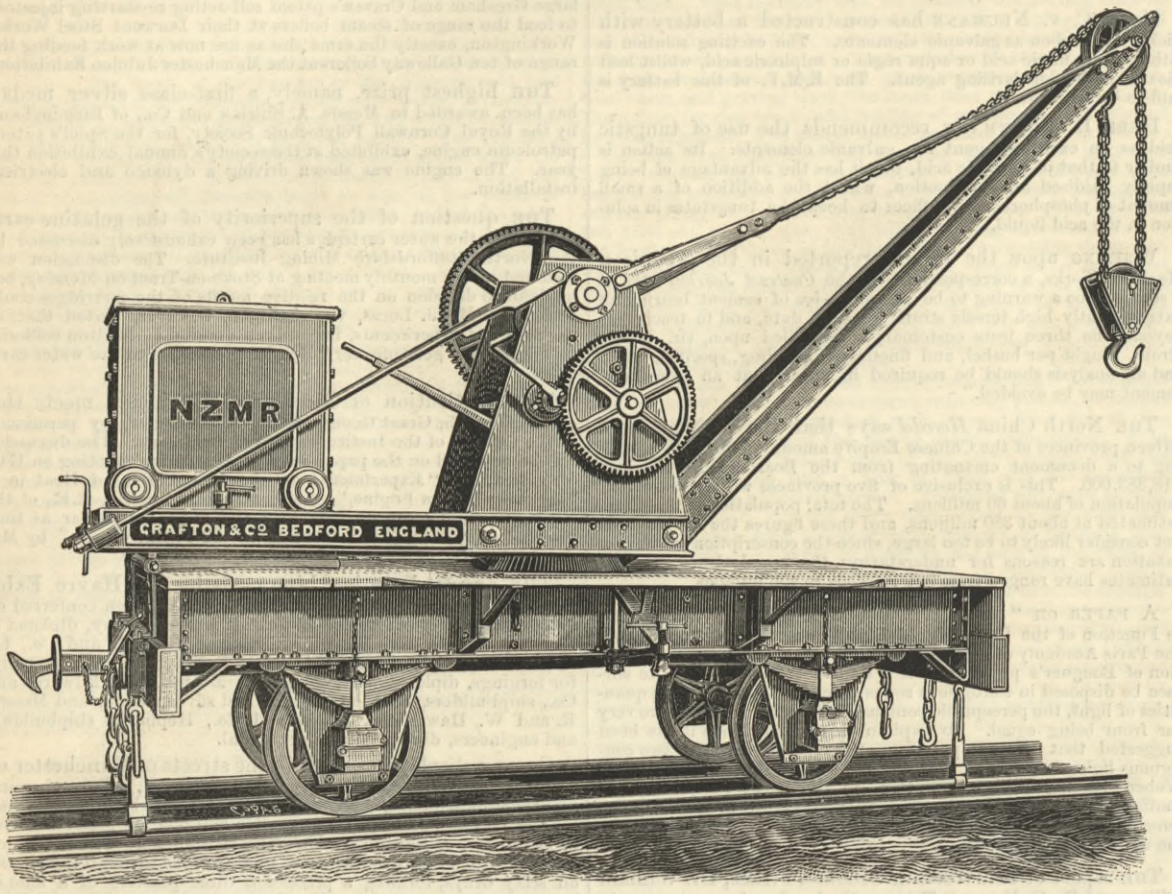
ON Monday, September 19th, Messrs. Edward Withy and Co., of West Hartlepool, launched the steel screw steamer Heathfield, built to the order of Mr. F. Wood, London. She is a vessel of 290ft. in length, with a large deadweight carrying capacity, and built to the 100 A1 class at Lloyd's. The vessel has a long raised quarter deck, short poop, long bridge house, and a topgallant forecastle. The main, bridge, quarter, and topgallant forecastle decks are of steel and iron, the chart house, cabin skylight, engine-room skylight, bulwarks, rails, galley, cargo battens, and five water-tight bulkheads of iron. The steamer is built on the web-frame system and fitted with Withy and Sivewright's patent improved cellular double bottom for water ballast all fore and aft, four steam winches, patent windlass, three stockless anchors hauling up into hawse pipes, steam quartermaster amidships, and right and left-hand screw gear aft. The vessel is rigged as a two-masted fore-and-aft schooner with iron lower masts, and will be fitted with triple expansion engines by the Central Marine Engineering Company, West Hartlepool.

AT the last meeting of the Swansea Harbour Board, the clerk read the report of the executive committee on the proposed erection of a pumping station. It stated that tenders for the erection of pumping station "A" at the North Dock had been received, and that the tender sent in by Messrs. J. and H. Gwynne, of London, who undertook to erect a suitable pump for £4180, had been accepted by the trustees. The clerk stated that five tenders had been received—Messrs. Easton and Amos, £2446; Messrs. J. and H. Gwynne £4180; Messrs. Allen and Co., £3996; Messrs. Tangye, £2780; and Messrs. Gwynne and Company, £2217. The report of the engineer (Mr. Schenk) described the differences in the specifications presented by the respective tenders, and said those of Messrs. Gwynne and Messrs. J. and H. Gwynne contained much fuller information than the others. In his opinion Messrs. J. and H. Gwynne had adopted the best form of culvert to minimise the density of the water by placing the culvert in an inclined direction, gradually increasing in size towards the outlet, and terminating in a large bell-mouth close to the bottom of the basin.

THE machinery and engineering plant of the Govan Forge and Steelworks, which only a few years ago was one of the most flourishing establishments of its kind in the Glasgow district, were disposed of last week by public auction, Messrs. Hutchinson and Dixon being the auctioneers. The total sum realised was about £6000, and many of the articles brought what were considered good prices. A 12-ton steam hammer by Thwaites Brothers, of Bradford, realised £612. A 40-ton overhead travelling crane brought £445, and a similar hammer of 20 tons realised £370. A slotting machine by Smith, Beacock, and Tannett, Leeds, brought £250; a 6-ton steam hammer, £225; a heavy lathe, £215; a self-acting lathe, £150; a slotting machine by Robertson, £155; planing machine, 20ft. by 4ft., £145; turning lathe by Shanks, £135; 12½-cwt. Rigby steam hammer, £120; melting furnace with metal platform, £152; radial drill, complete, £106; Lancashire steam boiler, 25ft. by 7ft., £105; a 2-ton Rigby steam hammer, £110; nine furnaces—two small size—£100; a large vertical by Harvey, £85; a 3-ton steam hammer, £84; a double-flued steam boiler, 30ft. by 6ft., £82; high-pressure horizontal steam engine, 16in. cylinder by 3ft. stroke, £70; and three gas producers and Siemens melting furnaces, £46 10s.

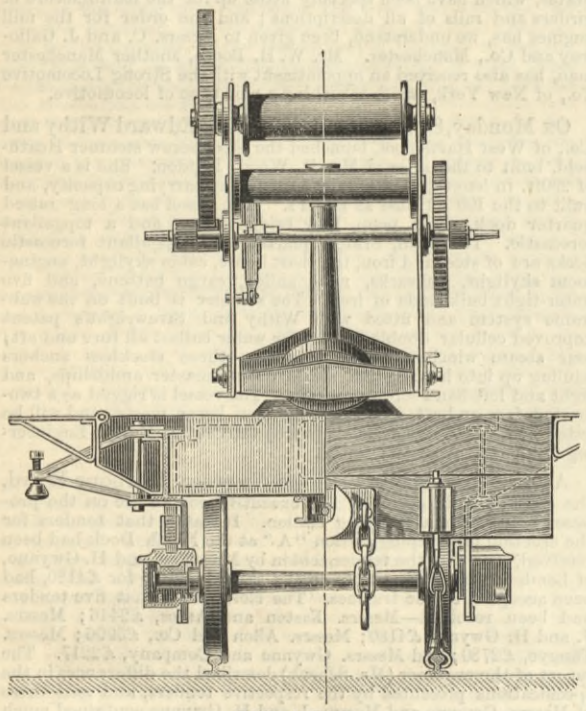
# PERMANENT WAY HAND CRANE.

MESSRS. GRAFTON AND CO., VULCAN WORKS, BEDFORD, ENGINEERS.




## FIVE TONS PERMANENT-WAY HAND CRANE.

THE accompanying engravings illustrate a hand crane on the New Zealand Midland Railway, now in course of construction by Messrs. McKeone, Robinson, and Avigdor, contractors, of Westminster-chambers, Messrs. Carruthers and Wilson being the engineers. With the exception of the centre casting, cross transome, barrel, and gearing, this crane is almost exclusively of wrought iron. The frames of the carriage are rolled iron joists, section 14in. by 6in., having between them at the centre of their length a massive casting bored to receive the post, and turned for a conical roller path; the wheels, which are of wrought iron, having steel tires and axles, are the same as those used upon the ordinary stock of the line, the axle-boxes being Beuther's patent, working in solid horn plates, as shown; four laminated springs support the load, and blocks are

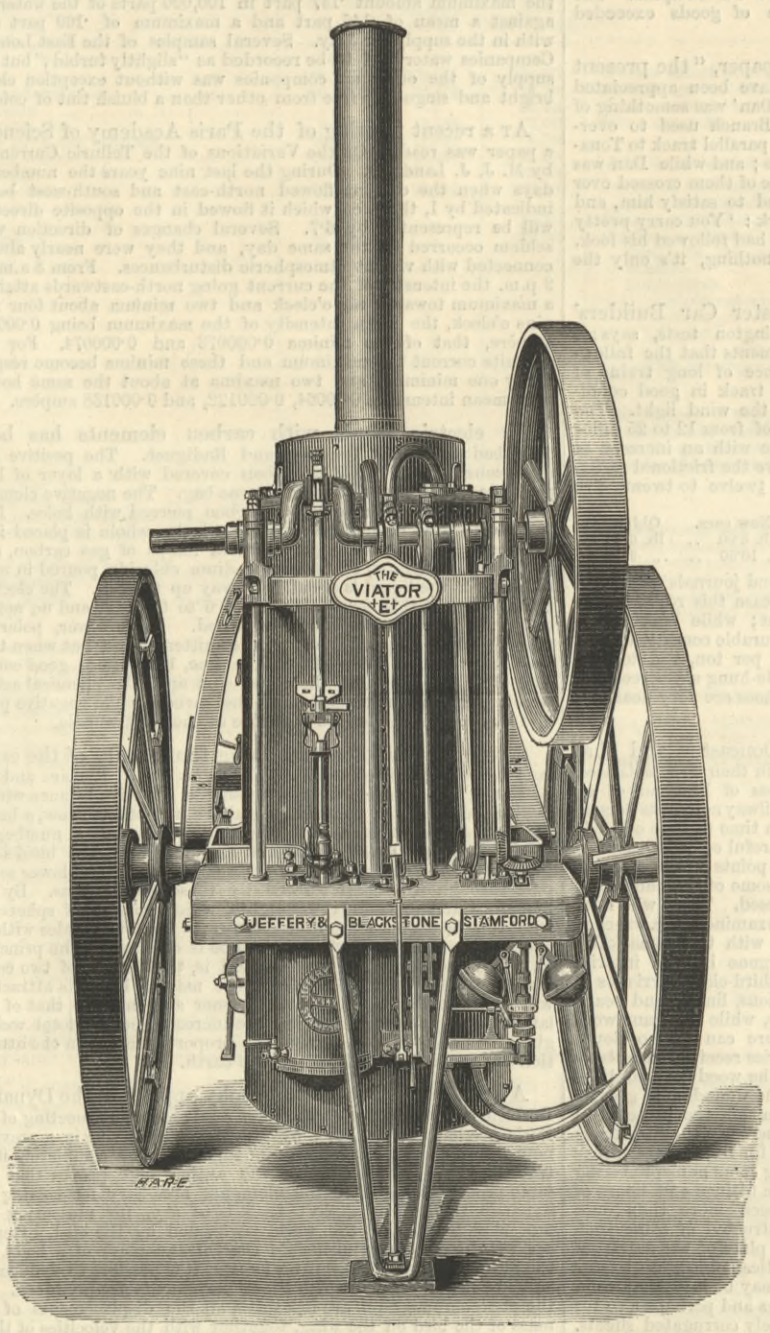


END VIEWS.

provided for relieving them when the crane is at work. A continuous central buffer, check chains, &c., are fitted to couple with other stock. The centre post, which is 8in. in diameter, is of best hand selected scrap iron. The side cheeks and superstructure of the crane are constructed of heavy plates of wrought iron, $\frac{3}{4}$in. thick, carrying the bosses for the various shafts, and tied together in three places by cross transomes. The whole of the gearing is exceedingly heavy; the shafts, which are turned bright throughout their entire length, run in bearings bushed with phosphor bronze. A wrought iron ratchet with a steel pawl retains the load, and a turned brake, with wood-lined wrought iron strap, is provided, by which one man can lower the full load with perfect ease. The jib is of wrought iron, and the tie-rods have links to enable it to be lowered on to a guard wagon whilst running in a train. The platform is extended by means of hinged flaps, so that ample room is provided for several men on each of the handles. The balance box is of cast iron, being run in and out in the usual manner by a screw, and secured by clamps. Two small wrought iron swing arms, carrying at their extremity a screw can be swung out at either side for blocking up the crane when lifting heavy loads.

## THE "VIATOR" VERTICAL ENGINE.

THE accompanying engraving illustrates the vertical engine which Messrs. Jeffery and Blackstone entered for the Royal




MESSRS. JEFFERY AND BLACKSTONE'S VERTICAL ENGINE.

Agricultural Society's trials at Newcastle in July. We give it as showing the type of engine for the information of those not acquainted with it; the particulars of the engine will be found in our impression of the 15th of July last, wherein will also be found the results of the trial of the engine on the brake.

## STERN-WHEEL STEAMER FOR THE RIVER MAGDALENA.

OUR readers are already well aware that Messrs. Yarrow and Co., of Poplar, have for many years made a speciality of stern-wheel steamers, and we illustrate in this week's issue one lately built by them for the navigation of the Magdalena river in South America, embodying the most recent improvements made by this firm.

The Magdalena, like most of the South American rivers, can only be navigated by steamers of exceptionally shallow draught, and yet possessed of high speed, which qualities are essential in consequence of the numerous shallows and tortuous rapids which divide its deeper parts. Stern-wheel steamers are specially adapted to overcome these obstacles, as they possess exceptional manœuvring capabilities, far in excess of anything that can be obtained by side wheels, and they can pass through narrow cuts or channels where a side-wheeler would inevitably run the risk of seriously damaging its paddles. Moreover, a vessel on the stern-wheel principle can be built much lighter than on any other system, because owing to the heavy weights—*i.e.*, the boiler, engines, and wheel—being at the extreme ends the hull can be suitably trussed by ties which are in tension, thus obtaining, from a structural point of view, a great depth of hull, while, on the other hand, if the weight of machinery be concentrated amidships such method of construction is inadmissible, and stiffness can only be secured by greatly strengthening the deck with materials, which would be in a state of compression, involving very considerable additional weight, the structural depth of the hull in this case being only represented by the distance between the bottom plating and the deck.

There is a remarkable advantage known to those who have worked stern-wheelers, that, in consequence of the position of the wheel, when ascending a strong current or rapid the vessel is enabled to make headway where a side-wheeler, possessing the same speed in still water, would be unable to contend against the stream. There also seems to be secured by the stern-wheel system a greater efficiency, which is possibly due to the reduced slip owing to the wheel working in a current moving in the same direction as the hull itself, particularly if the wheel is so placed that it acts on the water near or quite at the top of the following wave.

Messrs. Yarrow and Co. have constructed stern-wheelers for nearly every part of the world, and we hear on all sides of their successful performance. Among those built by this firm our readers will remember the Lotus and Water-lily, which played so important a part in the Nile expedition, and upon which the entire communication between Cairo and the head-quarters at Korti depended for several months when all other steamers were found utterly inefficient for maintaining navigation on a river of the character of the Nile with its numerous rapids, sharp turns, and shallows.

The illustration on page 372 is sufficiently complete as to require but little by way of description. The hull is 120ft. long by 24ft. 6in. beam, the extreme length over the wheel being 139ft. 6in. The horizontal compound surface condensing engines are placed quite aft, as usual, driving the wheel direct, one cylinder acting upon a crank on each side. The air, feed, and circulating pumps are worked direct from prolongations of the piston rods. The boilers are two in number on the return tubular principle, and are placed well forward, so as to balance the weight of the engines. The system of trussing, by which means the buoyancy of the centre of the boat is enabled to support the ends, is also clearly shown. The uprights, or kingposts, serve to carry the decks on which the cabins are placed, thus leaving the main or lower deck entirely free for cargo, which is not usually stowed below, partly on account of the expense and delay in raising and lowering it, but chiefly to leave the entire interior of the hull free, so that in case of damage by running against snags or rocks, it is immediately accessible for repairs.

The hull is sub-divided by eight cross and one longitudinal bulkhead, making a total of eighteen water-tight compartments. This sub-division is sufficient that in the event of two or three compartments being damaged, causing serious leakage, the safety of the boat will not be endangered. The steering wheel is placed in the pilot house, as shown, at a considerable elevation, so as to enable the man in charge to get a good all-round view. From this pilot house are actuated three rudders, placed immediately in front of the paddle-wheel and between it and the stern. These rudders being balanced do not involve any considerable amount of power to work them, and in consequence of the bow and the stern below the water-line being well cut away, and the rudders being of exceptional size, it is easily understood why these boats should steer remarkably well. At the bow there is a powerful steam capstan, especially adapted not only for general use, but also for hauling the boat off sand-banks when necessity requires. The accommodation for first-class passengers consists of a main saloon 50ft. long, and leading out of it are fourteen state rooms, fitted up in the usual style, and arranged so as to secure a good current of air from end to end. The officers' quarters are on the second deck, immediately below the pilot house, and it will be seen that the saloon deck offers for the passengers a well-sheltered promenade. The speed of this boat, judging from previous experience of nearly similar craft, will be fourteen miles an hour, on a draught of about 16in., a very satisfactory performance we need scarcely say.

# HEAD'S BLOOMING MILL.

MESSRS. WESTGARTH, ENGLISH, AND CO., MIDDLESBROUGH, ENGINEERS.

FIG. 1

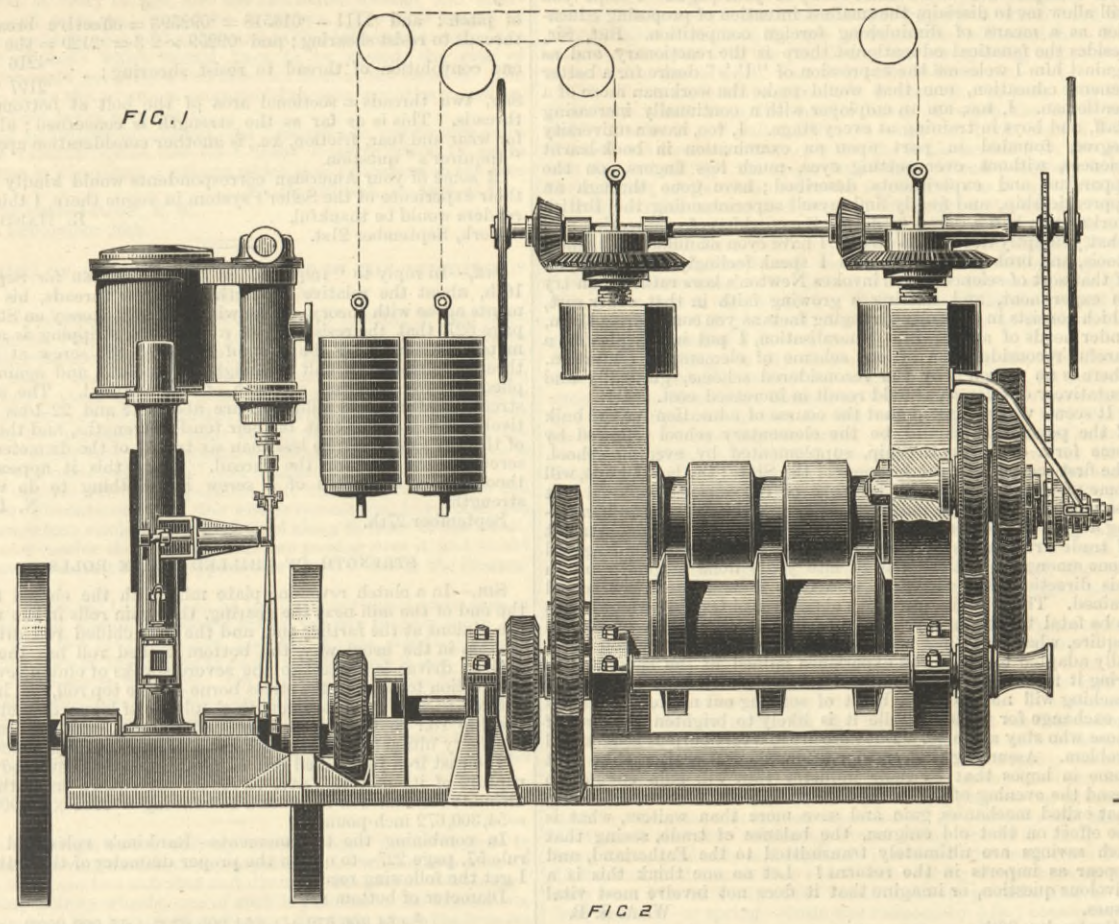


FIG. 3

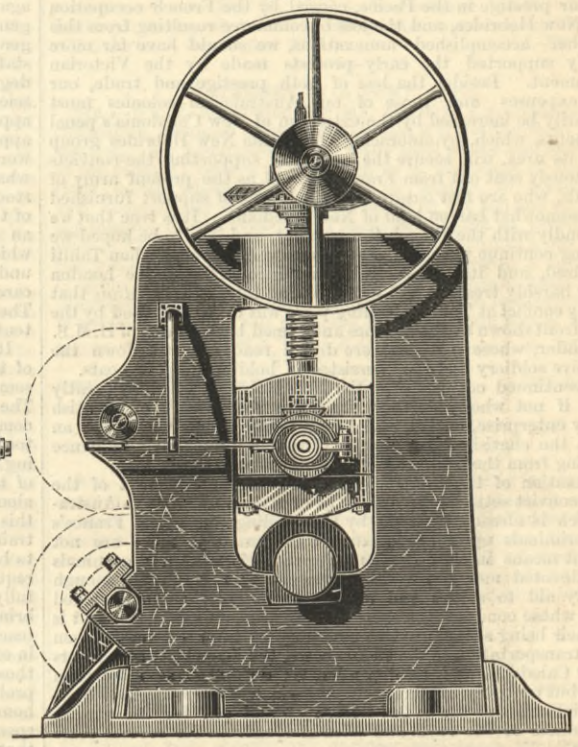


FIG 2

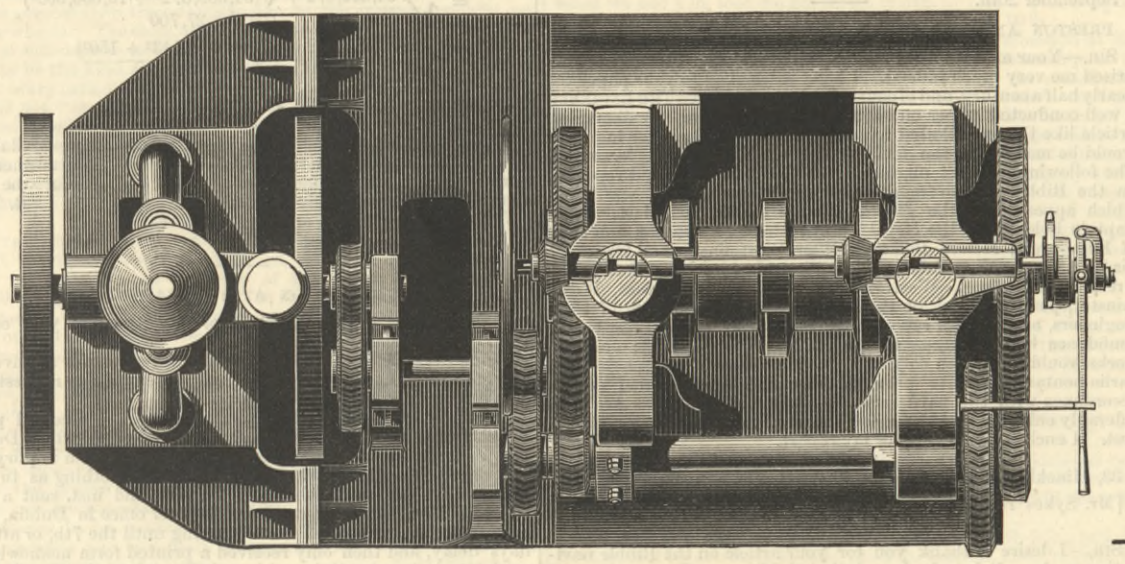
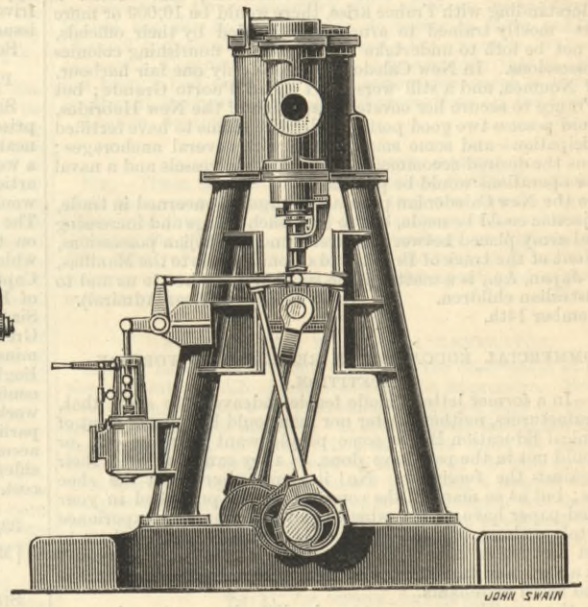


FIG 4




## HEAD'S IMPROVED BLOOMING OR COGGING MILL.

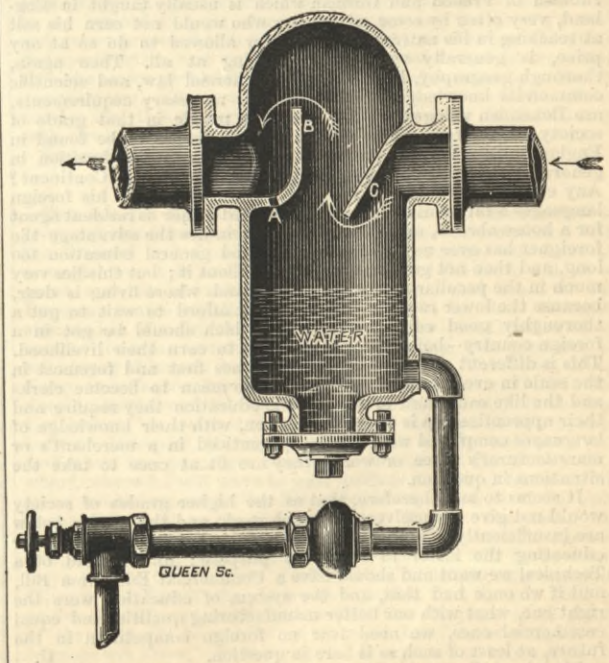
THE illustration above represents an improved blooming or cogging mill, designed by Mr. Jeremiah Head, M. Inst. C.E., and manufactured by Messrs. Westgarth, English and Co., of Middlesbrough. The advantages possessed by it are as follows, viz. :—(1) That the engine and mill are all upon one bed-plate and self-contained. (2) That thereby the foundations required are of the simplest and cheapest description. (3) That it requires very little room, and is therefore specially applicable where the available space is limited. (4) That the balancing gear is entirely overhead and in sight. (5) That the engine, which will be hereafter referred to, is of an exceedingly simple character, and can therefore be made much cheaper than the ponderous machines usually employed for such work. (6) That the roll screwing gear is operated either way by a friction clutch under the control of the roller himself. (7) That by the addition of a simple lever or other tackle overhead, the rope from which is passed for a turn or two round the capstan-head, to the right of the engraving, the finished blooms can be raised so as to be easily placed upon a high bogie for conveyance to the shears or reheating furnace, where this may be required.

The mill, as illustrated, is provided with a pair of rolls with two grooves 20in. wide, and with a vertical range of 22in. down to 4in. By increasing the distance between the standards the rolls might be lengthened and varied in form to any desired extent. The engine has a single cylinder 30in. diameter by 27in. stroke, and is intended to run at, say, 150 revolutions per minute. It is fitted with link motion reversing gear operated by a steam cylinder, controlled by an oil cataract and hunting valves. The steam distribution is effected by a piston valve ; the crank shaft is provided with two fly-wheels. The quick running engine-shaft is geared by the system of helical steel wheels, as shown, into the main pinion shaft, running in a tubular bearing across the standards in front of the rods. This tubular bearing, besides giving large wearing surfaces, excludes altogether any scale or dirt which might otherwise get in. Outside the left-hand standard the pinion shaft engages with a wheel keyed on to the bottom roll. Outside the right-hand standard it engages with an intermediate wheel running on a pin firmly fixed to the standard. A pinion secured to the boss of this intermediate wheel engages a wheel keyed on to the top roll in such a way that the latter can rise and fall throughout its entire range without affecting the gearing. The speed of the rolls, as compared with that of the engine, is reduced by the gearing in the proportion of 1·0 to 8·4. On the right-hand end of the main pinion shaft, previously referred to, is the capstan head. A rope turned once or twice round this can be employed either for lifting the finished bloom, or for lifting or hauling about castings at any part of the mill when repairs are being made. In order to balance the top rod, the screws are perforated lengthwise by holes 2¼in. diameter. A turned rod with an eye at the upper end passes down through each screw, and is firmly secured by a nut to the chocks carrying the upper roll. Chains ending in balance weights and passing over pulleys are secured to the bolts. The pulleys can be fixed to the roof or to stanchions rising from the standards, according to local circumstances, and the balance weights, which are made in segments, can be arranged to hang wherever most out of the way. In order to allow of the balance bolts passing the horizontal bevel pinion spindle surmounting the standards, the latter is placed 4in. out of the centre of the lowering screws. This involves making the bevel wheels and pinions with teeth placed somewhat askew, a mechanical contrivance now in common use in Wicksteed's testing machines and elsewhere, &c., which works perfectly well. The bevel pinion spindle has a hand wheel at each or either end for use in case of need. In regular work, however, it is intended to remove, or at all events not to make use of them. The right-hand end of the top roll is prolonged somewhat, and upon the prolongation is fitted a Weston's friction clutch, operated by a horizontal lever extending to where the roller usually stands. When the lever is pressed home the pitch chain wheel forming part of the clutch gear becomes fixed to the upper roll. A pitch chain travelling upon it then communicates motion to a corresponding pitch-wheel on the horizontal bevel pinion spindle. The screws are raised or lowered according to the direction in which the engine is moving.

When the roller desires to depress the upper roll he operates his clutch lever just before the piece enters the roll at the front. After it has passed through, and before the engine is reversed, he operates his lever again, and so gives the feed for the return passage. At the end of the latter, and before the rolls are again reversed for a new entrance, he can, if he pleases, by operating his lever, raise the top roll to any extent. Balancing the top roll with tackle passing through the lowering screws was originally suggested by Mr. A. de L. Long, of Middlesbrough. Although the mill, as shown, and which is intended either to bloom iron piles or cog steel ingots, does not include a system of live rollers for feeding it at either end, there is no reason why these additions should not be made. It is not known by all engineers that a single cylinder engine with fly-wheels, balanced slides, and steam reversing gear, will not stop on the centres provided the reversal takes place after the resistance to the engine is terminated, as in the present case. Nevertheless it is so. The reason is this—the attendant easily throws his link over with steam on ; the stoppage and reversal of the engine is then determined by a contest between the steam acting with full force in the new direction and the fly-wheels continuing the motion in the old one. This contest is divided into a series of battles lasting half a revolution each. When the crank is on the top and bottom centres the fly-wheels manifestly have it all their own way, consequently the ultimate victory of the steam must take place at some intermediate point ; that is, not on the centres. An engine and mill similar to the one illustrated, but not quite so large nor so complete, has worked for some years at the Newport Rolling Mills, Middlesbrough, with perfect success. The engine was never seen to stop on the centres.

## VAUGHAN'S WATER SEPARATOR.

THE accompanying engraving illustrates a neat form of water separator made by Messrs. Vaughan and Sons, of West Gorton. It depends for its action on the principle that if steam is brought into violent contact with a surface it will throw down the water held in suspension in it; to use an old phrase, the water is




"knocked out" of the steam by the deflector plates C and B. The water in separator is drawn off at a little distance from the bottom, above the accumulation of sediment, and ejected by self-acting ejector. A brass plug is fitted at the lowest part to facilitate the cleansing of separator. A brass tap can of course be substituted

## LETTERS TO THE EDITOR.

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

### COLONIAL DEFENCE.

Sir,—Referring to my previous letter respecting the importance of strengthening the naval defences of Australasia, permit me to observe that, had more been known regarding the injurious effect upon our prestige in the Pacific, caused by the French occupation of the New Hebrides, and the loss of commerce resulting from this and other—accomplished—annexations, we should have far more strongly supported the early protests made by the Victorian Government. Besides the loss of both prestige and trade, our naval expenses and those of our Australasian colonies must necessarily be increased by the extension of New Caledonia's penal settlements, which, by embracing the fertile New Hebrides group within its area, will secure the means of supporting the convicts continuously sent out from France, as well as the present army of criminals, who are fast outgrowing the means of support furnished by the somewhat barren land of New Caledonia. It is true that we are friendly with the French Government, and it is to be hoped we may long continue to be so; yet we were very friendly when Tahiti was seized, and its Queen and the missionaries of the London Society harshly treated; and it was during this *entente cordiale* that a bloody conflict at Tahiti's landing-place was only prevented by the steady front shown by the marines and armed boats' crews of H.M.S. Salamander, whose weapons were drawn ready to cut down the aggressive soldiery had they persisted in holding fast our boats.

The continued occupation of the New Hebrides will also greatly vitiate, if not wholly destroy, the many years' work of Scottish military enterprise, outlay, and labour; and will likewise put an end to the cherished hopes of a Christian humanising influence extending from thence to the New Caledonian group.

Annexation of the New Hebrides, and the enlargement of the Pacific convict settlements, would be of serious moment to Australia, which is already troubled by the landing of some of France's vilest criminals upon her coasts. Unfortunately, there are not sufficient means in New Caledonia for the reformation of criminals which devoted men are labouring to effect; nor is there enough womanly aid to soften and civilise the lives of these wretched beings, whose conduct is in some cases so vile as to necessitate, it is said, their being shot down like mad dogs by their warders. Even should transportation to the Pacific cease, the large body of convicts in New Caledonia and its dependencies, estimated at more than 10,000, but probably numbering 15,000—including nearly 2000 first-class criminals and about 250 women—would call for the utmost watchfulness of the royal and colonial squadrons for several years to come.

This large male convict population is not likely to prove an encouragement to the settlement of any honest and industrious French families in their near neighbourhood; and should a misunderstanding with France arise, there would be 10,000 or more convicts—mostly trained to arms—who, headed by their officials, might not be loth to undertake raids upon our flourishing colonies and possessions. In New Caledonia there is only one fair harbour, that of Noumea, and a still worse port called Puerto Grande; but were France to secure her coveted possession of the New Hebrides, she would possess two good ports—which she seems to have fortified in anticipation—and some smaller ones with several anchorages; and thus the desired accommodation for her war vessels and a naval base for operations would be provided.

Were the New Caledonian population largely concerned in trade, less objection could be made, but to have such a large and increasing criminal army placed between Australia and our Fijian possessions, nor far out of the track of British and colonial trade to the Manillas, China, Japan, &c., is a matter of no small importance to us and to our Australian children. R. A. E. Scott (Rear Admiral).

September 14th.

### COMMERCIAL EDUCATION IN RELATION TO FOREIGN COMPETITION.

Sir,—In a former letter I made feeble endeavour to show that, as manufacturers, neither master nor man could be in such want of a Technical Education Bill as some people want to make out, or they could not in the past have done, as they can now, hold their own against the foreigner. No! it is not there that the shoe pinches; but as so many of the consular reports published in your esteemed paper have shown, which I can from my own experience completely endorse, it is after the goods are made, placing them to the best advantage abroad, in face of the active, well-instructed foreign agents and travellers, who thoroughly outstrip us as salesmen and small merchants.

Now the question is an extremely difficult one to solve, on account of not having in England the same class of persons, ready made, to undertake the positions of agents and travellers abroad; and they must in England first be created, but how? It is a matter of £ s. d. and time. Unfortunately, what may be called a liberal education is in England confined to a class which is above doing such work as travelling, unless occasionally in his own business, and then even because, in nine out of ten cases, because he is not a good linguist or not acquainted with foreign manners and modes of doing business, he makes but a poor hand at it, and would be overhauled by a skilled foreign traveller in the same branch in the same town. To take anyone as a foreign traveller from a lower grade in the social scale would be to spoil everything from want of the necessary good education; because the middle or lower class education—unless got at a public school—is abominably bad, and one might say useless on the Continent, as he could not hold his own in any society, for want of general scholastic knowledge. The rubbish of French and German which is usually taught in England, very often by some adventurer who would not earn his salt at teaching in his native country if ever allowed to do so at any price, is generally worse than nothing at all. Then again, thorough geography, international commercial law, and scientific commercial knowledge, and many other necessary acquirements, are Bohemian villages to most clerks or people in that grade of society. Therefore, where are the proper people to be found in England unless they are created for the job, or until education in general is so improved and universal as it is on the Continent? Any clerk in this country, after he had furbished up his foreign languages a bit, could be at once employed either as resident agent for a house abroad, or as traveller. Herein lies the advantage the foreigner has over us. We have neglected general education too long, and then not gone the right away about it; but this lies very much in the peculiar conditions of England, where living is dear, because the lower ranks of society cannot afford to wait to get a thoroughly good education—part of which should be got in a foreign country—before they must begin to earn their livelihood. This is different abroad. Education comes first and foremost in the scale in every family, and people who mean to become clerks and the like can afford to wait till the education they require and their apprenticeship is completed; when, with their knowledge of languages completed whilst being apprenticed in a merchant's or manufacturer's office or works, they are fit at once to take the situations in question.

It seems to me, therefore, that as the higher grades of society would not give themselves up to such work, and the grades below are insufficiently educated of themselves, means must be found for educating the latter to fulfil the purpose; and instead of a Technical we want and should have a Commercial Education Bill, and if we once had that, and the system of education were the right one, what with our better manufacturing qualities and equal commercial ones, we need fear no foreign competition in the future, at least of such as is here in question. U.

Rheinland, September 16th.

Sir,—Permit me to thank your correspondent, "U.," for his valuable letter, and not least for the promise of future favours in his thoughtful concluding paragraph. After the somewhat sarcastic foot-note that you appended to a former letter of mine, it is exceedingly satisfactory to find that the views expressed in your leader of September 23rd, as well as those in "U.'s" letter, which you endorse, so closely agree with those deduced both from my own shorter experience and former study of your pages. I hope you will allow me to disclaim the smallest intention of proposing education as a means of diminishing foreign competition. But, Sir, besides the fanatical educationist there is the reactionary, and as against him I welcome the expression of "U.'s" desire for a better general education, one that would make the workman more of a gentleman. I, too, am an employer with a continually increasing staff, and boys in training at every stage. I, too, have a university degree, founded in part upon an examination in book-learnt sciences, without ever setting eyes, much less fingers, on the apparatus and experiments described; have gone through an apprenticeship, and finally find myself superintending the British workman in half a dozen trades on the outskirts of engineering and what you aptly call "trade art." I have even manufactured camp-stools, and broken them too. So I speak feelingly on the subject of that sort of science which invokes Newton's laws rather than try an experiment, and, having a growing faith in that other sort, which consists in carefully arranging facts as you come across them, under heads of appropriate generalisation, I put in my plea for a careful reconsideration of our scheme of elementary education. There is no reason why the reconsidered scheme, gradually and tentatively developed, should result in increased cost.

It seems we are agreed that the course of education for the bulk of the population should be the elementary school followed by some form of apprenticeship, supplemented by evening school. The first seems to be the business of the State; the last, I hope, will come more and more under the care of the various trades. Is it too much to hope that masters and men will be able in an increasing degree to co-operate in such work? Even in the department of trade art, schools of art do not produce originality. England alone among the nations has of late years done original work in this direction, but the men who have done it were not school trained. There is an unreality about school training which is apt to be fatal to originality. To succeed the elementary school, we require, what is getting more and more common, teaching carefully adapted to widen the experience gained in the shop, and to bring it into relation with natural science and human life. Such teaching will not spoil our boast of sending out master mechanics in exchange for waiters, while it is likely to brighten the lives of those who stay at home. But here arises a very curious economical problem. Assuming that master mechanic and waiter alike quit home in hopes that by their industry they will gain enough to spend the evening of life in the Fatherland, and further, assuming that exiled mechanics gain and save more than waiters, what is the effect on that old enigma, the balance of trade, seeing that such savings are ultimately transmitted to the Fatherland, and appear as imports in the returns? Let no one think this is a frivolous question, or imagine that it does not involve most vital issues. W. A. S. B.

September 26th.

### PRESTON AND THE RIVER RIBBLE NAVIGATION WORKS.

Sir,—Your article on "Preston Docks and the Ribble" has surprised me very much indeed. I have subscribed to your paper for nearly half a century, and of course I always considered The Engineer a well-conducted paper on engineering, and before any damaging article like the one alluded to would be published, proper inquiries would be made, and the facts ascertained from a reliable source. The following eminent engineers have been called in and reported on the Ribble improvement—copy of these reports I send you, which appeared in the *Preston Herald* on Saturday last, viz.:—Captain Belcher, of the Royal Navy; Messrs. Stevenson and Son, of Edinburgh; Messrs. Bell and Miller, Westminster and Glasgow; Sir John Coode, Victoria-chambers, Westminster; Mr. Alfred Giles, Great George-street, Westminster; Sir James Brunlees, Westminster, past-president of the Council of the Institution of Civil Engineers, all of whom report most favourably, and express entire confidence in the success of the Ribble improvements; and the works would have been carried out at a considerable sum below the parliamentary estimate provided they had been carried out in accordance with the parliamentary plans, but the works are considerably enlarged and deepened, which accounts for the additional cost. I enclose you a copy of my report.

Benjamin Sykes, M.I.C.E.

33, Hinckley-square, Preston, September 26th.

[Mr. Sykes' report will be found on page 266.—Ed. E.]

Sir,—I desire to thank you for your article on the Ribble navigation works. It is to be hoped that the Preston Corporation will call in a competent engineer as you suggest, who would give an impartial opinion. The engineer who has charge of the works is a member of a firm of civil engineers who have been engineers to the Ribble Navigation Company during the past forty years, whose firm gave evidence before Parliament when the Act was obtained in session 1883 that a large vessel could now get up from the sea to Lytham at low-water spring tides—see page 22, question 324, House of Commons Committee, 4th April, 1883. How such a statement could ever be made I cannot imagine. Why, a boat drawing 3ft. of water cannot get up to Lytham from the Irish Sea at low-water spring tides. The fact is, it is virtually one continuous sand-bank from the end of these works to the bar—length, five miles—and there is from 3ft. to 4ft. depth of water on the bar at low-water spring tides. If you look at the map of the Ribble estuary, which you published on the 13th of May last in one of my letters to you, you will observe I have drawn a line from St. Anne's-on-the-Sea to Southport from land to land, and four miles of this five-mile length is out in the open estuary. The nearest land on the north is Barrow-in-Furness, thirty miles off, and on the south is the Welsh coast, twenty-five miles off, and on the west is the Irish Sea. The dredgers are at work some three miles from the end of the south training wall, between six and seven miles from the docks at Preston, and over ten miles from the bar. The dredgers are at work in some hard marl at present, and as they move on up the river towards Preston the hole fills up with mud, gravel, and sand. I have myself sounded at low water over the concrete. The Gilbertson dredger has dredged during the first twelve months, from July last year to July this year, and I assure you I give you the facts. I ought also to add that thirty years ago the same firm of civil engineers dredged the river for a company called the Ribble Navigation Company. The works ended in failure and financial disaster; and by the advice of the same firm of engineers the Preston Corporation purchased the Ribble Navigation Company and commenced dredging again, and of course there is not the smallest hope of the works being successful. Why, there is no owner of an ocean ship who dare allow his ship to come over that continuous bank of sand five miles long, and to enter a channel over ten miles from the docks, which channel will run dry at low water. Only coasters can ever use such a channel, and coasters come now, and there is plenty of accommodation for those; and to accomplish what the Preston Corporation have entered on is to remove out of the bed of the river in one length four miles long from 18ft. to 20ft. deep, of sand, gravel, hard marl, and rock, 300ft. wide. This length they have not started on yet.

G. Henry Roberts, C.E.

87, Fishergate-hill, Preston, September 17th.

### THE RELATIVE STRENGTH OF SCREW THREADS.

Sir,—Referring to your correspondent "Inquirer's" letter, in your issue of September 16th inst., I beg to remind him of the fact that a very few threads of a ⅞in. bolt of nine to the inch—Whitworth's—are able to resist an equal strain with the section of the bolt at the bottom of the threads.

We may allow that the shearing strength of the threads per square inch = the tensile strength of the bolt per square inch, if the workmanship is good. The diameter at bottom of the threads of a ⅞in. bolt is, according to "Molesworth," = ·7327in.; area of ·7327 = ·4216 square inch; circumference of ·7327 = 2·3in.; and $\frac{1\cdot000}{9}$ = ·1111 = pitch at threads; and $\frac{\cdot1111}{6}$ = ·018518 = one-sixth of pitch; and ·1111 − ·018518 = ·092593 = effective breadth of threads to resist shearing; and ·09259 × 2·3 = ·2129 = the area of one convolution of thread to resist shearing; ∴ $\frac{\cdot4216}{\cdot2197}$ = 1·98. Say, two threads = sectional area of the bolt at bottom of the threads. This is as far as the strength is concerned; allowance for wear and tear, friction, &c., is another consideration apart from "Inquirer's" question.

If some of your American correspondents would kindly give us their experience of the Seller's system in vogue there, I think your readers would be thankful. R. Hartland.

Cork, September 21st.

Sir,—In reply to "Inquirer," in The Engineer for September 16th, about the relative strength of screw threads, his experiments agree with theory, for he will find in "Stoney on Stresses," page 627, that the resistance of a screw to stripping is approximately measured by the circumference of the screw at base of thread multiplied by half the height of the nut and again multiplied by the shearing strength of the material. The shearing strengths of iron and mild steel are about 18 and 22 tons respectively, or say 80 per cent. of their tensile strengths, and the height of the nut should not be less than six-tenths of the diameter of the screw at the base of the thread. From this it appears that theoretically the pitch of a screw has nothing to do with its strength. N. D. Y.

September 27th.

### STRENGTH OF CHILLED PLATE ROLLS.

Sir,—In a clutch reversing-plate mill, with the chilled rolls at the end of the mill next the gearing, the grain rolls in the middle the pinions at the farther end, and the top chilled roll driven by friction in the usual way, the bottom chilled roll has the whole mill to drive; is subject to the severe shocks of clutch reversing in addition to bearing the stress borne by the top roll, and in a mill worked to the full of its strength should be of larger diameter than the top roll to work with equal satisfaction. In this case the necessary ultimate twisting moment is 15,000,000 inch-pounds.

The cast iron top chilled roll is 24in. diameter, the modulus of rupture of its material, say, 40,000 lb. per square inch, then the ultimate resistance of its section to bending = ·0982 × 40,000 × $24^3$ = 54,300,672 inch-pounds.

In combining the two moments—Rankine's rules and tables, rule 57, page 227—to obtain the proper diameter of the bottom roll I get the following result:—

Diameter of bottom roll:

$$= \sqrt[3]{\frac{54,300,672 + \sqrt{(54,300,672^2 + 15,000,000^2)}}{\cdot1964 \times 27,700}}$$

$$= \sqrt[3]{\frac{54,300,672 + (100,000\sqrt{543^2 + 150^2})}{5440}}$$

$$= \sqrt[3]{\frac{110,600,672}{5440}} = 27\tfrac{3}{8}\text{in.}$$

This diameter is evidently too large. Does Professor Rankine's rule apply to cast iron? Perhaps some of your mathematical correspondents will tell me; and say how I can calculate the proper diameter from the two given moments. R. T. C.

5, St. Ann's-terrace, Portrack, Stockton-on-Tees, September 21st.

### CIRCUMLOCUTION AT THE PATENT-OFFICE.

Sir,—Perhaps you can kindly afford me space in your columns to draw attention to the following.

Being desirous to obtain provisional protection for an invention, I wrote to Mr. Lack at the Great Seal Patent-office, requesting he would forward me the requisite papers.

I sent my letter on the 29th ult. In reply, I received printed instructions to apply at certain cities in Ireland, of which Dublin is one, or to give notice at any money-order office. On inquiry at the office here—Freshford—the post people knew nothing as to how I was to give notice. I, therefore, on the 2nd inst. sent a postal order for £1 to the postmaster at the chief office in Dublin, with a request for the papers. I heard nothing until the 7th, or after five days' delay, and then only received a printed form acknowledging my letter and saying "the subject shall receive attention." This is the 13th, and I have heard nothing further. Thus, after nearly a fortnight's delay I am still without the papers. Perhaps publicity may effect a change for the better in this sort of administration.

Kilkenny, September 13th. C.E.

### SHIP CANAL FROM WOOLWICH TO NEWHAVEN.

Sir,—In your last issue you state that a ship canal is proposed from Woolwich to Newhaven by a Mr. Grylls, that the scheme is looked upon favourably, and that though no surveys have been made, it is believed that the country will be easy and inexpensive. Whether this was, as Artemus Ward would say, "sarkasm," or really put forward in sober earnest, I cannot judge, but on the supposition that it was the latter, I would crave a space in your columns to show the absurdity of the whole scheme.

An examination of the Ordnance map will show that there is no leading valley which could be utilised for the construction of a canal nearer to Woolwich than that of the river Darenth, which mingles its waters with the Thames at Crayford Ness. This river rises at River Head, about a mile north of Sevenoaks, and runs down a very decidedly defined valley; but in its course it falls some 200ft., the levels of its banks at various points being: Crayford Ness, 15ft.; Dartford, 20ft.; Horton Kirby, 70ft.; Farningham 105ft.; Eynesford, 120ft.; Shoreham, 150ft.; and River Head, 200ft. above Ordnance datum.

Supposing it be admitted that the Darenth has a sufficient supply of water for locking, leakage, evaporation, and compensation, which it certainly has not, on arriving at River Head the high range of hills overlooking the Weald has to be encountered; this has a height of 500ft., and as there is no water on the high ground, any further rise in the canal would be out of the question, and a cutting for a considerable length of some 300ft. depth would have to be constructed, falling to the southward to attain the level of the Medway Valley at Tunbridge, some 160ft. above datum, for which fall no head water could be obtained. This cutting at the deepest part, supposing the slopes to be ½ to 1, would cost at the least £450 per lineal yard, or about £800,000 a mile. Following the Medway Valley from Tunbridge by Parkhurst, the head would be reached at Ashurst, and a considerable rise with many locks would have to be encountered. Between Ashurst and the Ouse Valley the South Downs' range would intervene, and here again cuttings of 300ft. or 400ft. would be necessary in the Weald clay, with slopes of at least 2 to 1, costing about £1200 per lineal yard, or £2,000,000 a mile, the distance between the valleys being some ten or twelve miles. The Ouse Valley would be entered near Buxted, and would be followed by Ukfield, Isfield, Barcombe, and Lewes to Newhaven. In the lower part of this valley the inclination is small. The South Down Range, like that between Sevenoaks and Tunbridge, could not be surmounted by locking for the same reason, viz., absence of water in the high ground. The railways that would be interfered with would be the South-Eastern at Dartford, Sevenoaks, and Tunbridge—the two last points being on the main line to Dover—the Chatham and Dover main line at Sutton-at-Hone, and the Sevenoaks branch at Eynesford—at each of these points the lines cross the valleys on viaducts 70ft. high—

and the London, Brighton, and South Coast at Barcombe and Lewes. The opposition that would be raised to the scheme on these grounds, and the expense of the works involved, it is unnecessary to estimate.

Throughout the Darenth Valley important roads would be interfered with at every village, and the residential damage and interference with mills, &c., would be enormous. The total length of the line would be about 50 miles, and taking into consideration the number of locks which would have to be passed, the rate of travelling could not exceed two miles an hour at the outside. The dues, to make the scheme a commercial success, would be excessive, and the time saved very small.

I could go further into detail, but I cannot ask you to give more of your valuable space, nor do I think it worth while to waste more time in discussing a scheme which is so ridiculous on the face of it.

W. H. THOMAS, M. Inst. C.E.

15, Parliament-street, S.W.,
September 26th.

## SPECIMENS OF STEEL SCALE PRODUCED BY THE SKIDDING OF RAILWAY WHEELS.

SIR,—In reading an article with the above heading in your issue of September 9th, there seemed to be some difference of opinion as to whether the specimens referred to had left the tires of the wheels on the rails. Assuming that it does leave either the one or the other, may I state that the general appearance of the specimens illustrated in your issue, together with several other reasons, seems to favour the possibility of their having left the tires and not the rails? In either case, the abrasion continues as long as the brake is applied, and ceases when the brake is taken off.

Now, assuming that the specimen left the rails; as soon as the brake was discontinued and the wheels commenced to revolve, the specimen, which would have been forced along in front of the wheel, would now receive the weight of the van passing over it, and would not therefore have the oval appearance which it has in the illustration.

Again, assuming the scale to be the hundredth part of an inch in thickness, and assuming twenty trains per day to pass down the incline with the brake applied, and the wheels skidding at one particular part of the incline in each case, the rails would be comparatively useless in five days. On the other hand, the fact of the tires being worn into flat places, as stated by a locomotive superintendent, and the general appearance of the specimen, which in my opinion is broken off by coming in contact with the brake blocks or other obstruction as soon as the wheels commence to revolve, tend to substantiate the opinion expressed by Mr. Head in his paper.

Bridge-road, Stockton-on-Tees, September 15th. C. P. F.

SIR,—Although not a railway man, perhaps I may venture to offer the following results of my experience for what it is worth. I take it there are two extreme and distinct examples of "skidding" regarding railway wheels, one of such is peculiar to the locomotive, and obtains in the case of effort to start the train where the tractive force is greater than the adhesion due to the insistent weight on driving wheels. The second example is exemplified where the brake power is sufficient to arrest the revolution of the wheels, and which seems to be the kind alluded to by your correspondent.

Now every turner knows right well that his hardened steel turning tool will not "stand," *i.e.*, preserve its cutting edge, if the circumferential speed of the work in the lathe exceeds, say, from 15ft. to 20ft. per minute. He is fully alive to the fact that when this speed is much exceeded the hardened cutting edge of the tool will not bite or cut into the softer metal, but will be burned away, aye, and fused away if the speed is excessive—in fact, as if held to a grindstone.

Let us compare the case of driving wheels having been allowed to kid at a circumferential speed of, say, 35 miles per hour, spent, and suppose the diameter of the wheels = 6ft. Now we may allow that the versed sine of an arc of 3ft. radius, subtended by a chord of 1in., is of so small a quantity that we assume the tread of the tire has a bearing of 1in. on the rail. Conceive the wheels to be revolving on this bearing, of about 1in., without being able to move the train—we may compare the 1in. of rail to the tool, and the tires revolving at a rate of 3080ft. per minute to the material to be turned—we may expect that the tires will be the aggressors and burn the rails, and the abraded scale found will belong to the rails. For the second case, supposing the driving or carriage wheels to be arrested in their revolutions by the application of the brakes whilst the train moves at 35 miles per hour = 3080ft. per minute—here the tires will be the tools and the rails the material to be planed—we may expect that the rails will be the aggressors and burn flats on the tires, and the abraded scale found will belong to the tires.

R. HARTLAND.

Cork, September 19th.

## THE GENERATION OF STEAM.

SIR,—Referring to the paper on the above subject in your issue of the 9th inst., allow me to take exception to the term "waste" as applied to the heat contained in the gases of combustion after leaving the boiler flues.

Waste would appear to signify an avoidable or preventible loss; but how would you prevent the escape of hot gases from the boiler flues without stopping the draught? These gases, in virtue of the heat they contain, have to perform, before they leave the chimney, one of the most important functions in a steam power plant—that of producing a draught, and thereby rendering combustion possible. We might therefore as well speak of so much heat or power being wasted in driving the governor or the feed pump. If you provided sufficient boiler heating surface—aided by fuel economisers—to prevent any gases escaping above say 250 deg., you would never be able to get up a fire at all. The only alternative is artificial draught; but as one could not take the power off the main engine—for the blower would be required long before the former could start—it is open to question whether the separate blowing engine, between steam, attendance, repairs, &c., would not run away with considerably more than the $\frac{2000}{14500}$ = 13·8 per cent. of the total power wasted up the chimney now-a-days by the hot products of combustion. An engine of 100 indicated horse-power requiring 3 lb. of coal per indicated horse-power per hour, and 21 lb. of air per pound of coal, would take 105 lb. of air per minute at the requisite pressure.

Though the memorable Capell fan controversy showed wide divergencies between different modes of computing a fan's efficiency, it would be easy enough to calculate between certain limits the power necessary for the above work. Note that our fan would have to be driven by some supplementary extraneous power—hand, electrical, or other—until sufficient steam was got up in the boilers.

H. LEUPOLD.

Brindisi, September 14th.

## A PROBLEM IN STRAINS.

SIR,—It is curious that Mr. Hartland should have so nearly demonstrated the fallacy of his theory but yet missed it. One is tempted to ask if he tried his experiment before writing to you. He proposes to hang a Salter's balance from a nail, load it with 5 lb., drive another nail through the lower hook to retain it in its then position, and then remove the load. We are all agreed that the strain on the upper nail would then be 5 lb., neglecting the weight of the balance. Next, we are to hang 1 lb. into the lower hook, and Mr. Hartland contends that the load on the upper nail will be 6 lb., viz., 5 lb. strain from the lower nail and 1 lb. load. But if this strain of 6 lb. exists, it must be transmitted through the spring balance, which yet registers 5 lb. only.

Let Mr. Hartland extend his experiment, adding 1 lb. increments to the load suspended from the hook, till there is a total of 5 lb. actual and visible weight. If we are to add the initial strain of 5 lb. on the lower nail, the gross strain transmitted must be 10 lb. But still the balance registers 5 lb. only. If Mr. Hartland is yet in doubt, let us assume for a moment he is right, and that the strain is 10 lb. The hook so far is in contact with the lower nail, and there is no palpable evidence whether or not that nail is setting up strain. Now add another ½ lb. weight to the load in the hook, and the latter will immediately descend and part company from the nail; it is now certain that the nail imparts no strain, and the total possible strain is 5½ lb., due to the suspended load alone. But we are confronted with the paradox of the spring being compressed more with a load of 5½ lb. than it is with 10 lb. strain.

The only conceivable explanation is that the balance told the truth the whole time, the results being (*a*) when the hook was empty the lower nail pulled 5 lb.; (*b*) when the hook carried 1 lb. the nail was strained 4 lb.; (*c*) when the hook carried 5 lb. the nail was strained nil; (*d*) the upper nail was strained 5 lb. only in all three cases; (*e*) the strain upon the upper nail was always identical with the strains transmitted through the balance, the balance being the equivalent of the bolt in the original inquiry. Mr. Hartland's dilemma should have been apparent at the 1 lb. stage. If the strain is 6 lb., the hook will move out of the position proper to 5 lb., and lose contact with the nail, losing at the same time the 5 lb. strain due to that contact. The remaining strain is the 1 lb. load only, but 6 lb. assumed strain is necessary to produce this result, and therefore 6 lb. = 1 lb.

Notwithstanding the slip demonstrated above, Mr. Hartland's deduction is virtually correct for actual practical cases, for between such and his illustration there is no true analogy. He assumes a practically rigid connection for his two nails, and a very elastic medium for transmitting the strain. In practice the elastic balance would be a metal bolt, and the two nails would be two or three thicknesses of metal—flanges—having probably almost the same elasticity of compression which the bolt has of extension. To put Mr. Hartland's illustration on all fours with this, it is necessary to consider his two nails as held apart by a spring having equal movement for load with the spring of the balance. For ease of illustration, assume that both springs act in compression, of course in opposition to each other, and that every pound weight causes 1in. movement in either spring.

Now at the commencement of the experiment the balance spring is strained 5 lb. and compressed 5in., and as it is held there by the opposing spring, the latter must also have been strained 5 lb. and compressed 5in. As the springs are opposing when one is farther compressed, the other elongates to the same extent. Consequently if we put additional strain on the balance spring tending to compress it farther, the distending spring between the nails follows up with a continually diminishing thrust till the balance spring has been loaded with 10 lb. At that stage the balance spring has been compressed five extra inches, and the opposing spring having extended itself by the same amount has expended all its elasticity and exerts no thrust, the only remaining strain being the 10 lb. load. We have, then, gradually and regularly increased the load from 0 to 10 lb., and at the same time reduced the spring thrust between the rails from 5 lb. to 0. In other words, for every pound added to the load the nail—or spring—strain was reduced by ½ lb.; consequently when we add 1 lb. load we get strain = 5 lb. + 1 lb. − ½ lb. = 5½ lb., and for 10 lb. load, strain = 5 lb. + 10 lb. − 5 lb. = 10 lb.

From the above it will be seen that the determination of the actual strain in a bolt depends largely upon the relationship of its elasticity to that of the pieces it binds together. In considering this relationship notice should be given to other points than the mere theoretical elasticity of the solid material. For instance, at first sight it would appear that two thick cast iron flanges connected by a wrought iron bolt would present a case where the bolt would have a relatively high elasticity, and yet, owing to a highly elastic jointing material being used, or a badly faced joint, or unequal screwing up, &c., the ultimate elasticity of the combined flanges might be much higher than that of the bolt, and the flanges would have a "following up" power when additional strain was imposed upon the bolt. For most practical cases it is therefore desirable to consider the strain of the original screwing up as added to that of the subsequently imposed load. The exception would be in cases of heavy work where the extra cost of the bolts would be a material consideration; it would then be necessary to consider the question more closely on the lines indicated above.

C. G. MAJOR.

September 20th.

SIR,—One of your sceptical correspondents cannot accept Mr. Hartland's authoritative solution of this problem. His top nail is a rigid beam, whilst the problem has a flexible one which has been set to a resistance of five tons, tending to stretch the bolt between the top and bottom nuts. I think his own appliance will show him the correctness of the conclusions of others.

Suppose the Salter's balance to be loaded with 5 lb., and the bottom nail be driven in to hold the 5 lb. tension, then remove the weight. Mr. Hartland must agree that 1 lb. will not take it away from the nail, but he must admit that the bottom nail is lightened of its load by 1 lb. Under these conditions the problem is answered by saying that five tons hung to the loop of the bolt will remove all pressure from the bottom nut, because the reaction of the spring is just five tons, the tension on the bolt is always five tons—or in other words, 5 lb. hung to the Salter's balance will need no assistance from the bottom nail.

JOHN BATEY.

47, Heytesbury-street, Dublin, September 23rd.

SIR,—As regards my letter of September 16th, page 233, I posted it before I tried the suggested experiment with a balance, so confident was I of the result being in favour of the view I held; but a short conversation held a few minutes after the posting of the letter, with a friend, flashed the scales from my eyes at once, so that simple as the experiment was, I needed no recourse to it to disabuse the erroneous impression I held for years regarding the strains exemplified through "X.'s" problem. I did not ask you to suppress my letter, and accept my thanks for deleting portions of it. Verily I have been "hoist with my own petard;" but no matter, it is a consolation to know that more than I have been mistaken in their views, and reading between the lines of "Zit's" letter of 23rd inst., he seems to be wavering, till he obtained the balance and tested the matter.

In conclusion, I beg respectfully to call upon your correspondent "Zit," who is no doubt a practical engineer, to kindly enlarge on "X.'s" most instructive problem, showing its bearings with both variety and thoroughness. I hope he will comply.

Cork, September 26th. R. HARTLAND.

SIR,—Permit me to point out that most of your correspondents have now reduced their discussion of "X.'s" ingenious problem in strains to a puerile squabble about words. There can be no doubt whatever that in the diagram as first drawn by "X." the strain on the bolt cannot exceed 5 tons, save by just so much as is needed to compress the spring just so much further as will take the load off the lower nut. If, however, we turn the whole affair upside down, all the conditions are altered, and whatever load is put on in addition to the 5 tons must be carried by the bolt, except in so far as the stretching of the bolt receives the tension of the spring.

The important question for engineers, then, is this: "Are the conditions under which a tie-rod, bolt and nut, boiler stay, &c., is used those answering to condition No. 1, as first sketched by "X.," or are they identical with No. 2—that is, the case of "X.'s" diagram inverted?

It will be seen that in the case of a boiler stay we have precisely condition No. 2, and consequently the additional stress caused by the pressure of the steam is borne by the stay, and must be calculated for; but the tie-bar between two railway carriages may have no augmented stress put on it by the pull of the engine, provided it is screwed up so tight to begin with that the buffers are sent home a little, and are not separated while the train is running. In bridge work very complex questions of this kind may arise, rendering it difficult to say whether a tie is or is not subjected by the rolling load to more than the original tension. It is very easy to say that it will be best in all cases to act as though it had to endure the extra stress, but the extra weight thus introduced may be a serious consideration when a bridge of large span has to be made. Thus, for example, the ties in a bowstring girder may or may not be in the condition No. 1 according to the relative elasticity and stiffness of the roadway and the bow.

It would occupy too much of your valuable space to go into the consideration of this case at any length. There is much more in the problem than appears at first sight, and I commend it to the attention of men like Mr. Graham or Professor Smith, who have made calculation of stresses in framed structures a speciality.

Sunderland, September 26th. J. TREVOR.

## STRESSES IN A CAMP STOOL.

SIR,—Whilst acknowledging Mr. Hartland's correction of my calculation, I cannot agree with him that it is not the right demonstration. My assumption of "a beam fixed at one end and loaded at the other" I believe to be correct as a statement of the conditions under which the material is subject to strain. He very dogmatically says if I place a board on the top and sit upon it my mistake will be evident. A camp stool is not so, provided the seat is flexible, and assuming the weight to cause a dip of 2in. below the horizontal line; 140 lb. so placed will give a direct pull of 35 lb. on each leg, which is equal to that weight hung on the unsupported end of a beam, say, 8$\frac{5}{16}$in. from the bolt-hole or point of support. It is at this point the breaking strain should be calculated. Therefore $\frac{19 \times 5 \times 1 \times 1}{8{\cdot}3125}$ = 1·1416 cwt., or 127¾ lb.—nearly—breaking strain of each leg.

JOHN BATEY.

47, Heytesbury-street, Dublin, September 23rd.

## RADIAL STEAM HAMMERS.

SIR,—Referring to the notice in THE ENGINEER of our radial steam hammer which appeared in July last, we think it only fair to state that we got the idea from Mr. R. L. McMutrie, foreman blacksmith at Messrs. Stephen and Sons, Linthouse, Govan. It was he who suggested the principle and mode of working the machine, and it was for his use that the first was made by us.

Clyde Engine Works, Polmadie, Glasgow, September 28th. JAMES BENNIE AND CO.

## MOORGATE-STREET STATION ROOF.

SIR,—It is proverbially unwise to prophecy, and therefore I will not attempt to assert that this roof will tumble down or be blown down or be burnt down, but that one of these catastrophes is likely to happen very shortly any engineer who takes the trouble to inspect the roof will feel inclined to predict. Here, in the very centre of London, is an ugly structure, not only of wood, where something better is called for, but of scantlings flimsier than would be permitted for a temporary pig shed at an agricultural show. Would not Sir Edward Watkin do better to leave politics and Channel tunnels alone and to attend a little more to his numerous railways? Coroners' inquests are to be avoided; that at Doncaster has been a bad one; but, in all seriousness, there is likely to be another at Moorgate-street soon, if precautions are not taken.

London, September 24th. PESSIMIST.

## BOSTWICK'S FOLDING GATES.

SIR,—These, as illustrated and described in THE ENGINEER of the 23rd inst., may be ingenious, but they are certainly not novel. Gates with this horizontal lazy-tongs movement have been used in America for years, *e.g.*, at the ferry landings at Philadelphia and New York, where, till the arrival of the boat, it is desired to bar the way to the water, but where a quick opening of a passage is necessary directly a boat arrives.

YANKEE.

## EDISON'S NEW ELECTRICAL GENERATOR.

SIR,—I have read with much interest the description of Edison's new generator which appeared in your last impression. Permit me now to suggest that a very careful investigation shall be made as to the specific heat of magnets. It is quite clear that if the theory of the conservation of energy is true, work must be done every time a magnet is demagnetised by heating it. If this be the case, then more heat must be expended in raising a magnet to a given temperature than would be needed to heat a similar non-magnetised bar through the same range. May I venture to suggest that such an inquiry as this could be admirably carried out by Mr. Hughes.

London, September 21st. VOLT.

## TRIAL OF STONE BREAKERS.

SIR,—*Re* the above paragraph in your journal, may we add that Messrs. Baxter and Co.'s machines were driven by "Lancashire" belts. The competing "Blake" started with a double leather, which immediately broke; was repaired only to break again. A new leather, single, was substituted, and eventually an order was given to our firm for a belt similar to that driving Messrs. Baxter's machines.

The writer and a representative of our firm were present and witnessed the test. Mr. Baxter's report and other circulars are enclosed.

Pp. LANCASHIRE PATENT BELTING AND HOSE COMPANY,
S. J. M'MEEHAN.

Strangeways, Manchester, September 26th.

## INVITATIONS FOR TENDERS.

SIR,—Your advertisement columns of the last two weeks contain an invitation to contractors to tender for a public shelter of iron to be erected at a popular watering-place on the Devon coast; and as we proposed to tender for the work, we obtained the plans and specification, and we were much surprised to find in the latter that the major part of the ironwork is to be provided by a Scotch manufacturer, who, we learn, will tender for the whole affair. Surely, Sir, this is very unfair. Advertising for tenders under such circumstances is a farce.

CONTRACTORS.

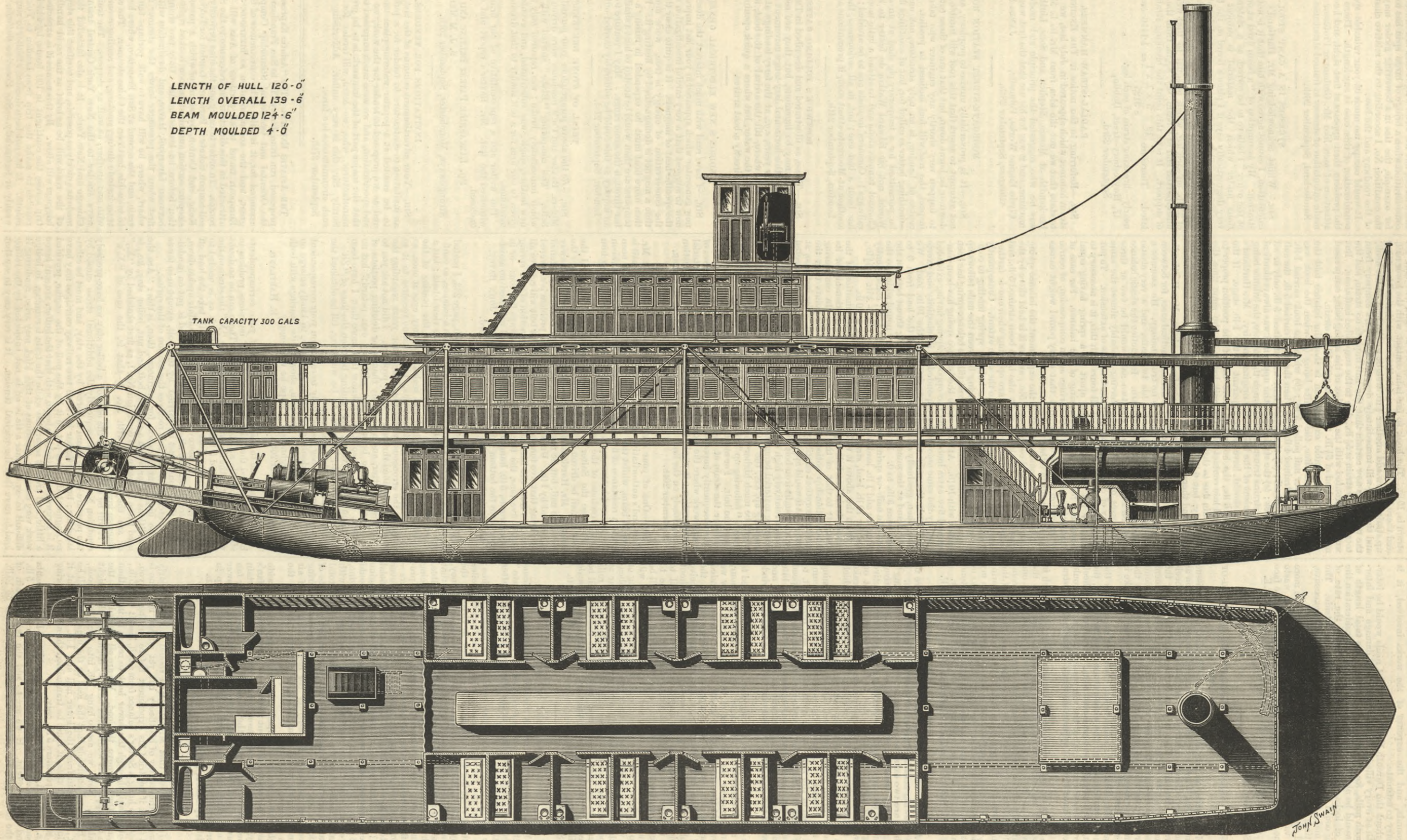
September 27th.

THE ASIATIC EXPRESS.—The "Asiatic Express," which will, it is proposed, run from Jersey City to San Francisco in connection with the Oriental and Occidental Steamship Company, will soon be arranged for, it is said. The conveniences of the route will be so great, and the accommodation so luxurious, that much of the European travel to all portions of Asia will be, it is thought, attracted in this direction, in preference to the Suez Canal or other routes. In order to carry out the idea perfectly, it is proposed to sell coupon tickets in Paris and London for Tokio, Yokohama, Hong Kong, and Canton, by means of which a passenger will have his sleeping section and his state room booked right through to destination before he leaves home. Only two changes of conveyance between Liverpool, Havre, and destination will be necessary, the first when the passenger leaves the steamer at the Jersey City wharf, where he will have to walk perhaps ten yards to reach his train, and the second at San Francisco, where he will leave the train to take his berth on the China steamer. The cars composing the train include dining, smoking, and reading-room cars, all connected with one another, as well as sleepers. The train will be in many ways similar to the New York Central train running between Chicago and New York. It is also intended that the trip shall be made as quickly as possible, and to effect this stoppages at all points of the road will be as brief as the rapid handling of freight and baggage will allow. By this means it is expected to accomplish the trip across the continent in 100 hours, by which means it will be possible to make the trip from London to Yokohama in about a month. It has not been decided whether to run the Asiatic express weekly or fortnightly.—*San Francisco Bulletin.*

# SHALLOW DRAUGHT STERN-WHEEL STEAMER FOR SOUTH AMERICA.

MESSRS. YARROW AND CO., LONDON, ENGINEERS.

(*For description see page* 268.)



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NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-street.*


## CONTENTS.

THE ENGINEER, September 30th, 1887. PAGE



## TO CORRESPONDENTS.

**Registered Telegraphic Address "ENGINEER NEWSPAPER, LONDON."**

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

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

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

E. J. B.—*Letters and papers are awaiting the application of this correspondent.*

R. S. H.—*There is nothing in the least novel in your suggestion. The mode of carrying it out may be novel. We do not think any railway company would incur the cost of applying the invention.*

T. H.—*The largest driving wheels are those of the Cornwall, London and North-Western Railway, 8ft. 6in. diameter. Driving wheels 9ft. in diameter were used for many years on the Bristol and Exeter broad-gauge engines.*

ERRATA.—*Page 254, last column, line 25 from the end of paragraph, for "1728 feet," read "1728 inches." Line 21 from end of paragraph, for "foot-pounds," read "inch-pounds."*

### MACHINERY FOR CUTTING ISINGLASS.

*(To the Editor of The Engineer.)*

SIR,—Can any of your readers give us the address of makers of machinery for cutting isinglass? H. O. E.
London, September 23rd.

### PATENT CUT STEEL NAILS.

*(To the Editor of The Engineer.)*

SIR,—Could you or any of your readers inform me who is a maker of steel patent cut nails, similar to what is known as "Patent Rose?"
Reading, September 28th. E. DAVIES.

### AUTOMATIC BOILER FEEDERS.

*(To the Editor of The Engineer.)*

SIR,—Can any of your subscribers kindly inform me who are the makers of automatic boiler feeders, and if any reliance can be placed in their use? J. J. B.
London, September 26th.

### DRAUGHTSMEN'S SALARIES.

*(To the Editor of The Engineer.)*

SIR,—Can any reader tell me what is a fair salary for a fully competent designer and draughtsman, age twenty-eight, in a machine-building factory? Only one employed. W. R.
Nottingham, September 28th.


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## MEETINGS NEXT WEEK.

SOCIETY OF ENGINEERS.—Monday, October 3rd: Ordinary meeting. Paper to be read:—"Stability of Factory Chimneys," by Mr. R. J. Hutton, of which the following is a synopsis:—Remarks as to errors made by former writers—Best form of section—Batter—Conditions of stability—Mortar—Remarks as to wind-pressure on differently formed surfaces; Rankine's coefficient erroneous—Position of resultant force at any section; Rankine in error—Weight of brickwork—Safe stress—Examples of chimneys and of failures. A visit to sewerage and waterworks at Acton and Ealing will take place on the 19th October, of which due notice will be given.

## DEATHS.

On the 27th September, at 2, Victoria-road, Worthing, EDWIN ARTHUR BERNAYS, M. Inst. C.E., late Superintending Civil Engineer, H.M. Dockyard, Chatham, aged sixty-five.

On the 22nd July, at Shanghai, JOHN BROUNLIE, C.E., Assistant Engineer to the China Railway Company, aged twenty-two years, son of Charles and Catherine De Bels Brounlie, of Turin.

# THE ENGINEER.

*SEPTEMBER* 30, 1887.

### THE HEXTHORPE COLLISION.

THE coroner's juries empanelled to inquire into the circumstances of the Hexthorpe collision have returned verdicts of manslaughter against the driver and fireman of the Manchester, Sheffield, and Lincolnshire Railway. They were admitted, however, to moderate bail, awaiting their trial at the next assizes. We do not see how a jury could find any other verdict, and Sir Edward Watkin has admitted the liability of his company to the sufferers and the relatives of those slain. But the last word has yet to be said on the subject, and while there is much to be urged in excuse for the driver and fireman, nothing can be said in favour of the system on which the traffic was worked. In fact, the accident was the result not only of negligence on the part of the driver and fireman, but of a defective system of conducting the traffic for which they were in no sense or way responsible. We have already stated all the facts, but it may save trouble if we re-state the salient points. There is a ticket platform at Hexthorpe only used during the Doncaster race week. At this platform a Midland train was standing, the tickets being collected, when the regular Manchester, Sheffield, and Lincolnshire through train from Liverpool ran into it, with results too well known to need recounting here. The collision occurred because the regular block signals were not used. The traffic at this particular time was so heavy that the ordinary block signal stations were too far apart, and they were supplemented by flag-men, who cut up the ordinary block sections into smaller lengths. Thus, when a driver got "line clear" outside Hexthorpe, it did not mean that there was an open road through Hexthorpe, as would be the case under ordinary conditions, but only that the line was clear to the flag man. All this seems to have been very precisely stated in the book of instructions delivered to the driver. Unfortunately he took it for granted that he knew all that was in the book—that it was the regular book of instructions, with the contents of which he was well acquainted, and so he did not take the trouble to read it. We may ask here how it was that his foreman did not find out whether instructions so important had or had not been read and understood? This will no doubt be cleared up at the trial. However, whether he was on the look out for red flags or not would have mattered little had he seen them in good time. It is stated that neither he nor his fireman saw them, and that they got within 200 yards of the Midland train before they saw it. As soon as the driver perceived that the line was not clear he put on his brake, we all know, with little effect. The speed was no doubt reduced, but the train was not stopped in time to avert a dreadful collision.

One of the first points for consideration here is, did the railway company when they abrogated the normal system of signalling provide an efficient substitute? The circumstances of the collision are sufficient answer to this. It will be seen that there was a weak link in the chain of conditions constructed to secure the safety of the travelling public. The substituted signal system was incomplete, it was not self-sufficing. It had to be supplemented by a special book of instructions, and the Manchester, Sheffield, and Lincolnshire Company in pointing out and urging that there would have been no collision if only the driver had read his book of instructions, condemns itself. The sufficiency of the system all hinged on the reading of a few passages in the instruction book. The principle here involved is radically wrong. No railway company is justified in risking the safety of passengers on such a contingency. If it was essential to safety that the driver should be made acquainted with the method of signalling used at Hexthorpe during the race week, then he should not only have had printed instructions, but verbal instructions as well. No pains seem to have been taken to get the facts well into the head of the driver. It may, however, be argued that the system was so well thought out and so good, that no special instructions were necessary. But if this was the case then the driver may be excused for not reading the instruction book; and no doubt an adequate method of signalling would have avoided the catastrophe altogether. If, for example, the red flags had been supplemented with fog signals there would have been no accident. On most lines, when a rail is taken out the red flag man puts down a couple of fog-signals as an additional precaution. Why was this neglected at Hexthorpe? The flag men had detonators given them; why were they not used? A more important question remains for consideration. It does not seem to be disputed that the driver of the Manchester, Sheffield, and Lincolnshire engine had a clear interval of 200 yards in which to pull up. He was running down an incline of 1 in 112, but the velocity of the train could not have been very great, for he had slackened speed at Hexthorpe cabin, and the regulation speed between Hexthorpe Junction cabin and the station is thirty-two miles an hour. It is not probable, therefore, that he was running at more than thirty miles an hour when he caught sight of the Midland train. Now thirty miles an hour is 44ft. per second, and $\frac{600}{44} = 13{\cdot}6$ seconds. The train was fitted with an ordinary vacuum brake, non-automatic, and therefore not complying with the Board of Trade regulations. The circumstances demanded the utmost promptitude of action on the part of the brake; but the vacuum brake is never prompt. Five or six seconds at least must have elapsed before the blocks at the end of the train took hold. The delay was fatal to twenty-five individuals. The Westinghouse automatic brake can pull up a train running at fifty miles an hour on a level in about 750ft. The distance run by a train after the brakes are applied will vary as the square of the speeds, while the times vary as the speeds. If a train moving at fifty miles an hour traversed 750ft. before it stopped, a train running at thirty miles an hour ought to be pulled up by the same brake in a distance of 270ft. From this it follows that if the Liverpool train had been fitted with a Westinghouse automatic brake, it would, if running on a level, have been pulled up about 100 yards in the rear of the Midland train. At Hexthorpe, however, as we have said, the train was on a falling gradient. This gradient, however, would not double the distance run by the train after the brake was applied. We do not know the weight of the Manchester, Sheffield, and Lincolnshire train, but we shall probably not be far wrong if we take it at 200 tons, engine and tender included. The accelerating force of the incline would be $\frac{200}{112} = 1{\cdot}78$ tons. But the retarding force of the brakes would be at least twenty tons. This is assuming that the co-efficient of friction was only 0·1. It will be seen, therefore, that the accelerating effort of gravity was only one-tenth the retarding effort of the brakes, and so could but little augment the distance traversed by the train on the incline as compared with the distance traversed by it on a level. It is abundantly clear, therefore, that if the Westinghouse automatic brake had been fitted to the train, there would have been no accident, and it is also clear that the vacuum brake used—which must not be confounded with the automatic vacuum-brake—was very inefficient Indeed, the driver himself stated that the brake seemed to act badly. How comes it that the train was fitted with an old-fashioned brake, condemned long since by the Board of Trade?

We find, then, on reviewing the story of this lamentable collision, that it was due to a concatenation of circumstances, each contributing to bring about the direful end. In the first place, the block system being suspended, no adequate precautions were taken to make the driver and fireman of the Liverpool train aware of the fact. Secondly, we have been unable to satisfy ourselves that the flag-men did their best to attract the attention of the Liverpool train officials—they may have done so or they may not. Thirdly, the train, instead of being fitted with a brake that would satisfy the Board of Trade, was fitted with a now antiquated device worse than no continuous brake at all, in that it might well give a driver a false and most perilous sense of safety by its presence which would be falsified by its action. It is not usual to find in the history of a railway accident so many causes contributing to one result. The whole tale is eminently instructive, and the lesson which it tells may well be taken to heart by railway men all over the world. The shareholders of the Manchester, Sheffield, and Lincoln-Railway, we may be certain, will not soon forget it.

### THE NEWBERRY-VAUTIN GOLD EXTRACTION PROCESS.

THE method of extracting gold by means of chlorine from auriferous quartz and other minerals that are not susceptible of being advantageously treated by the ordinary processes of battery, or mill-amalgamation, has not hitherto proved as useful in gold-mining countries as might have been expected from its simplicity. This is in great part to be attributed to the fact that in the original form of the process as introduced by Plattner, about forty years since, where gaseous chlorine is passed through the finely-divided ore, considerable delicacy of manipulation is required, the exact proportioning of water to ore in the mass being of importance, and the provision of a chlorine still and chemicals for generating the gas render it unsuited for out-of-the-way localities. The greatest objection to the process has, however, been its extreme slowness, from two to three days being requisite for the conversion of the gold into chloride and the subsequent extraction of the latter salts by washing with water, while from ten to twenty hours more was required for the precipitation of the gold from the chloride solution. In 1884 a series of experiments was commenced, and carried on for two years, at the laboratory of the Technological Museum, Melbourne, by Mr. J. Cormo Newberry and Mr. Claude Vautin, with a view of rendering chlorination more generally available in the treatment of rich pyritic ores such as are now becoming the staple product of the deeper Australian gold mines. These have resulted in the elaboration of the process bearing the joint names of the inventors, which has been very successfully adopted on a working scale in Australia, and in order to satisfy the numerous inquiries made from other parts of the world, the inventors have erected a model, half-sized, plant in London, which we lately had the opportunity of examining when at work on the treatment of a very pyritic gold ore from Queensland. The principal differences between the new and old processes are as follows:—(1) Substitution of chlorine under pressure in rotating barrels for the old method of chlorination by the slow absorption of the gas in tanks. (2) The use of vacuum-washing and filtration instead of simple washing by displacement. (3) Continuous precipitation of the gold from the liquors by filtration through charcoal instead of using ferrous sulphate solution in special tanks. The last, which is perhaps the greatest novelty, is the result of experiments made many years since by Mr. Newberry on

the reducing action of nuclei and their probable influence on the origin of gold nuggets.

The order in which the several operations are carried out is as follows:—The auriferous material under treatment, which, when containing sulphides in quantity, is previously calcined as perfectly as possible, is deposited in a hopper placed over the chlorinator, which is a revolving barrel constructed of iron lined with lead, and of sufficient strength to withstand a pressure of 100 lb. per square inch. The lead lining is protected from excessive scouring by ribs of wood placed at intervals round the inside of the barrel. A charge of about 30 cwt. of ore is run from the hopper into the chlorinator, and water and chlorine-producing chemicals, generally sulphuric acid and chloride of lime added. The man-hole cover is placed in position, and the vessel is then gas-tight. A valve of special construction, attached to the barrel on the side opposite to the man-hole, is then connected by rubber hose to an air-compressor, and air under sufficient pressure to liquefy chlorine gas, about four atmospheres, is forced into the chlorinator. The valve is then closed and the hose disconnected, and the vessel with its contents caused to revolve by frictional gearing from one to four hours, according to the size of the gold grains, during which time the chlorine has combined with the gold and formed soluble gold chloride. The chlorinator is then stopped and the air-pressure withdrawn, and any chlorine that exists in the form of gas after the air-pressure has been removed is passed into lime water and absorbed; by this means the workmen are prevented from inhaling any chlorine gas. The cover to the man-hole of the chlorinator is then removed, and the vessel again put in motion, when the contents are discharged into the filter below, which consists of a large lead-lined iron vat with a false bottom, and connected with the vacuum pump by a pipe underneath. As soon as the contents of the chlorinator are deposited in the filter the communication between the vacuum pump and filter is opened, and the solution of gold chloride rapidly withdrawn from the ore and deposited in a holder. Water is continually added to the surface of the ore in the filter and the solution from it tested from time to time, and, when found free from gold, the connection with the vacuum pump is broken and the filter tipped up and the waste ore or tailings fall into a truck and are run out on to the tailings heap. The removal of the gold solution and washing of the ore occupies about one hour. The solution of gold is then passed through charcoal in another vessel, during which the chloride of gold is decomposed and the gold deposited on and in the charcoal, which, when fully charged with gold is burnt, and the ashes fused with borax in a crucible and the gold obtained.

The chief advantages of the new system are its rapidity and greater certainty of action, and its cheapness; most of the work done by hand in the old process being done automatically. The great saving of time is due to the rapid filtration which is brought about by means of a vacuum produced under the filtering medium by a specially constructed pump, the action of which prevents the material, however fine, from settling down on or into the filter bed in a compact mass; but, on the contrary, keeps the filter bed lively and open. The revolving barrel or chlorinator keeps the ore in motion during the time it is in contact with the chlorine, and the introduction of compressed air prevents any chlorine existing in the form of gas; but it is liquefied by the air pressure and forms a very strong solution of chlorine in water, whereby the combination of the chlorine with the gold is greatly accelerated. By these means the gold in the ore is converted into a chloride in a few hours instead of taking from twenty-four to forty-eight hours under the old method.

The advantages of decomposing the gold solution by passing it through charcoal in lieu of the old and tedious method of precipitation by sulphate of iron are numerous and obvious. We have been informed by Mr. Vautin that the method has proved very successful in the treatment of gold ores containing tellurides from Colorado, which may be completely decomposed if bromine is used instead of chlorine in the barrel. The solvent action of bromine upon gold is even more energetic than that of chlorine. When the gold is notably argentiferous the presence of an alkaline chloride—particularly chloride of calcium—in the liquor is to be desired in order to dissolve chloride of silver as it forms, and so leave the gold exposed to the action of the chlorine. For this purpose the use of hydrochloric acid in decomposing the bleaching powder may be preferable at times to sulphuric acid.

## THE PRESTON DOCKS SCHEME.

We have received from Mr. Sykes a letter, which will be found in our correspondence columns. Mr. Sykes is angry with us without cause, and accuses us of unfairly treating a matter of great general interest. We need scarcely point out that we have no motive for publishing a "damaging article," and Mr. Sykes must learn not to be offended if the public works which he constructs are criticised. Engineers of world-wide reputation have to undergo such ordeals. In the *Preston Herald* of Saturday last appears a defence of the scheme, quoting the opinions of many able men in its favour. We never for one instant disputed that the Preston Dock scheme was supported by the opinions of competent engineers. We do not for a moment suppose that the people of Preston would have undertaken any scheme of such importance until they had obtained favourable opinions from engineers. Works of this kind are never undertaken on the advice of a single engineer or of an isolated firm. Furthermore Mr. Sykes misses the whole point of our contention, which is not that the works cannot be made, but that if made they will not pay, because the cost of maintenance and the interest on the capital expended will come to a larger sum than the docks can earn. Given money enough and time enough, and the engineer can accomplish anything. The question of success is one of the meanings attached to the work, and we have failed to find that any engineer of eminence has pledged himself that the Preston Docks must be a commercial success. In order that our readers may be placed in a position to judge for themselves, we give in another place a description of the scheme in full, written at our request specially for this journal by an engineer eminently qualified to deal with such a subject, and what he has said is based on a careful personal examination and inspection of the works. On this statement of facts we make no comment whatever; our readers must judge for themselves how far it is consistent or inconsistent with anything which we have written.

We have already told our readers that the Town Council of Preston have had before them a resolution to apply to Parliament for permission to borrow a sum of £510,000, on the security of the rates, for the purpose of completing the docks and the channel by which they will be placed in communication with the sea. The resolution was stoutly opposed, and the meeting was ultimately adjourned to the 29th. During the discussion which took place, some interesting information was brought to light; more was desirable. The facts possess considerable interest for engineers, as well because of the peculiar physical difficulties to be overcome as of the light which they throw on municipal methods. The story of the docks may be briefly stated here. Preston, a large manufacturing town, communicates with the sea by a river, the Ribble. It was decided some years since that a dock should be constructed, but as docks would be of no use without a channel to the sea, it was decided furthermore that regulation works should be undertaken and the river deepened. Now, virtually the river may be said to terminate at Lytham or near it, and from this point to the bar, a distance of about six miles, extends a great flat tract of sand, gravel, marl, &c. At low water this is left dry for miles, the Ribble finding its way through various channels. It is possible when the tide is out to walk across to Southport by wading up to the knees through one or two channels; but the tide ebbs and flows with tremendous velocity, as is its manner in all nearly such estuaries. At high tide as much as 25ft., or even more, of water is over the sands; at low water there is no channel more than about 3ft. deep. It is stoutly contended that docks cannot be made to pay unless steamers can get in and out of them at all states of the tide. This question has been very fully thrashed out in connection with the Manchester Ship Canal. It appears that the advocates of the Ribble scheme are content to make a deep-water channel to some point at or beyond Lytham, and trust to the high tides to take steamers over the five miles of sand between Lytham and the bar. Very grave questions arise here. It is quite evident that if the scheme is carried out in this way the utility of the docks must be seriously impaired. On the other hand, how is a channel to be made and kept open under the conditions detailed on page 263?

As is very often the case, the scheme became enlarged as time passed. The first estimate was £558,150. When the proposal came before Parliament it was unopposed on engineering grounds, and there was virtually no cross-examination of the witnesses, or adequate inquiry as to whether, first, the works could be made or maintained at all; or, secondly, granting this, the money asked would be sufficient for the purpose. The Corporation got their Act, and the works were proceeded with and have been going on ever since. The total cost incurred up to the present appears to be about £700,000. A new estimate has been prepared by Mr. Sykes, based on the proposed extensions, bringing the contemplated expenditure up to £1,171,105, representing a perpetual charge on the Preston rates of about £40,000 per annum, against which is to be offset the profits, if any, earned by the docks. As this is nearly double the first estimate, it is not remarkable that fourteen members of the council voted for delay and inquiry. We shall not attempt to enter into a consideration of the more or less covert charges made against certain members of the council. We take it for granted that, as a matter of course, every one concerned has acted in perfect good faith from beginning to end. But it is open to us to say that we believe that explanations are wanted which are not as yet forthcoming. For example, the first estimate for dredging was £94,776. A further sum of £143,000 is now asked for. Why is this necessary? Has it been found that the amount of dredging first proposed both as to distance and depth was insufficient, or is it that the difficulties encountered in dredging were under-estimated? During the recent discussion to which we have referred above, a passage by Mr. Vernon Harcourt in the "Encyclopædia Britannica" was quoted by Alderman Hibbert. It is worth reproducing, strongly supporting, as it does, our views on the matter:—"Training walls which stop in the middle of a wide sandy estuary, like the walls carried out on the Seine and the Ribble, can only be regarded as incomplete works, which sooner or later will have to be extended if the full benefit of a trained channel is to be reached. . . . . The training walls on the Seine and on the Ribble, whilst improving the trained channels, have been prejudicial to the channels beyond, and the extension of the works has been authorised on the Ribble. . . . . Once begun, they must be carried out to deep water. . . . . The training walls in the Ribble estuary must eventually be extended, even beyond the limits at present authorised, if a good navigable channel is to be secured to Preston." The question has yet to be answered, will it be possible to maintain training walls at all in such a tideway during the winter season, or, if they are maintained, will not the sand be washed right over them into the channel, rendering perpetual dredging at enormous cost necessary? Even Mr. Sykes, who is sanguine, draws a line. "After the channel is dredged," he says, "to the full depth, there will be about 700,000,000 cubic feet of tidal water brought up and down the river every spring tide. This will have the effect of scouring out and keeping the bed of the river clean, provided the Corporation keep out the refuse and solids from the sewage of their own town, and of those towns lying above Preston, situate in the watershed of the river Ribble." It is very difficult to reconcile efficient scouring action with the assumption that such sewage as the Ribble receives may be sufficient to block up the channel. A letter bearing on this question of dredging, from the pen of Alderman Hibbert, appears in the *Preston Herald* of the 17th inst. It runs as follows:—"After a good deal of fencing, on Thursday last, Mr. Sykes was pinned to the statement that the length he was calculating for was about seven miles only, from the dock sill seaward, which is substantially the same length that Mr. Thomas Walker tendered for. On referring to the lithograph plan showing the new river from Preston to the sea, dated February, 1884, and signed 'Edward Garlick,' I find that this length of about seven miles brings us only a little beyond the *commencement* or thereabouts of the 'proposed south training wall;' that this wall extends two and three-quarter miles beyond where Mr. Sykes's estimate leaves off; and further, that from the end of the proposed south training wall to the bar measures on the plan six miles, as I stated, and that his correction of my statement was itself incorrect." Assuming this to be true, it will be seen that the heaviest part of the dredging work is not included at all in the new estimate. It is highly desirable that this point should be cleared up.

The proper course to be pursued by the ratepayers of Preston is to call in some competent and disinterested engineer of large experience in such work, and to get a report from him, not only as to the value of the work already done, but as to the probable expenditure in the future. Already it is said that about £100,000 has been spent on dredging. What is there to show for this? How is it that Mr. Sykes did not produce for the benefit of the Town Council a chart, showing the old and new soundings along the channel. If the dredgers have been working out seawards, and can show that they have made a fair beginning, at all events, a strong argument is at once supplied in favour of the works. That the dredgers should do good work in the river is no more than was to be expected. The *crux* of the whole problem is the formation and maintenance of a channel from Lytham to the bar. If everything is straightforward and likely to be successful, the Town Council should court an inquiry such as we suggest. It might cost five hundred or a thousand guineas, but the money would be well spent, no matter what the tenour of the resulting report might be. The Council is, however, at present against it.

## THE FAULTY SWORD BAYONETS AND SIR JOHN ADYE.

Owing to the reflection cast upon him by the mention of his name before the House of Commons, in connection with the bad cutlass sword bayonets which were found in the hands of the Navy, Sir John Adye pressed for the appointment of a Special Committee to inquire into the case so far as it affects him. The Committee were directed to undertake this investigation, and have now made their report, which appeared in the daily papers of last Saturday, September 24th. In this there is little room for anything new. In The Engineer of May 27th last, page 418, we gave the account of the steps which brought about the approval and issue of these converted cutlass bayonets, as related in the proceedings of the Committee of which Sir Hussey Vivian was president. The same account is here repeated with little variation, showing that Sir J. Adye had put the Superintendent of Enfield in direct communication with the Admiralty, in order to settle the matter effectually and without circumlocution, and had given directions to carry out what they had determined on, after repeating the question at the end of a period of delay which had occurred. It is difficult to conceive what better course a Director of Artillery could pursue. Surely all details could be most effectually dealt with by the responsible manufacturer and those who were to use the arms on service. When they had come to a decision, and a decision which involved no expenditure of money, but a considerable saving compared with the manufacture of new weapons, it would surely have been vexatious for the Director of Artillery to raise further questions. We do not believe that any sane man was likely to do so. However important the matter was, it had become a question of detail. Sir John Adye could not know the details of manufacture as well as General Dixon, nor the requirements of the naval service as well as Sir Arthur Hood. The time had come to let the work proceed. Sir John Adye had every reason to recognise these officials as the recognised and most competent authorities that could be found, and if the matter afterwards miscarried, he must be regarded as free from blame. Any other view of the case can, we think, only be attributed to prejudice or something worse. In saying this, however, we do not necessarily repudiate the idea of raising such a question in the House, or of treating the Director of Artillery as responsible for the work of his subordinates. Let it once be recognised that the Director of Artillery is to stand or fall by the manufacturing success of the departments under him, and no doubt a most effectual guarantee would be established for the selection of the best manufacturing officers that could be found; but the application of such a principle could only be reasonable when the Director of Artillery had a long tenure of office, and when the officers in question were those of his own appointment. In the case in question it could not be urged with any show of reason that Sir John Adye was responsible for the qualifications of General Dixon, who had held his appointment of Superintendent of Enfield, and had acquired considerable experience in his work probably, while Sir John Adye was still a captain of artillery on active service in the Crimea or India. The Committee say, as they could not fail to say, that "Sir John Adye cannot be held to be personally responsible for the faulty material of the cutlasses and sword bayonets." They certainly go on to regret that Sir John Adye did not obtain a "categorical reply" to his question "whether the conversion could be effected," and that no record has been "kept of what passed at the conference held at his desire between the Superintendent of the Small Arms Factory (General Dixon) and the Director of Naval Ordnance (Sir Arthur Hood), on May 25th, 1871." This regret is questionable. To insist on written categorical replies and written minutes of each interview might be a wise step for a man to take whose object was to guard himself from all consequences that might arise in future inquiries into possible future failures. This peculiar form of caution, however, is hardly one of the qualifications we desire in our responsible officers. It has accompanied timidity and inefficiency more commonly than vigour. We have no desire to make cause with Sir John Adye. We have expressed our wish that he could have taken to steel as a material and breech-loading as a system sooner than he did; but we say without hesitation that to find a fault with his

part in the transaction of the converted cutlass bayonets, it would be necessary to have a perverted judgment or a sinister motive.

### ANOTHER FAILURE OF A VACUUM BRAKE.

As the 3.40 p.m. train from Birmingham to Manchester and Liverpool was approaching Wolverhampton on the 16th inst. the Webb vacuum brake refused to act, and the train rushed through the station at a high speed. The cause of failure is not stated, but many circumstances may have contributed to the result. In the Board of Trade Returns for the half-year ending December, 1886, there were no less than twelve such cases of overrunning reported by the London and North-Western Railway Company against the same brake, one of these being the collision at Carlisle on the 21st December last, owing to the main pipe having become blocked with ice, which has always been a great enemy of vacuum brakes. In the previous half-year there were also the collisions at Sutton Coldfield on May 4th, owing to the "stalk of the ejector valve breaking," and at Birmingham on May 5th from the couplings breaking. Both these cases were dealt with in our columns at the time. In addition to the causes of failure already mentioned, viz., ice, a broken ejector valve, and broken couplings, there are, it seems, many others which also give no warning, viz., the boiler being short of steam; the boiler having too much water; water in the main pipe; waste in the main pipe; leakage in the main pipe; couplings not properly connected; coupling working off the end plug; ejector pipe breaking; and the vacuum clack-box on engine breaking. With so many means of rendering the brake useless, it is not to be wondered at that trains should escape control and collisions occur. The automatic tell-tale feature in the guards' vans would hardly seem to be of much service. In the instructions for working the vacuum brake it is stated that there is a small vacuum constantly maintained in the train pipe, and that if this should not be kept up, "the valve in the van will drop, the bell will ring, and the automatic brake be instantly applied," on the van! There will probably be a more rude awakening than anything afforded by a peal of bells before such a fantastic suggestion for preventing loss of life in emergencies is done away with. One of the causes of this brake having failed to act is, as we have said, being short of steam in the boiler; and while many things may contribute to bring about this condition, probably the most prompt is the explosion of the boiler. This was successfully illustrated on the morning of the 27th inst. As a South-Eastern train from London to Dover was approaching Lewisham the dome was blown off the boiler of the locomotive into the garden of the Lewisham Conservative Club, and the report adds, the train ran some distance before it was stopped. In such a case, of course, the vacuum brake is of no service, and it is easy to imagine what the consequence might be if such an incident occurred when descending a steep gradient, or when approaching a crowded terminal station. We are forcibly reminded by this occurrence of Sir Edward Watkin's remarks when addressing the South-Eastern Company's shareholders shortly after the Penistone disaster, in July, 1884, as to the dangers to be apprehended from an explosion of the Westinghouse air-pump. After informing the meeting that the vacuum brake used on the South-Eastern Railway was the very best brake out, the chairman went on to say:—"The Westinghouse brake was worked with an air-pump at a pressure of 90 lb. to the inch. This was on the engine; so that if the air-pump were to explode—and it was not an impossibility—it would lead to the most dreadful disaster." Sir Edward did not appear to know that his vacuum brake was worked by steam from the boiler at 140 lb. or 150 lb. to the inch, and he does not appear to have anticipated his boilers ever being unable to withstand this pressure. It may be well to inform this inaccurate chairman that when the boiler of an engine fitted with the Westinghouse brake exploded, the brake was applied automatically on the train, which was thus prevented from overrunning the derailed engine.

## INTERNATIONAL RAILWAY CONGRESS, MILAN.

AN International Railway Commission, composed of the representatives of railway administrations and companies, was appointed to sit permanently at Brussels by the first Railway Congress, held in 1885, at that city, with the object of preparing the work for each future Congress, to be held every two years. Delegates of a number proportionate to length of way may be sent to the Congress by any railway company or administration, subject to a proportionate subscription to cover expenses. This year, as we have stated, the meeting is being held at Milan. Although at the Milan Congress England has been well represented numerically, English members had not their due weight at its councils, because present railway men have not had the advantages their sons now enjoy of practical instruction in continental languages, nor of that constant intercommunication with other European peoples that falls to the lot of their compeers in France, Belgium, Italy, and Germany, the three first of which countries sent the largest numbers of delegates to the Congress. The British Government was represented by Major-General Hutchinson, chief railway inspector of the Board of Trade; the Great Western Company by Mr. James Grierson, general manager; the Great Eastern Company, by Sir H. Tyler, M.P., director, and Mr. John Wilson, engineer-in-chief; the Great Northern Company, by Sir Andrew Fairbairn, director; the North-Eastern Company, by Mr. John Cleghorn, director, and Mr. C. N. Wilkinson, secretary; while the railway department of the Indian Government was represented by Colonel C. H. Luard, R.E. Mr. Barton Wright was also present at a dinner given by Sir Andrew Fairbairn to the English members, together with Mr. Ely, engineer-in-chief of the Pennsylvania Railroad. The other States besides those named that have sent delegates are Algeria, the Argentine Republic, Austria, Hungary, Brazil, Bulgaria, Denmark, Egypt, Greece, Holland, Luxemburg, Mexico, Portugal, Roumania, Russia, Servia, Spain, Sweden and Norway, Switzerland, Tunis, and Turkey,

The Congress was opened at the Scala Theatre, Milan, on Saturday, September 17th, by Signor Saracco, Italian Minister of Public Works, and President of the Congress, whose address of welcome was replied to by the President of the Permanent Commission, M. Fassiaux, secretary-general to the Belgian Ministry of Railways, Posts and Telegraphs. Members were drafted off to the five sections:—Way and works, traction and stock, working, general questions, and secondary lines; under which the subjects set down by the Permanent Commission have been divided. The officers of these sections were appointed, and in the evening the members had an official reception by the Syndic, or Mayor, of Milan. On the following day they went to Venice and visited the Exhibition there, the special train there being provided by the Adriatic Railway Company, which has now absorbed the network of lines on the east and along the east coast of Italy, as the Mediterranean Company has that on the west and along the west coast.

On the 19th the sections got well to work at the Higher Technical Institute, the stone floors of which were laid with thick felt under carpets, not only in the several rooms, but also in the adjacent passages, so that the noise of footsteps—so fruitful a source of distraction—was completely deadened. The discussion of the questions taken in hand, pursued into the afternoon, was not finished in time to hold the intended general meeting in the afternoon, which was therefore adjourned to the following day, the sections again meeting in the morning. Accordingly, on the 20th, the first general meeting, very well attended, was held at the Scala Theatre, when the presidents brought up the conclusions arrived at by their several sections. In the evening the members of the Congress, many of them being delegated by their Governments, were received by the Syndic, or Mayor, and the municipality of Milan.

On Sunday, the 18th, the members made an excursion to Venice, where they were entertained by the Mediterranean Railway Company, after which they visited the port and the public buildings.

A general meeting was to have been held on Monday, but was adjourned until the following day, when the presidents of the various sections gave an account of their labours. Most of the "orators," as the speakers are called, spoke from their places in the body of the *foyer*, so that either they had their backs to any given auditor, or, through turning the face, gave no opportunity for observing the play of feature, which is so great an aid to hearing a speech. This, combined with the various accents, made it extremely difficult to follow the proceedings. These were almost entirely in French, which is still the universal language of Europe, though English occupies that proud position in other quarters of the globe. M. Banderali, Engineer of Material and Traction — which is more than locomotive superintendent—for the French Northern Railway, formed a notable exception, as his clear voice and distinct enunciation permitted of following the conclusions of his section throughout the large hall.

In the evening the members were invited to a reception by the Prefect of the Province of Milan, when they were well treated with some *recherché* operatic music, both vocal and instrumental.

The Congress will be continued during the whole of the present week, terminating on Sunday with an excursion to the Lake of Como.

Under the presidence of Commendatore Brivschi, Senator and Director of the Technical Institute, four out of the five sections brought up reports, conclusions of which were ultimately adopted. The secretary of the fifth section—secondary lines—gave a *résumé* of the results arrived at as to the 26th question, "What are the general arrangements of way, stations, bridges, signals, stock, &c., most favourable for working secondary railways?" concluding that greater simplification was advisable, the lines being single and of very narrow gauge. M. Belpaire, Administrator of the Belgian State Railway, maintained that accidents were due more to neglect than want of signals, and recommended that the staff be used and telephonic communication be afforded between the stations, and that the men at many level crossings be abolished as tending rather to favour than avert accidents. A 10-ton carriage on the longitudinal system was recommended, as also the abandonment of a van between the engine and first carriage.

Question 23, as to the taxing of railways, brought up by the president of the sixth section matters of general interest M. Léon Say, the eminent French economist, contended that goods sent short distances should not be liable to Government tax; and there was a general feeling in favour of taxing the carriage of goods being abandoned altogether.

The first section—way—reported generally in favour of metal sleepers, although there had not been a sufficiently long experience of them to warrant any definite conclusion being arrived at.

In connection with the eighth question, relating to conditions of construction and erecting of passenger stock—especially as to balancing of wheels, suspension of body, and reduction of weight—M. Banderali, Ingénieur du Matériel et de la Traction on the Northern of France Railway, and secretary of the second section—stock—enlarged upon the advantages as regards standing and running derived by his company from perfectly balancing their carriage wheels, and paid a passing tribute to the Mansell wheel and the generally smooth running on English railways. On the whole, an underframe with only two axles and a double system of springs was preferred; but whether the body be suspended or not, felt or india-rubber should be interposed so as to take up the shocks due to irregularities of the way, and prevent their reaching the passengers. What could be done in this direction had been proved by the way in which President Garfield was conveyed to the sea while lying sick and wounded. The section recommended a reduction, as far as possible, of dead weight per passenger carried, the expense incurred by giving additional room for the convenience of passengers being met by a surtax. In connection with locomotives—question 9—the section strongly recommended a total abandonment of the use of sand for securing adhesion of the wheels, as it involved great expense and inconvenience, and advocated instead the use of a jet of water, or of exhaust steam, which had given such good results on the Gothard Railway. Whether locomotives should be repaired in the sheds, or be sent to the works, must depend upon each individual case, the amount of repair needed, and the capabilities of sheds and works.

In the evening the Prefect of the Province of Milan, Commendatore Basile, held an official reception at the Prefecture, where the guests were entertained with some high-class music, both vocal and instrumental. On Wednesday afternoon, September 21st, was held the second general meeting, Commendatore Brioschi again presiding.

With respect to Question 28, the report of the second section gave reasons for and against continuous brakes for secondary lines, and concluded against their use, as hand brakes are found sufficient. This was ultimately endorsed by the Congress, although M. Belpaire pleaded the cause of continuous brakes in the event of the present limit of speed being increased, while also demanding that the speed be made subordinate to safety. M. Level, on the contrary, claimed perfect liberty of action for secondary lines in the matter of speed, brakes, and signals.

As to lines of slight traffic, M. Heurteaux, who brought up the report of the 3rd and 5th sections combined, drew attention to the paper prepared by M. Dejaer and M. De Busschere, which embodied valuable information obtained by a regular inquiry into the subject. This paper concluded by observing that a reduction of speed permits of suppressing fences and guards at level crossings, with simplification of signals, and advocates the suppression of a guard's van between the engine and first carriage, the use of composite, and suppression of special carriages, and reduction in the number of classes to two. These measures render possible a cheaper permanent way, reduction in maintenance and *personnel*, simplification of stations, reduction of types of stock, and also of cost and maintenance of locomotives, with saving in fuel and lubricants, and possible suppression of firemen. This last added to the use of cars with longitudinal passage, the disestablishment of unimportant stations, and the loading and unloading by brakesmen and other hands on the train, the looking after "halts" by private individuals and distribution of tickets *en route*, led to a reduction of hands both in the trains and at stations. The report advocated simplification generally, as on the Cirio-Lanza line, and pointed out the advantage of subletting these lines, after the example of the French Northern and Western Companies.

M. Jaquemin, of the French Eastern Railway, presented the report of the third section—working—on the fourteenth question: "What are the best means for an efficient *contrôle*—checking—of passengers?" defining the mutual obligations connected with the ticket, and recommending that tickets be collected in the trains instead of at the exit from the stations, with supervisions of the collectors themselves. This conclusion, which should involve the use of stock with a through passage, was adopted without discussion, as also was the report of the third section on goods traffic—question 16.

The subject of lighting stations—Question 19—previously thrashed out by the second and third questions united, led to a comparison between incandescent gas-burners and electric lamps, much to the advantage of the latter, it being pointed out that the electric plant may be used for power during the day. It was stated that at Sampierdarena, on the Italian-Mediterranean line, the work, which is considerable and has to be performed in a restricted space, was greatly expedited by the electric light. The section, however, reserved all definite conclusion on the subject until the next Congress.

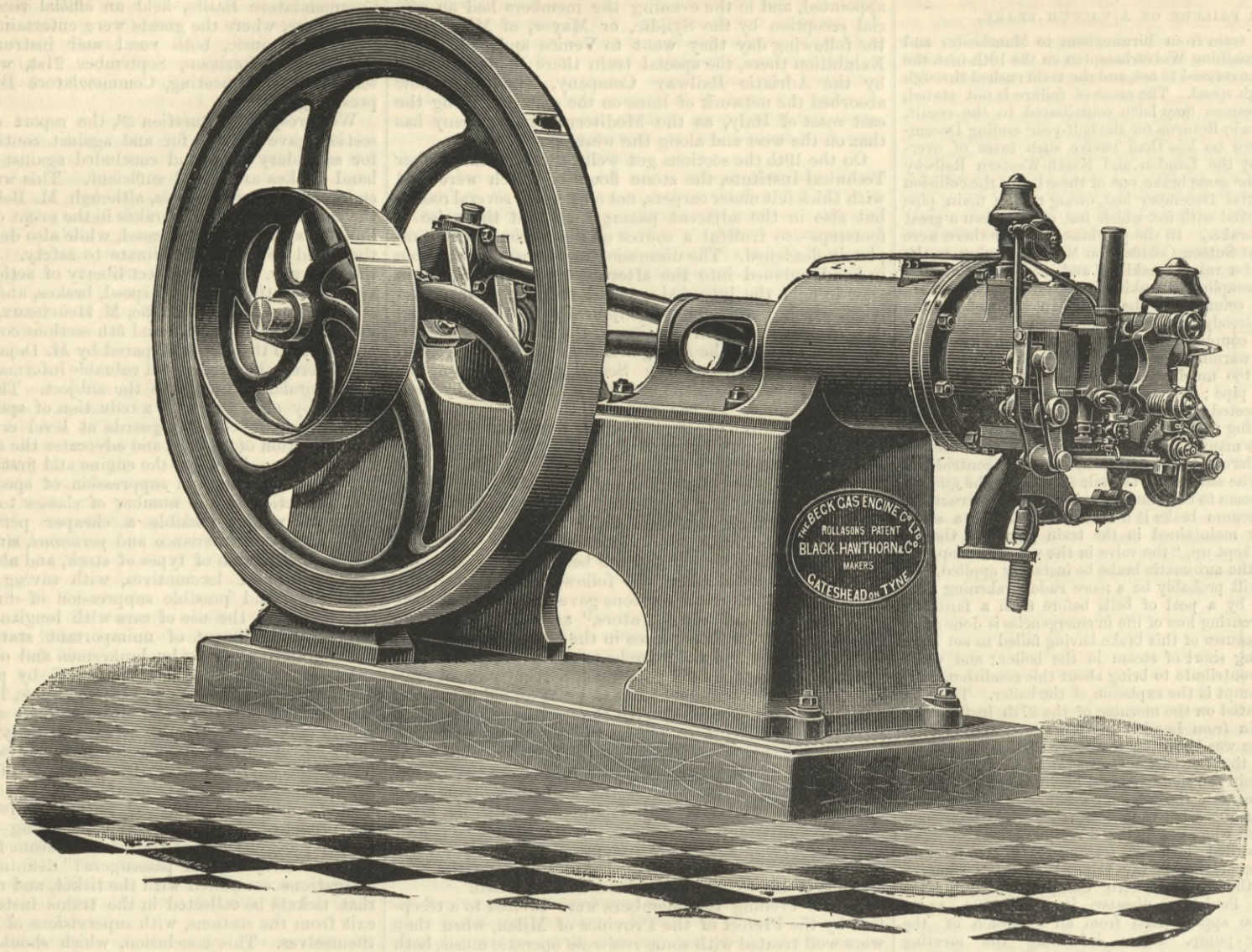
Question 3, as to iron, or rather metal bridges, "What are the results obtained by the use of steel in the construction of bridges, and what extension may be given to the use of this metal for such constructions?" was brought up by the first section, after an animated discussion both as to steel itself and as to the formation of bridges. The unanimously approved conclusion arrived at by the section is in favour of mild steel, much superior to iron in strength, and obtainable at low rates. Great care, however, is to be exercised in selecting the steel, and also in its use, especially in countries like Russia, where it is subject to great variations of temperature; and special precautions to be taken in bridges of considerable span.

The meeting was adjourned early to enable members to visit a junction on the Mediterranean Company, a short distance from Milan, where an experiment is being tried of working signals from a long distance by hydraulic power, and which we hope to describe with the aid of drawings. In the evening Sir Andrew Fairbairn entertained the English members and one American member of the Congress at an elegant dinner at the Borsa, Major-General Hutchinson, Chief Inspector of Railways to the Board of Trade, being present. A special operatic performance was also given by the Milan municipality in honour of the Congress at the Theatro dell' Accademia dei Filodrammatico—illuminated throughout by the electric light.

The whole of Thursday was devoted to the Genoa excursion, in which over 300 members took part. Leaving Milan at an early hour in the morning, they were conveyed in a special train, placed at their disposal by the Mediterranean Company, which also entertained them at lunch in the Palazzo Ducale, presided over by Count Belinsaghi. The steamer, Umberto I., 1400 tons, built by Macmillans, of Dumbarton, with engines by Thompson, of Glasgow, then took the visitors along the Riviera Orientale, where the Appenines come down to the edge of the Mediterranean. A reception, by Syndic Podesta, at the Municipal Palace, where are preserved Paganini's violin and sword, terminated a most enjoyable excursion to the City of Christopher Columbus.

THE Walsall Chamber of Commerce, at their monthly meeting decided to make representations to the Board of Trade with a view to urging a temporary suspension of the operations of the new Merchandise Marks Bill. Merchants were, it was stated, in possession of stocks which had been rendered fraudulent by the new measure, and as at the time of acquisition the goods could be legally traded, it was only reasonable that they should now have time for their disposal.

## ROLLASON'S GAS ENGINE, NEWCASTLE EXHIBITION.

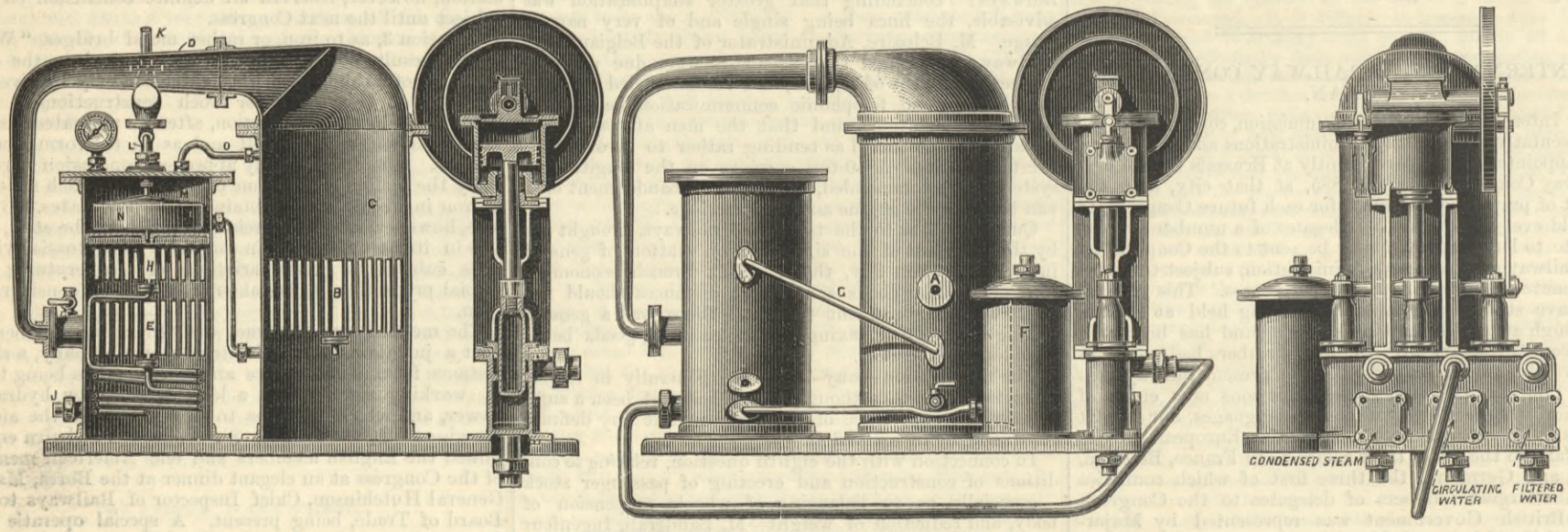



## THE NEWCASTLE EXHIBITION.

The Beck Gas Engine Company, of St. Nicholas-buildings, Newcastle-on-Tyne, and Queen Victoria-street, London, exhibit in the West Court a 2-horse power nominal "Beck" gas engine (Rollason's patent) which we illustrate above. This is a three-cycle engine, in which the products of combustion are expelled, and a pure charge of gas and air admitted for each explosion. The following advantages are claimed for this engine:—Great economy in gas consumption; high speed, the engine being capable of running at any speed from 140 to 380 revolutions per minute with perfect regularity of combustion; steadiness in running; the entire absence of back ignitions or premature explosions, the combustions taking place at a low temperature, a small quantity of circulating water being therefore required for cooling the cylinder. The engine is constructed so as to run light loads with a very weak mixture of gas and air, the proportions of which are increased or diminished automatically in the same ratio as the varying load. This is effected by the use of a small slide valve, actuated by the governor. We hope shortly to refer to this engine again, and to publish more details relating to it. We may add that we notice a 6-horse power engine of this make is also working in the Exhibition, driving the machinery of Messrs. Andrew Reid and Co., model printing office, and a smaller one is employed in blowing the large organ. The engines are being manufactured by Messrs. Black, Hawthorn, and Co., of Gateshead-on-Tyne.

There are several other gas engines shown. The Elland silent engine, by Messrs. R. Dempster and Sons, Elland; the Sunderland engine, by Mr. Charles Ridealgh, Sunderland; the Dougill engine, by Messrs. Hindle, Norton, and Co., Oldham; and the Stockport engine, by Messrs. Andrews and Co., Stockport. We must, however, defer further reference to such of these as have not already been described in our columns.

Messrs. Ernest Scott and Co., Newcastle-on-Tyne, have an exceedingly interesting stand, and exhibit specimens of very highly-finished machinery. A high-speed compound launch engine, and a combined fan and engine for producing forced draught, are remarkable alike for their excellence of design and workmanship, and skill in the selection of material, and are fully equal to anything of the kind we have seen. The same firm shows one of Rayner's patent volute double-distilling condensers, which is illustrated by three views above. This distiller, which has just lately been brought out, has been designed for obtaining fresh water from sea water. It is exceedingly compact, and the mode of action will be understood by reference to the engraving. Steam from the boiler is admitted into the evaporator through a reducing valve at A, at a pressure of about 60 lb., and passing through the volute B, evaporates the salt water contained in the chamber C. The vapour thus generated passes through the pipe D into the volute condenser E, where it is condensed, the fresh water thus obtained flowing into the filter F, from which it is pumped into suitable drinking tanks. The steam from the boiler after passing through the volute B is conveyed by means of a pipe G to the secondary volute H where it is condensed, and the water resulting is conveyed by means of a pump to the hot well or feed tank. The necessary condensing water enters at J and is discharged at K. The method of keeping the supply of salt water in the evaporator at a constant level is very efficient and ingenious. To the main circulating discharge pipe, a small pipe L, which is in communication with the chamber M, is fitted, and through this the circulating sea water runs back until it attains the working level in the evaporator, when a valve in the end of pipe L is closed by the action of the float N. The regulation of admission is thus automatic and certain. The steam from the boiler can be regulated by means of a stop valve at A, so that the pressure in the evaporator does not exceed 4 lb. The pressure gauge is so arranged that by means of the connecting pipe O the pressure in both condenser and evaporator is shown at the same time. A safety valve is fitted at the top of the condenser, and an automatic blow-off valve is arranged to blow off when the desired density of brine has been attained in the evaporator. The "Esco" triple pump, which is combined with the apparatus, has been specially designed for the purpose. It has three suctions and deliveries, one for circulating water, a second for condensed steam, and a third for filtered drinking water, so that the latter is kept fresh and clean.




RAYNER'S DOUBLE-DISTILLING CONDENSER.

Some time ago we drew attention to a hydraulic rivetting plant worked without the intervention of an accumulator, brought out by Messrs. Higginson and Co., Liverpool. Since then the system has received considerable development, and has been further applied for the working of presses, winches, and other machinery, chiefly by Messrs. Harfield and Co., of Blaydon, who are now sole manufacturers under Messrs. Higginson's patent. Examples of this machinery are shown in operation by Messrs. Harfield and Co. We specially noticed a 300-ton press for drawing down steel ingots. The press is worked direct from a set of three-throw pumps having a heavy fly-wheel. The ram is brought down to its work by a head of water, but as soon as the dies bear upon the ingot the pumps are brought into action, and by means of the momentum of the fly-wheel produce a powerful squeeze. When the blow is complete, the hand lever is thrown out

of gear by a self-acting valve, and the ram is raised ready for another operation. Hydraulic winches with direct-acting oscillating cylinders are also shown, worked on the same system. In this case a steam pressure pump is placed in any convenient position in the ship, generally in the engine-room. From this pump winches, windlasses, or capstans can be worked, there being only one pressure and one return water pipe. The column of water in the pipe acts as an endless and noiseless messenger chain, transmitting the necessary power to the whole series of machines. All the winches may be worked at one time, or any one may be thrown out as desired. Also when one winch is lowering, the momentum of the falling load may be utilised to assist in raising the load of any winch that may be lifting at the time. As previously stated, the great advantage claimed for this invention is that no accumulator is required; consequently instead of the pumps always delivering against a fixed load, they only have to exert a pressure equal to the actual load lifted. It is unnecessary to say anything as to the advantages of hydraulic power on board ship. These are, to a large extent, common to all systems, and are well known, though it is only very recently that shipowners have taken the matter in hand practically. In addition to the foregoing, Messrs. Harfield and Co. have some fine specimens of their patent anchor gear. Foremost among them is a steam lever windlass for merchant vessels, in which the cable holders are so constructed that the cables cannot slip. Another important point is that the engines are made reversible. The advantage of this is that in shallow water it is frequently necessary to assist the weight of the anchor in paying out the cable, and this is quickly effected by means of the reversing gear. This windlass, as well as others of the Harfield type, is fitted with a compound frictional brake and connector. This consists of two series of discs, one fixed by means of feathers to the holder, and the other by similar feathers to a block on the main spindle. By a hand wheel and suitable gear these two sets of discs can be clamped together, so forming a very powerful brake. Only one operation is necessary both to check the cable in running out and to connect the holder. A number of other windlasses and capstans are shown by the same firm, all possessing some special advantage, or adapted for some special service.

Below we illustrate a new syphon liquid meter, which is exhibited by Messrs. W. and B. Cowan, of London and Edinburgh. Fig. 1 is an elevation of the meter and cistern, with the fronts removed. Fig. 2 is a plan view of same. Fig. 3 is an elevation showing the interior, and Fig. 4 shows the end of the meter with an arrangement added to the ball valve whereby the force of the entering stream is reduced, and commotion in the measuring chamber avoided. The measuring chambers D D are alternately filled through the reciprocating funnel F, and emptied by the syphons S S. The measuring capacity of each chamber is the quantity it is capable of containing between the low-water and high-water lines, *i.e.*, between the surface of the water which remains in the chamber after each action of the syphon and the level which must be attained before that action begins. The funnel F receives its reciprocating motion from the beam K K, this beam being moved by the lower beam D, whose motion is transmitted to it by connecting-rods. The alternate discharge of water from the two syphons with the buckets C C actuates the beam D. During the filling of a chamber the bucket on the end of the beam immediately below is in a position to receive the first water that runs from the syphon, which depresses that end of the beam as soon as the weight becomes sufficient to overcome the resistance. The end of each syphon projects far enough under the chamber to admit of its being sealed by the small quantity of water which the bucket retains, and the seal is increased by the water which accumulates. The effect of this is to retard the rise of the water within the syphon till it has attained such a height in the chamber as will, on the removal of the seal when the bucket descends, secure the certain and full action of the syphon. With syphons of moderate size and of the flat form shown, this arrangement secures perfect and complete action even when the supply of water to the meter is only drop by drop. When larger syphons are employed, the meters are furnished with the plungers P P, one of these being suspended over each chamber from the supplementary beam. This beam M M has the same axis and moves in the same plane as the beam K K. When, therefore, a mere dribble or drop supply would rise in the chamber and standpipe over the bend of the syphon without charging it, and would also load and drive away the bucket without this being followed by the emptying of the chamber, the plunger prevents this by displacing and so raising the water to the height at which the syphon will start into complete action. The meters are adapted for use either with an intermittent or a constant supply, because the cistern may be so small that the consumer will practically draw water direct from the mains. The working parts are extremely simple, and do not appear likely to get out of order, and as all the parts are readily accessible and open to view, no consumer would have any difficulty in understanding the principle and mode of working.

Fig. 1

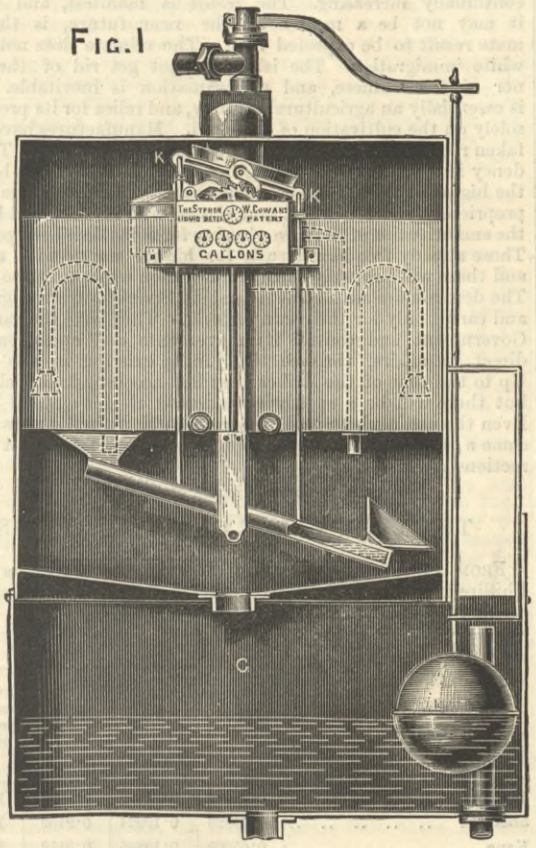



Fig. 3

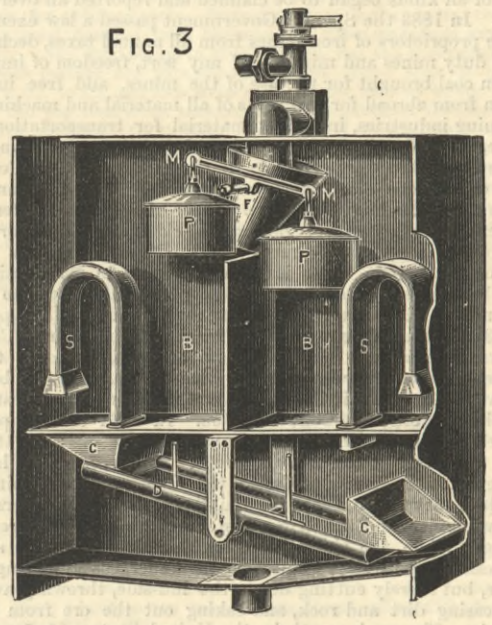



Fig. 4

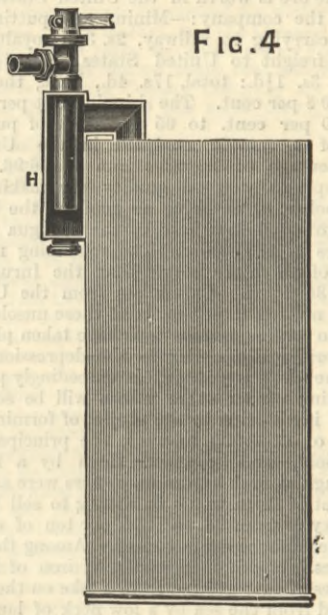
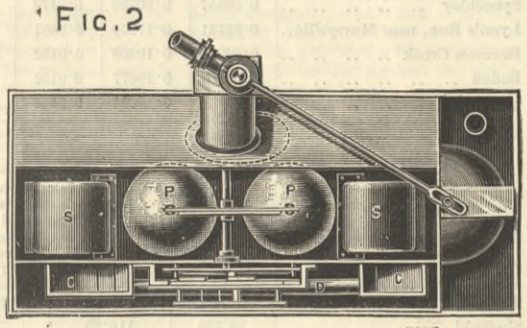



Fig. 2

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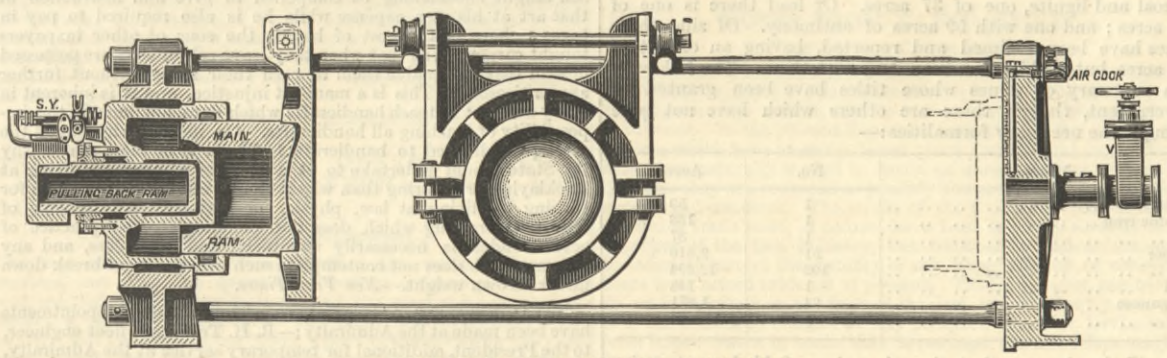
COWAN'S SYPHON METER.




HYDRAULIC PIPE TESTING APPARATUS.

Water meters on the well-known Kennedy system are shown by the Glenfield Company, Kilmarnock, who also exhibit the hydraulic pipe-testing machine illustrated by the longitudinal section below. In this the pipe to be tested is fixed by means of a hydraulic cylinder and ram, a relief valve with adjustable weight preventing the pressure for making the joint exceeding the proper amount. The pipe is filled with water by the valve V, the air escaping by the air cock at top through passages formed in the end plate. The valve V is then closed, and water at the desired pressure for the test admitted through the cock S, there being also a relief valve in this case, so as to prevent excessive pressure. After testing, the pipe is released by reversing the slide valve, which brings the pull-back cylinder into operation. The machine is well designed, and adapted for its work, and by its means any size of pipe can be tested by a lad, with the necessary assistance for rolling the pipes in and out of the machine. With the ordinary apparatus in which the joint is made by means of screws, three or four men are generally required at the moving head. Among the other exhibits of the same company is a pressure recorder, which shows by a diagram the pressure in a water, gas, or air main, continuously for twenty-four hours, a week, or any other time, according to the construction. Four of these are fixed at various points on the water mains in the City of London, and by reference to the self-recorded diagram any dispute as to pressure of water during a fire can be settled.

Among steelmakers no exhibitor stands out more prominently than Messrs. John Spencer and Sons, Newburn-on-Tyne, a firm which has long taken a foremost place in the manufacture of high-class steel forgings and castings. Space will not admit of more than a passing reference to this well-arranged exhibit, in which are to be found castings up to ten tons in weight, forgings—machined and rough—and steel springs of every description. There is also a piece of an armour-plate, intended for the glacis surrounding the turret of one of the large Italian war vessels now under construction, a section of an armour-plate of unhammered cast steel 4ft. 4in. long by 12in. thick, and a length of tube 5ft. 4in. long, 21½in. outside-diameter and 12in. inside diameter, bored and part turned. These latter are intended to show methods of construction which Messrs. Spencer suggest as equal, if not superior, to hammered plates and gun tubes.

In concluding this series of notices we should state that we have endeavoured to lay before our readers the principal features of novelty and importance in this interesting Exhibition. There have necessarily been omissions, as, owing to the demands on our space, we have been compelled in some instances to curtail, and in others to omit altogether. On the whole, however, a fair review has been given. We trust that the results of the undertaking will prove satisfactory to the promoters, and that an Exhibition which has done—and promises, even now, to do—so much good to the trade of the great Tyneside district will at least prove as successful in a monetary point of view as it has been from a purely commercial and educational standpoint.

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Institution of Civil Engineers.—The Birmingham students of the Institution of Civil Engineers made a visit to Messrs. J. and E. Wright's wire and hemp rope works, in Garrison-street, on the 22nd inst., and during an interesting and instructive inspection were shown over the whole of the works, comprising the wire rope mills, hemp ropery, twine mills, and the various outdoor departments. The members were very much entertained by watching the course of the manufacture of the steel wire cable at present being manufactured by the firm for the Birmingham Central Tramways Company to work the Hockley section of the Birmingham Cable Tramways, also steel ropes destined for Bilbao (Spain).

University College, London.—We notice from the prospectus of University College, London, engineering department, that the work of this College commences for the session on the 5th of October. The instruction in surveying and the lectures on the various branches of civil engineering are given by Professor L. F. Vernon-Harcourt. The general lectures on engineering and machine design, as well as the work in the engineering laboratory, are in the hands of Professor Alex. W. Kennedy. In this laboratory, the arrangements of which formed a principal subject of the paper on "The Use and Equipment of Engineering Laboratories," read by Professor Kennedy before the Institute of Civil Engineers last winter, students go through for themselves, during the session, a systematically arranged course of experimental work in connection with elasticity and the strength of materials, the efficiency and economy of steam boilers and engines, the appliances for which have been considerably extended during the last few months. Electrical technology is under the care of Professor Fleming, by whom—with Professor Carey Foster—a dynamo installation has lately been fitted up for the purpose of practical experimentation in "applied electricity." Building construction forms the subject of lectures by Professor T. Roger-Smith as a part of his course on architecture. Economic geology is treated as a special subject, in a short course of lectures by Professor T. G. Bowrey; and chemistry as applied to engineering and architecture, in a course by Professor Charles Graham. In addition to these matters directly connected with engineering, the College provides ample instruction in all the sciences on which engineering is based, mathematics, mechanics, physics, chemistry, geology, &c., and very special attention is given to graphic methods of calculation as applied to scientific and technical problems in the lectures and drawing class of Professor Karl Pearson.

## ABSTRACTS OF CONSULAR AND DIPLOMATIC REPORTS.

*Corea—Trade in* 1886.—The value of the total trade of the three ports—Chemulpo, Fusan, and Yuensan—open to foreign competition showed an increase of £184,920, or 48 per cent. over that of 1885, chiefly on imports, the excess of which was £167,550, or 56 per cent. The imports of metals fell from £12,508 to £10,748, and those of machinery rose from £1815 to £10,035. Of the total amount of imports Great Britain contributes 68 per cent. The trade of the country must now be regarded as robust and sound. Not only does it not show any signs of having suffered from the great scarcity of rice, the staple food, and the outbreak of cholera last year, but on the whole gives indication of healthy growth and steady progress. It is not yet of sufficient importance to attract the attention of British traders in the interests of home manufactures. There is no agent or representative of any British firm settled at any of the open parts.

*Germany—Development of export trade.*—It is intended in the interests of Thuringian trade to establish at Gotha an association for the development of the export trade of manufactures. Similar associations exist in various parts of the empire to facilitate the export of German goods by enabling the manufacturer to cheaply and easily obtain any information as to the disposal of their goods. These associations intend to appoint representatives in the great commercial centres, and also travelling agents who will furnish information respecting the goods to be exported, market requirements, &c.

*Germany—Trade of Stettin.*—The imports of iron and metals into this port were 85,907 tons against 98,450 tons in 1885. The exports of 17,236 tons against 12,852 tons. Of this export 4559 tons of raw metal went to the United States. The raw iron from Luxemburg proved a large competitor of the English. Prices per ton were :—

| | Scotch. | English. | Luxemburg. |
|---|---|---|---|
| | £ s. d. £ s. d. | £ s. d. £ s. d. | |
| May | 3 10 2—4 1 4 | 2 14 5—3 0 0 | From 1s. to 5s. 2d. cheaper than English. |
| June | 3 1 0—3 10 2 | 2 9 4—2 11 10 | |
| July | 2 16 11—3 1 2 | | |
| August & September | 2 18 0—3 6 1 | 2 9 10—2 12 11 | |
| October | 3 5 1—3 12 2 | 2 10 2—2 13 11 | |
| November and Dec. | 3 6 1—3 16 3 | 2 14 5—3 2 6 | |

The exports of lead for 1886 were 10,639 tons, against 8386 tons for 1885; and of tin-plates and zinc 36,694 and 26,796 respectively. Inland lead was quoted at from £13 4s. 7d. to £14 14s. 11d. per ton, and tin-plates at from £18 11s. 2d. to £19 6s. 6d. per ton. British tonnage entering Stettin fell from 43·5 per cent. in 1885 to 41·3 per cent. in 1886.

*Holland—Trade of Rotterdam in* 1886.—Imports into Rotterdam increased by 152,445 tons, or 7 per cent. British imports showed a slight increase in agricultural and steam engines, &c., and manufactured metal. Coals decreased 3·3 per cent., and raw metal 39 per cent. The relative proportions of the shipping of the principal nationalities entering the port were—British, 64·8 per cent.; Dutch, 17·7 per cent.; and German, 7·9 per cent. The trade in petroleum is on the increase of arrivals for 1885, being 237,508 barrels, due in a great measure to the continued improvement of the new waterway—the entrance to the river Maas, which enables vessels to reach this port without breaking bulk, as formerly, the extra charges for lightering pressing heavily on such a low-priced article as petroleum. This channel continues in a very satisfactory condition, vessels drawing upwards of 23ft. being able to reach Rotterdam, which is a matter of great importance to consigners of cargoes and owners of vessels. The petroleum trade of this port will probably be further increased in the present year by the establishment of tanks for the storage of oil, such as are in use at Amsterdam and other places. Legislative measures have been taken with reference to a railway from Rotterdam to the Hoek of Holland; the necessary expropriations have passed both Chambers, and the operations of laying down the line may be shortly looked for.

*Newfoundland Customs Tariff.*

| | £ s. d. |
|---|---|
| Agricultural implements and machinery imported by agricultural societies for the promotion of agriculture | Free |
| Anchors and chain cables, copper and composition metal for ships, including bars, bolts, nails, and sheathing *ad val.* | 10 per c. |
| Boiler and ship plates | Free |
| Coals brought or imported into the ports of Carbonear, Harbor, Grace, and St. John's per ton | 0 1 3 |
| Coals imported into all other places | Free |
| Crushing mills for mining purposes | Free |
| Gas engines—patent | Free |
| Iron of all kinds in bars, bolts, hoops, pieces, plates, and sheets, except where otherwise mentioned *ad val.* | 10 per c. |
| Iron, old composition metal, and copper—old | Free |
| Iron—pig | Free |
| Machinery and parts thereof, including propellers *ad val.* | 10 per c. |
| Materials for sheathing the bottoms of vessels, such as composition metal, copper, and zinc, together with nails of the same, such materials to be marked with the name of the vessel to be sheathed, and to be used for no other | Free |
| Nails—cut *ad val.* | 15 per c. |
| Nails—wrought *ad val.* | 10 per c. |
| Nail strips of brass, iron, or zinc to be used for the making of cut nails in the colony | Free |
| Ores to be used as a flux | Free |
| Ploughs, harrows, ploughing, raking, reaping, potato and seed-sowing machines, to be used in the colony | Free |
| Steam engines, boilers, saws, propellers, and water wheels when used in the original construction of factories, mills, and steamboats built in the colony | Free |
| Tin block, sheets, and solder *ad val.* | 10 per c. |
| Goods not otherwise charged with duty described, enumerated, or exempt *ad val.* | 20 per c. |

*New South Wales New Customs Tariff.*—The tariff, complaints of the incidence of which on American trade were given in our "Abstracts of Consular and Diplomatic Reports," June 8th, 1887, p. 24 and 25, has been superseded by a new one coming into operation on the 1st October next. Great changes have been made, as a comparison of the two tariffs shows, the articles now liable to duty being few.

*Tariff.*

| | £ s. d. |
|---|---|
| Bolts, nuts, rivets, screws, spikes—flat or pointed—bolt rings and washers—plain or galvanised metal | Free. |
| Galvanised iron, bars, corrugated, or sheets per ton | 2 0 0 |
| Galvanised manufactures—except anchors per ton | 3 0 0 |
| Iron chains | Free. |
| Iron safes or safe doors | Free. |
| Iron and steel wire per ton | 1 0 0 |
| Lead, pipe, roll, or sheet | Free. |
| Nails | Free. |
| Zinc, manufactured or perforated | Free. |

The 5 per cent. *ad valorem* duty upon all articles not enumerated in the above, or in the free list, is abolished, and the number of articles admitted free consequently much extended.

*Spain—Mining industry of Santiago de Cuba.*—The existence of minerals here has been known since the conquest of the island by the Spaniards in the sixteenth century, and at times attention has been turned to mines but to a very limited extent. In 1834 an English company re-started the old copper mines of Cobre, and continued making very large profits till 1868. Owing to political disturbances, the low price of copper, and a quarrel with the Spanish Railway Company that brought down their ore, the mines were stopped in 1869, and a couple of years ago were made over to the Spanish Railway Company, who continue to make a little copper by precipitation from the impregnated waters. In 1855 the Spanish Government mining engineer drew attention to the enormous deposits of magnetic and red hematite iron of extraordinary richness in some of the spur hills to the east of Havana. Little attention was paid to this until five years ago, when another mining engineer came from Spain to investigate the matter. The result of his inquiries was that mines of all kinds began to be claimed and reported all over the island. In 1883 the Spanish Government passed a law exempting the proprietors of iron mines from all annual taxes, declared free of duty mines and minerals of any sort, freedom of import duty on coal brought for the use of the mines, and free introduction from abroad for five years of all material and machinery for mining industries, including material for transportation of the ore, also reduction of the tonnage dues on vessels coming to take iron ore to 2½ per ton. In the last session of Cortes these concessions have been extended to lead, manganese, and zinc. Including the Cobre copper mines above referred to, there is an extent of 2520 acres claimed and reported. The copper is of good quality; but with the present low price of the article there is little prospect in these mines, unless by working on a large scale the precipitate from the old Cobre mines, which are full of water impregnated with copper. In 1883 an American company called the Jurugua Iron Company was formed, and bought a group of the iron mines that had been claimed and reported at a price of about £62,500, built a railway 16¾ miles in length, also a large wharf, investing altogether a capital of about £312,500. In 1884 the company exported to the United States 22,000 tons of ore; in 1885, 80,000 tons; and in 1886, 110,000 tons. But, so far, they have not begun to ship in proportion to the capacity of the mines; that they may do so they are building a line of steamers of their own under the English flag, two of which vessels are already running. When the ships are completed they expect to ship 1000 tons of ore a-day. There is no underground mining of this ore, but merely cutting down the hill-side, throwing away the encasing dirt and rock, and taking out the ore from the solid vein. The ore is worth in the United States £1 5s. per ton, and cost the company:—Mining and putting on railway car, 3s. 10d.; carrying to railway, 2s. 3d.; royalty to original owners, 2¼d.; freight to United States, 7s. 11½d.; duty in United States, 3s. 1¼d.: total, 17s. 4d., being the large profit of 7s. 8d., or 30·8 per cent. The shipping test per cargo of this ore is from 60 per cent. to 65 per cent. of pure iron, and an analysis of a sample analysed in the United States, gives the percentage of metallic iron as 66·96. This iron ore is of exceptionally good quality for making steel, and it has been spoken of as being as good as the best Swedish iron. The quantity of land held by the Inrugua Company for mining purposes is 1783 acres. The remaining mines of iron not sold, some of which are better than the Inrugua, cover an extent of 10,736 acres. Capitalists from the United States have been here making inquiries about these unsold iron mines; and although no further transactions have taken place with iron mine-owners, principally owing to the depression in the iron trade during the last few years, it is exceedingly probable that during the coming winter other mines will be sold and companies formed; in addition to the project of forming a company, with a capital of £833,000, to work the principal iron mines remaining unsold, and connect them by a railway with Havana. Though at first iron mine-owners were asking exorbitant prices, most of them would be willing to sell their properties for a royalty of from 9d. to 11½d. per ton of ore exported, with a moderate advance against same. Among the claims put in for iron mines is one of manganiferous iron of large extent, situate five miles of easy ground from a lake on the coast. This lake is separated from the sea by a low neck of land 656 yards wide, which if cut through, would give an entrance from the sea to the lake, and so form an oval-shaped port of about two miles diameter, having a uniform depth of 26ft. This would open up a rich country, while there would be a plentiful supply of fresh water from a river about a mile off. The ores from several of the iron mines could be easily brought down to this lake for shipment. Although some contracts have been lately made with people in the United States for manganese mines, none of them have been worked; the analysis of ore from one of them gives a mean of 80 per cent. of binoxide of manganese, or 55 to 57 per cent. of metal. The extent of manganese mines is 1863 acres. Of chrome iron there is one mine of 138 acres; and of coal and lignite, one of 37 acres. Of lead there is one of 148 acres; and one with 59 acres of antimony. Of zinc three mines have been claimed and reported, having an extent of 791 acres, but nothing has been done with them. The following is a summary of mines whose titles have been granted by Government, though there are others which have not gone through the necessary formalities:—

| Mines. | No. | Acres. |
|---|---|---|
| Antimony | 1 | 59 |
| Chrome iron | 1 | 138 |
| Coal | 1 | 37 |
| Copper | 51 | 2,516 |
| Iron | 102 | 12,494 |
| Lead | 1 | 148 |
| Manganese | 24 | 1,871 |
| Zinc | 1 | 74 |

It will thus be seen that there is a large field for enterprise in mining industries at this end of Cuba; and since that of sugar has become so unprofitable, this may become an important mining district, especially as the Government are willing to offer all the advantages possible, with a view of developing the country. There would be a difficulty from insufficiency of labour for working on a large scale, a difficulty which could only be surmounted by importing miners from Spain and elsewhere. The United States Consul at Santiago remarks on this question, which is of so much importance as regards the industrial development of Cuba:—The negroes are inadequate in number, and most unreliable though good workmen, they cannot be depended upon, as they quit work as soon as they earn a little money and return to work as soon as it is spent. This greatly impedes the possibility of profitable and systematical production, and is often the cause of great loss to the producer. Were it not that the Spanish Government, so as to protect the interests of their colony, allowed the soldiers of the various regiments stationed here to perform manual labour, the effect on all the industries of this island would be very serious. The cost of living is very small, and can be fairly estimated for the labourer at 9½d. a-day. During the sugar season the prices for labour vary from 1s. 11d. to 4s. 9d. a-day, averaging 3s. 1d. a-day. The season lasts seven months, from December to June. During the remaining five months the sugar estates only employ half their regular number, the other half finding work in agricultural pursuits. Other industries, such as farming, mining, and wood-cutting, employ their labourers continually. The importation of the Chinese, who cannot be used in the United States, is suggested, as they are particularly adapted to this climate. "That labourers are most humanely treated I can testify from personal observation." The United States Consul at Matanzas takes a more gloomy view of the labour question. We have here three pure races—the Asiatic, Chinese, black and white, and the result of the mixture of all, the mulatto, who has the endurance of the black and the intelligence of the white. There is really no immigration, and owing to the peculiar habits of the inhabitants the mixed race is continually increasing. The result is manifest, and though it may not be a matter of the near future, is the ultimate result to be expected here. The climate does not invite white immigration. The island cannot get rid of the black nor of the Chinese, and amalgamation is inevitable. Cuba is essentially an agricultural country, and relies for its prosperity solely on the cultivation of the land. Manufactures have never taken root here, though there are some of small amount. The tendency is to increase the divergence which always occurs between the higher and lower or proletariat class. There are large landed proprietors, small holders, and slaves, who in 1888 will be free, the emancipation of the slaves having for some time been going on. Those already free have struck for higher wages with success, and there will probably come a time when wages must be raised. The dominant class in the island is Spanish, utterly ignorant, and caring only for their own interest. They have the ear of the Government and control its movements and operations, and direct its affairs, through the juntas existing in the island. Up to the time of the strikes they had accomplished their ends, but there will be a speedy termination to this state of things. Even the peninsular Spaniards are becoming tired, and will welcome a change, and it is not a matter of surprise that insurrections break out.

## THE FUEL VALUE OF NATURAL GAS.

From an elaborate investigation made by Professor F. B. Phillips in the United States, we learn the following facts concerning the value of natural gas as a fuel:—

| Gas fields. | 2. Weight in kilos. of carbon per cubic metre of paraffines. | 2. Weight in kilos. of hydrogen per cubic metre of paraffines. | 3. Factor. | 4. Available heat units per cubic metre of gas. |
|---|---|---|---|---|
| Fredonia | 0·80406 | 0·22492 | 0·9224 | 11,449 |
| Sheffield | 0·65526 | 0·19924 | 0·9152 | 10,040 |
| Kane | 0·65669 | 0·19866 | 0·9152 | 10,354 |
| Wilcox | 0·64622 | 0·19828 | 0·9152 | 9,925 |
| Speechley | 0·69857 | 0·20738 | 0·9173 | 11,144 |
| Lyon's Run, near Murrys'lle | 0·53741 | 0·17950 | 0·9081 | 9,296 |
| Raccoon Creek | 0·62918 | 0·19408 | 0·9152 | 9,661 |
| Baden | 0·64209 | 0·19677 | 0·9152 | 9,515 |
| Houston | 0·64737 | 0·19694 | 0·9152 | 9,224 |

| Gas fields. | 5. Available heat units per 100 cubic feet of gas. | 6. Pounds of water at boiling point, vaporated by 100 cubic feet of gas. | 7. Pounds of pure charcoal, equal in heating effect to 100 cubic feet of gas. |
|---|---|---|---|
| Fredonia | 32,421 | 133·30 | 8·845 |
| Sheffield | 28,430 | 116·89 | 7·756 |
| Kane | 29,319 | 120·54 | 7·999 |
| Wilcox | 28,102 | 115·54 | 7·667 |
| Speechley | 31,554 | 129·73 | 8·609 |
| Lyon's Run, near Murrys'lle | 26,321 | 108·22 | 7·181 |
| Raccoon Creek | 27,355 | 112·47 | 7·463 |
| Baden | 26,941 | 110·77 | 7·350 |
| Houston | 26,119 | 107·38 | 7·126 |

1 cubic metre = 35·3166 cubic feet; 1 kilogram = 2·20462 lb. avoirdupois.

Technical Education.—Why should a man who desires his son taught shoemaking be compelled to give him instruction in that art at his own expense while he is also required to pay in taxes a share of the cost of having the sons of other taxpayers taught carpentry, so that when they leave school they are possessed of skill that will enable them to earn their living without further apprenticeship? This is a manifest injustice, and it is inherent in every attempt to teach handicrafts which does not include the impossibility of teaching all handicrafts. Or, indeed, why should the attempt be limited to handicrafts? There is no more reason why the State should undertake to fit a man for earning his living at bricklaying or tailoring than why it should undertake to fit him for earning his living at law, physic, or divinity. Any scheme of industrial training which does not contemplate the practice of actual trades is necessarily superficial and worthless, and any scheme which does not contemplate such practice must break down under its own weight.—*New York Times.*

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—R. H. Trubshaw, fleet engineer, to the President, additional for temporary service at the Admiralty, to date September 24th; J. Miller, fleet engineer, to the Hotspur, to date September 24th; E. Tricker, staff engineer, to the Iris; F. Wise, engineer, to the Firefly, to date September 24th; Albert S. Blake, engineer, to the Inflexible; Joseph R. Galpin, engineer, to the Mercury, to date September 26; Richard W. Jones, assistant-engineer, to the Anson; Robert C. Widdecombe, fleet engineer, to the Prince Albert, to date September 11th; Sidney G. Haddock, assistant engineer, to the Curacoa, to date September 28th; Francis H. Lister, Walter H. Williams, John G. Liversidge, and Charles W. J. Bearblock, assistant engineers, to the President, additional, for study at the Royal Naval College, to date September 30th; W. H. Morpey, George W. Roome, Frederick G. Dawson, Arthur R. Emdin, Edward W. Liversidge, John A. Vaughan, Thomas E. Morris, Henry Toop, Ernest C. Thornhill, Walter Edwards, Henry P. Sparkes, John H. Jenkin, Charles W. Bolt, William A. J. Davis, C. S. Hardcastle, Lewis Wall, Ralph H. C. Ball, Edmond E. Bond, H. J. Meiklejohn, Charles H. Hill, Robert S. Jennings, and Thomas H. B. Bishop, acting assistant engineers, additional, for study at the Royal Naval College, to date September 30th; William T. Bray, John F. Ryder, and Alexander G. Smith, chief engineers, to the Excellent, additional, to date October 1st; George H. Cooke, engineer, to the Linnet, to date September 27th; Edward A. E. Crowley, Arthur R. Anderson, and Charles E. Eldred, assistant engineers, to the Audacious additional, to date September 27th.

## AMERICAN ENGINEERING NEWS.

(*From a Correspondent.*)

*The Big Bend tunnel.*—This tunnel in California has been driven through a mountain spur for the purpose of draining a section of river bed to facilitate the search for gold, the bed having been proved to be rich in precious metal. Work has been in progress for a long while and is now about completed; the water will be turned into it about the middle of September. When the river is diverted through the tunnel, joining its course further down, the prospecting and mining for gold in the Bend, which is twelve miles long, will be commenced.

*Track fencing.*—Many of the Western railroads, more especially those through the cattle regions, are fencing in their lines, usually with barbed wire. On the Chicago, Kansas, and Nebraska Railroad the contract for 1400 miles of fencing for 700 miles of road in operation was awarded at 50c. per rod, or 224,000 dols. for material and labour. There are 448,000 posts, spaced at intervals of a rod, and as there are five wires to the fence, there were 7000 miles of wire used. The work was done by five gangs of thirty-five men each, each gang having a construction train loaded with material and tools, and furnished with cars for meals and sleeping. These gangs put up the fence at the rate of about a mile per day. The first cost is heavy, but it secures the railroad companies from the constant suits for damages for killing cattle, and renders the operation of the road much safer, as cattle cannot get on the track and wreck trains.

*A hurricane chart.*—The New York branch of the Hydrographic Office has issued a new hurricane chart, prepared by Commanders Bartlett and Hayden. It has many improvements on the chart formerly issued from the office, and will make the chance of escaping such storms much more certain than before. With the chart are a set of general rules for the hurricane season, and the laws of storms, relating more especially to the West Indian hurricanes. The following note is given with regard to the use of oil on troubled waters:—"The testimony as to the great value of the use of oil in heavy seas is so conclusive that it is now recognised by every commercial nation. No ship can afford to neglect its use in an emergency, when heavy broken seas threaten to come on board. Once tried its value will never be disputed."

*The Prince Edward Island tunnel.*—The survey of the Northumberland Strait, which has been made for the Dominion Government by Mr. J. G. Jonah, to ascertain the feasibility of the proposed subway, are now completed, and the report has been forwarded to the Government. The route surveyed this year was from Cape Jouriman, N.B., to Carleton Point, P.E.I., a distance of seven and a-half miles, about one mile shorter than the line previously surveyed between Cape Tormentine and Cape Traverse. The engineer reports an absence of engineering difficulties. The bottom is not broken up by sudden depressions, there are few rocks, and the underlying clay is firm. It is proposed to build out piers one and a-quarter miles and one-quarter mile at the New Brunswick and Island respectively, thus reducing the length of the iron "subway" or tunnel to about six miles.

*Electric Lighting in New York City.*—The Commissioner of Public Works has awarded contracts for lighting different sections of the city as follows: United States Illuminating Company, 24 and 40 cents per light per night; Brush Electric Light Company, 25 and 40 cents; Mount Morris Electric Lighting Company, 40 cents; Harlem Lighting Company, 24, 50 and 60 cents; American Electric Manufacturing Company, 32 and 40 cents; East River Electric Light Company, 19·9 and 39 cents.

*A new water power motor.*—An inventor of Buffalo, N.Y., has sold rights for two counties in an invention for utilising water-power to the Niagara River Motor Company, which has a capital stock of 250,000 dols. On a floating platform there are three vertical bearings on which runs a chain provided with projecting paddles, the paddle being hinged so as to feather against the chain when moving against the current; training walls are used to give the current a direct sweep on the paddles. On one of the bearings, or shafts, is a belt pulley, and the company will erect two large dynamos on the bank, drive them from the pulley, and distribute electricity to any part of the city of Buffalo by wires. The machine is to be 100ft. long, with steel blades 10ft. high and 8ft. wide; the masonry of the training-walls will be laid in cement. As the machine will be 8ft. below the surface, there is little to be feared from ice. The cost of this machine is estimated at 12,000 dols. The rights sold are for Niagara and Erie counties, which include the whole of the Niagara River frontage, but there are plenty of other streams which can be utilised, and the inventor is looking for a suitable one near New York. The model has worked successfully and great things are expected of it.

*Double-deck street cars.*—Double-deck street cars are very exceptional in this country. They have been tried in several towns and cities, but were not popular. In New York the objection probably was the discomfort of the outside seats, owing to the great heat in summer and the intense cold in winter. As there is in New York no municipal law against the overcrowding of street cars, the ordinary box cars when loaded are probably heavier than the English double-deckers seating only a certain number. If double-deck cars were generally introduced under the same arrangement, either four horses would be necessary during the busy hours, or the S. P. of C to A. would have its hands full. Some years ago some very fine cars of this style were built for the Third Avenue Railroad Company—a surface line—but they were not popular, and were finally sold to a South American company. With the increasing adoption of mechanical traction, however, there is a better chance for operating such cars, and twelve have recently been built for the St. Louis Cable and Western Railroad Company, of St. Louis, Mo. They were first introduced in June last, and have been well patronised, giving satisfactory results. They have seating capacity for eighty persons.

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

(*From our own Correspondent.*)

THE iron market is a little disturbed this week by financial troubles, but after the quarterly meetings consumers will have resumed their regular negotiations, and the market is expected to receive a perceptible impetus. The sheet makers sustain their activity, but the marked-bar firms, whose business during the past three months has shown a growing tendency, are not quite so favourably situated at the moment, there being a quietude in the Australian demand. It is expected, however, that some important home requirements will be exposed at the beginning of the next quarter. The quotation remains at £7, with £7 12s. 6d. for the Earl of Dudley's make. Second branded qualities are £6.

Makers of medium and common bars are experiencing a steady enquiry from South America and India and elsewhere. With both of these markets business has been much facilitated by the advanced rate of exchange which allows of the acceptance by merchants of orders which previously had to be refused. Prospects consequently are more encouraging, not only on this account, but also in respect of the home demand, which is expected shortly to find a freer expression. Prices remain at the figures which have ruled for a considerable time past. Medium bars are £5 10s., and common qualities range from £4 15s. 5d. down occasionally to £4 12s. 6d. There is but little chance of any early alteration in these prices.

The sheet makers have no complaints to make with regard to the extent of the business which is being done at their works. So full, indeed, do they continue of orders that many of them find it impossible to book new business for early delivery. They therefore have the market practically in their own hands, and it would not be surprising if another substantial advance in prices were early declared. Leading makers still persist in their demand for the advanced quotation of £6 7s. 6d. for doubles, but business can in some cases be done at the old figures of £6 5s.; lattens are £6 7s. 6d.

The lessened production of galvanised sheets which will now result from special local causes occurring this week is inclined to have a strengthening tendency of the market. This has not yet become conspicuous, but makers are trying to promulgate this view. An early accession of orders is anticipated. The minimum for 24 gauge is £10 to £10 5s. f.o.b. Mersey.

Some activity prevails at certain of the plate works, where orders are being placed for Indian railway wagon work and for tank and constructive engineering purposes. The demand from the boiler makers is, however, very small. These latter qualities are £7 10s. to £8 10s., and on to £10. Tank plates are quoted £6 10s. easy.

As regards hoops, production is small, in consequence of the number of mills engaged having been reduced. The American season demand has now closed, but for home consumption the demand for cooper's hoops is fair. The price at works is £5 5s. to £5 10s. for ordinary sorts. Strip iron is in rather better request, and a good demand from the wrought tube makers is expected shortly. Nail strip is also in good inquiry, but the requirements of the lock-makers are exceptionally poor. Tube strip is quoted £4 17s. 6d. to £5, and lock strip £6 to £7 for sizes up to 6in.

In the pig iron trade makers in outside Midland districts show a more confident front than do those of South Staffordshire. Current prices, they declare, leave very little profit at the furnaces, and as recent events have shown that consumers are buying, they are now quoting an advance of from 1s. to 1s. 6d. per ton upon the fortnight. As Midland makers show no eagerness to contract, this advance is in some cases conceded, though much business is still done on the old terms. Some makers of finished iron are reported to have covered their wants as much as nine months' ahead.

Lincolnshire pigs are sold at 40s. to 41s. at stations for Nos. 3 and 4, and 1s. additional for No. 2; Derbyshires at 37s.; and superior Northamptons at 36s. to 36s. 6d.

The execution of orders at the Staffordshire furnaces is not being followed by a proportionate accession of new business. At the same time the fresh orders are somewhat more numerous than they have latterly been. All-mine pigs are not in brisk request; they are quoted at 50s. to 52s. 6d. nom.; while part-mines are 40s. nom.; and common, 28s. 6d. to 30s. West coast hematites are in good sale at 54s. to 55s. delivered into this district; and Welsh hematites are 52s. 6d. upwards.

The 2000 tons of iron, forming the stock at the Bromford Iron-works, Oldbury, last week, fetched the following average prices:—Hematite forge, £2 10s. per ton; cinder forge, £1 9s. 6d.; Northampton forge, £1 15s. 6d.; puddled bars and ball furnace bars and billets, £3 to £3 12s.; warehouse stock merchants' iron, £4 10s.; rusty and odd strips and hoops, £4; pottery mine and ores, 10s.; twenty-seven wood boats, from £3 to £29; fourteen iron boats, £21 to £78.

The coal that is beginning to be stocked for winter use is imparting a stronger tone to the market, and the Cannock Chase colliery owners have resolved to make the usual winter's advance on the 1st of October of 1s. per ton on house coal and 6d. per ton on slack. The Sandwell Park Colliery Company are starting their second powerful drawing plant this week through an improved demand.

I have previously had occasion to record the manufacture of some splendid specimens of the roll casters' and roll turners' art in South Staffordshire for use in linoleum mills. Hitherto the rolls have been mainly for Scotch mills. Now, however, the United States has come to this country for a complete machine plant for linoleum mills, weighing altogether some 300 tons. The whole work is in the hands of a Gloucester millwright, and the rolls have been supplied from the West Bromwich locality. Three very fine rolls have been despatched, weighing respectively about 13, 20, and 24 tons, and the turning of the same in the lathe has been accomplished very successfully. The work is quite a triumph of the engineer's craft, and deserves special mention. The rolls are made with a hollow core through the centre, through which, in operating on the linoleum manufacture, a jet of steam is constantly kept passing to keep the rolls warm. Another large steel roll is also included in the plant, but that, I understand, is being drawn elsewhere than from this district. The more importance attaches to the contract since the American buyers intimate that if the plant when erected is found to work satisfactorily, a duplicate order may probably be placed.

The heavy pipe founders are unable to detect any specific improvement in business at date. The anticipations which were indulged in, that the recent severe drought would bring out a large number of new orders from the water companies, have not so far been adequately realised. The companies do not seem prepared to entertain the expenditure to provide against the possibility of a repetition of the experience. The Wolverhampton Corporation are, however, among those bodies who have determined to protect themselves, and the order which they have lately distributed for 1500 tons of 18in. mains between three firms in this district are very welcome. Prices do not, however, improve, and makers this week declare that business at present rates certainly does not pay. The number of export contracts coming into this district is very small, since the founders near the seaboard monopolise the bulk of the business. There is no Staffordshire industry upon which the heavy railway rates tell more severely than the iron pipe trade.

## NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

*Manchester.*—The general condition of the iron trade throughout this district continues most unsatisfactory. A dull, lifeless tone characterises the market, and there is but a cheerless outlook for the future. In the present depressed condition of the market the failures which have recently taken place locally and in Staffordshire have naturally tended to create an uneasy feeling, as in some quarters they are regarded as possibly the precursors of still further commercial disasters. The strain of the prolonged period of unprofitable trade must, of course, have been felt very severely in all branches of the iron industry, but whether to such an extent as to seriously involve the stability of any large number of concerns, there is no actual evidence at present. Trade, however, can hardly go on indefinitely on the lines of the last two or three years, and it is the continued absence of any prospect of relief forthcoming from improvement in trade that is perhaps the most discouraging feature.

The business doing during the past week has again been extremely small, and there was a very dull market at Manchester on Tuesday. For pig iron the inquiries, if anything, have been fewer, and there has been less actual buying. The fall in Scotch warrants has encouraged buyers here to hold out for lower prices, which local and district makers have not been willing, and in fact are not in a position, to concede. The result has been that business has been practically at a standstill, and very few transactions have been put through. Nominally the current market prices remain unchanged from last week, but there has been practically little or no actual business offering to bring out genuine quotations. So far, however, as it has been possible to test the market the tone generally is easier, and where sales of any weight are made they have to be on terms more favourable to buyers than would have been conceded a week or two back. Lancashire makers still quote 38s. 6d. for forge and 39s. 6d. for foundry, less 2½ per cent., delivered equal to Manchester, and as they have only a comparatively small quantity of iron to offer, occasional sales to regular customers on whom they are able to get about their list rates are sufficient to keep them going, and they do not attempt to compete in the open market with the lower priced district brands. Even in Lincolnshire iron, which can be bought at 2s. to 2s. 6d. per ton under the prices quoted for local brands, very few transactions of any weight are reported; recently there has been a moderate business done on the basis of 36s. 6d. to 37s., less 2½, for forge and foundry quailties, delivered equal to Manchester, and odd sales continue to be made at about these figures, which are the lowest makers will accept, 6d. more being held for in some instances; but buyers are very indifferent, and where they do come into the market, it is only limited wants they have to cover. For Derbyshire foundry iron the average figure remains at about 40s., less 2½, delivered equal to Manchester, with, however, very little inquiry stirring. In outside brands offering here the tone generally is weaker. Makers do not actually quote under 42s. 10d., net cash, for good named foundry brands of Middlesbrough, delivered equal to Manchester, but they are not in all cases so firm in holding to their list rates and the lower qualities are decidedly easier to buy. Scotch iron can also be bought at lower prices than were being taken last week.

There is still only a very slow business doing in hematite, and although it can scarcely be said that prices are lower, there is a generally unsettled tone, which points in the direction of some possible giving way. For No. 3 foundry qualities, delivered into the Manchester district, prices range from 52s. 6d., less 2½, at which there would be no difficulty in buying, to 53s. and 53s. 6d., less 2½, which are about the average figures quoted by makers.

In the manufactured iron trade a steady tone is being maintained generally, but this is mainly the result of the continued activity in shipping. In hoops and sheets especially makers are in most cases just now so busy with shipping business that it is difficult to place orders for anything like prompt delivery, and prices are consequently firm as a rule at late rates. Delivered into the Manchester district, bars average £4 17s. 6d., hoops £5 5s., and sheets £6 7s. 6d. to £6 10s. per ton. In North-country plates business has been done at about £4 19s. per ton delivered here. The dulness in the home trade continues, however, an unsatisfactory feature, and holds out but a discouraging prospect for business after the close of the autumn shipping season.

In the condition of the engineering trade there is still no material change to report, or if there is any change, it is not in the direction of improvement. Tool makers in some cases report a slackening off in work, and the branch of trade in which there is perhaps the nearest approach to activity is in stationary engine building, but the Bolton strike has no doubt thrown work into the hands of some concerns which probably would otherwise have only been indifferently employed. Cotton machinists are in most cases tolerably well supplied, and the same may be said of boiler makers. Taking trade all through, it may perhaps be described as moderate, but with work only obtainable at excessively low cut prices. The returns of the trades union societies indicate a stationary condition of trade as regards employment; the numbers of out-of-work members on the books have shown comparatively little or no variation for the past month or so, and the recent reports have been compelled to take a decidedly less hopeful tone as regards the prospects of improvement.

There is not much to add to what I reported last week with regard to the Bolton strike. Further negotiations, so far as the employers are concerned, are now at an end; their works are open for such of their old hands as they may require to return on the terms offered by the employers, and if they choose to remain out on strike the employers are determined to carry on their works with men obtained from other districts. The men, on the other hand, show no sign of giving way; they are being still well supplied with funds, the strike committee having last week a balance of over £1000 in hand after paying all current expenses, and they seem quite prepared to face the winter out on strike. I understand that the men object to open arbitration as a means of settling the dispute, because it would include not only high-paid towns like Manchester, which they want to fix as the basis, but also the low-paid towns in various parts of the kingdom, with the result that the average rate of wages would not be what they demand, whilst the retention by the employers of the workmen they have engaged during the strike was an equally serious obstacle. The men have, however, offered to resume work at an advance of 1s. per week, to be followed subsequently by a further advance of 1s., but this is begging the whole question, and is practically an admission that the men, in declining arbitration, had no case on which to arbitrate. This last proposal of the men has of course been declined by the employers. It would be impossible to estimate what this strike has cost during the five months it has already lasted. The mere obtaining of men from other districts has of necessity involved a very serious outlay of the Employers' Association, whilst the expenditure in support of the men on strike cannot have been much under £25,000. In addition to this, there has been the cost entailed upon the town by the extra police and military which have been required to preserve order and protect the workmen engaged by the employers. The injury which has been inflicted upon the industrial interests of the town is perhaps the most serious result of the strike, and will probably take years to repair. Bolton had gained a high reputation for special classes of work, which had resulted in a wonderful development of industrial enterprise, and this has received a check from which it will take a long time to recover.

In the coal trade the month closes with a tolerably brisk demand for all descriptions of house-fire coal, and in these prices are showing an upward tendency. There is no general advance, but some collieries have put up their pit prices about 6d. per ton, and in other cases there is levelling up where prices have been exceptionally low. Other descriptions of fuel remain without material change. Common round coals still meet with only a very slow sale for steam and iron-making purposes, with supplies plentiful. Engine fuel is in moderate demand, but with the increased production of slack supplies are in excess of requirements. Prices at the pit mouth average 8s. 6d. to 9s. for best coals, 7s. to 7s. 6d. seconds, 5s. 6d. to 6s. common house coals, 5s. to 5s. 6d. steam and forge coals, 4s. 6d. to 5s. burgy, 3s. 6d. to 4s. best slack, and 2s. 6d. to 3s. per ton for common sorts.

Shipping continues very quiet, with prices as low as ever, steam coal delivered at the high-level, Liverpool, or the Garston Docks being obtainable at 6s. 6d. to 6s. 9d. per ton.

*Barrow.*—There is no change to note in the condition of the hematite pig iron trade, which remains somewhat quiet, although a demand, though not a spirited one, is experienced alike from home and from foreign users of metal. The business doing is comparatively small, but this is explained by the fact that all the iron which is practically required at the moment is supplied by the heavy deliveries which are being made by makers on account of orders booked some time ago. The proof that the demand has not altogether fallen off is proved by the fact that a good business is offering for forward deliveries. It is, however, observable that the demand at the moment is spiritless, and that although evidences are not wanting that the future will be one of activity in the hematite iron trade, prices rule low, and business is doing at lower values than have been current for some time past. The quotations for Bessemer pig iron and for forge and foundry iron are respectively 45s. per ton, net f.o.b., for the former in parcels of mixed numbers, and 44s. for the latter, but sales are quoted at 43s. 6d. for the former and at 42s. 6d. for the latter. Stocks, which are comparatively low, are mostly in the hands of second-hand dealers. The output of the furnaces is steady, and about four-fifths of the smelting plant is producing iron. The trade doing in steel is considerable, and the activity at local mills is very great. This is, of course, most conspicuous in the rail department, where orders are very largely held. Firm rates are ruling, and heavy sections of rails are quoted at £4 6s per ton, net f.o.b., or at makers' works. A good outlook is presenting itself for an improvement in the trade of steel for shipbuilding purposes, and bars, billets, and general merchant steel enjoys a fair but not brisk market. There is no improvement to note in the shipbuilding trade, the only new feature being the acceptance of some orders for repairs. The Barrow Shipbuilding Company is proceeding to complete a barge which has been on the stocks for three years. Finished iron quiet. Iron ore steady, and in good request. Coal and coke firm, and in large consumption.

## THE SHEFFIELD DISTRICT.

*(From our own Correspondent.)*

THE approach of winter causing the colliery undertakings to be well employed, particularly in the house pits, has led to briskness in the call for colliery material of all sorts. Colliery ropes for haulage, corves and fittings, wheels, buckets, and underground material generally, is in animated request. Firms engaged in the production of car frames are rather more fully employed, and a similar remark applies to engineers' tool makers; but from what I hear I am disposed to dispute the statement that the edge tool branches are badly off for work. The Canadian tariff has undoubtedly affected—most adversely affected—the call for Sheffield files, and there is not likely to be any improvement in Canadian business until more liberal tariff arrangements are conceded. Till then new markets must be sought for elsewhere.

Some recent railway accidents have been clearly attributable to the breakdown of goods wagons which did not even belong to the company on whose line the accident occurred. Major Marindin, the Board of Trade inspector, has had his attention called to the unsatisfactory material too often employed in the construction of railway wagons, and the result has been to formulate specifications of the materials and forms to be used in the future construction of wagons. Buffer springs are to be used in all cases, a new form of general spring is to be adopted, and other changes are introduced. By way of further precaution, the parts are to be inspected and marked by a Government inspector.

The Christmas and New Year trade is now beginning to be felt, though, as yet, to a merely limited extent. Several cutlery firms who have been somewhat poorly engaged during the summer, are now taking on new hands. Competition in the silver and plating branches keeps as keen as ever, and it is complained that very little profit can be made. Two large firms are in receipt of heavy orders from abroad.

"Stored-up sunbeams" is a poetically scientific title I have heard given to coal, but coal merchants have not within my experience found it a fit term for fuel in the language of commerce. The other day, however, in a journey to Doncaster, I noticed a coal truck bearing the legend "bottled sunshine," which is almost as good as "stored-up sunbeams."

A pleasing incident of the good feeling existing between the Manchester, Sheffield, and Lincolnshire Railway Company and their employés is afforded by the action now being taken at various stations. Meetings of the servants are being held to show in a practical manner their sympathy with the directors, the company, and the chief managing officials, upon whom the brunt of the anxiety falls. The proposal is to give a week's wages to help the company to meet the heavy financial loss which will be involved by the calamity at Hexthorpe. At Sheffield a preliminary meeting has already been held, and the proposal has been adopted with perfect unanimity. A larger meeting, including signalmen and shunters, is to be held on Friday. The movement originated at Mexbrough, which is only a short distance from the scene of the deplorable disaster, and where the Manchester, Sheffield, and Lincolnshire Company have a large number of employés. This is the first occasion within my experience of the midland district of such practical sympathy being manifested by the staff of any railway or other company, and is a pleasing recognition of the fact that all the work:people—high or low—are mutually associated in the prosperity or adversity of the undertaking.

Messrs. John Round and Son, Tudor Works, silversmiths, electroplaters, and Britannia metal workers, have been awarded a gold medal at the Antwerp Exhibition.

## NOTES FROM SCOTLAND.

*(From our own Correspondent.)*

THE Glasgow warrant market has been depressed this week as regards prices, but a large quantity of iron is reported to have changed hands at the reduced quotations. For shipment the inquiry is not satisfactory, although it is understood that considerable orders formerly placed have yet to be implemented. The past week's shipments amounted to 8473 tons, as compared with 7861 in the same week of 1886. Of the quantity shipped 1445 tons went to the United States, 894 to Canada, 400 to Australia, 825 to Italy, 400 to Russia, 420 to China, 280 to Holland, and smaller quantities elsewhere. Since last report one furnace has been put out at Dalmellington, and there are now 82 in blast, as against 77 twelve months ago. As very small quantities of iron are going into store, the belief grows that makers must be adding considerably to their stocks, as the shipments and the home consumption are not thought to be sufficient to carry off the current production.

The market values of makers' iron are as follows:—Coltness, No. 1, 52s. 6d., No. 3, 44s.; Langloan, 48s. 6d. and 45s. 6d.; Gartsherrie, 47s. and 43s. 6d.; Calder, 48s. and 41s. 6d.; Summerlee, 51s. and 42s. 6d.; Carnbroe, 43s. 6d. and 39s. 6d.; Clyde, 46s. and 41s.; Monkland, 46s. 6d. and 39s.; Govan at Broomielaw, 43s. and 39s.; Shotts at Leith, 48s. and 45s. 6d.; Carron at Grangemouth, 47s. and 44s. 6d.; Glengarnock at Ardrossan, 48s. 6d. and 41s.; Eglinton, 43s. and 39s.; Dalmellington, 43s. 6d. and 39s. 6d.

The demand for Cumberland hematite pigs in the Scotch market is low, and there is also little doing at the moment in Cleveland warrants.

Makers of manufactured iron continue busy, especially in making sheets, the demand for which is greater than can be readily undertaken. The orders for sheets come chiefly from Italy and require to be implemented so as to allow of the goods to enter Italian ports before the end of the year, after which an increase is expected to be made in the import duties. For merchant bars there is a fair inquiry, the price being firm at £42 15s. per ton, less 5 per cent. discount. Shipping orders for bar iron are scarce at the moment, but the home trade in bars is proceeding upon a satisfactory scale. There is again a better demand for unbranded iron for the Indian market, and the price is firm at £4 7s. 6d. per ton net. For scrap iron, which is quoted at £2 7s. 6d. per ton, the present inquiry is poor. Old rails are likewise dull.

The shale miners' strike is practically at an end, although some of the men here and there still hold out. From the commencement of the strike, some ten weeks ago, there never was the slightest chance of the oil companies making any concession to the men, and it is considered remarkable that the advisers of the latter should not have been fully aware of the fact. The depression in the oil trade was so very serious that it had become a question whether a number of the companies should be able to continue, and a rigid economy was not merely desirable, but imperative, so that a reduction of wages was an absolute necessity.

## THE NORTH OF ENGLAND.

*(From our own Correspondent.)*

THE prospects of the Cleveland pig iron trade continue very discouraging. At the market held at Middlesbrough on Tuesday last, a further reduction in prices was made. The news arriving day by day from Glasgow is far from satisfactory, and has the effect of keeping buyers out of the market. On Tuesday several merchants offered No. 3 G.M.B. at 33s. 9d. per ton for prompt delivery, or 3d. below last week's price, but consumers would only purchase what they required for immediate use, as they expect to do better before long. Among the makers there are some who are now anxious to secure fresh orders, and are willing to accept 34s. per ton for No. 3, with prompt delivery, or even with delivery extending to the end of the year.

Stevenson, Jaques, and Co.'s current quotations: "Acklam Hematite," mixed Nos., 45s. per ton; "Acklam Yorkshire," Cleveland, No. 3, 35s.; "Acklam Basic," 36s.; refined iron, 48s. to 63s., net cash at furnaces.

Warrants, like makers' iron, have fallen 3d. per ton, and are now quoted at 33s. 3d. per ton; buyers, however, offer 1½d. less, and but little business is proceeding. Middlesbrough holders are not willing to take this figure, and it is only at Glasgow that business can be done.

The stock of pig iron in Messrs. Connal's store at Middlesbrough is still diminishing, and on Monday night it had fallen to 330,162 tons.

There is no improvement to report in respect of the finished iron trade, prices remaining the same as quoted last week.

Activity in the steel trade still continues, orders and inquiries being very numerous. Prices are firm at £4 2s. 6d. for rails, and £6 per ton for plates.

On the 16th inst. the Diamond Rock-boring Company commenced operations at Seatog Carew in a new search for salt. This boring is situated two miles further to the north than any yet made, and if successful will afford further evidence as to the extent of the deposit.

On the 12th inst. a new sliding scale for the purpose of regulating the wages of miners according to the market value of Cleveland pig-iron was signed at Middlesbrough by the mine-owners and by the workmen's representatives. The scale is virtually the same as that which recently expired, only a few unimportant modifications having been made. The duration of the arrangement is fixed to extend until June 30th, 1889, or for nearly two years, and it is thereafter to continue in force unless and until either of the parties to it give the other three calendar months' notice to terminate.

The directors of the Whitby and Scarborough Railway, a line only recently opened for public traffic, do not appear to be in a particularly happy state of mind. Their property is intrinsically a very nice one, though not of great magnitude, and its tendency is towards improvement in value. The chairman, Mr. Alderman Foster, in moving the adoption of the report, at the recent half-yearly meeting of the company, said that "the directors were fully convinced that it was possible to make the line more profitable, as the district through which it passed possessed great capabilities. But he could not say when those capabilities would be developed." The real impediment appears to be the difficulty of working with the managers of the North-Eastern Railway, which envelopes its poor little neighbour on all sides except that of the sea, and which will certainly absorb it some day. Its present troubles are, no doubt, part of a preparatory process. Mr. Foster continued, "there had always been differences between the company and the North-Eastern as to the mode of working the Whitby and Scarborough line; and by way of settling matters amicably, it had been proposed to the North-Eastern to have the differences laid before the Railway Commissioners, who were experienced in settling differences of this kind. The proposal was declined." Of course it was. The best thing Mr. Foster and his colleagues can do is to make terms with their powerful competitor, to absorb and work their line. That being done, all will go smoothly, and they will be saved a great deal of trouble and anxiety.

## WALES AND ADJOINING COUNTIES.

*(From our own Correspondent.)*

THERE is some degree of uneasiness in the coal district, first, with regard to the attitude of the colliers' delegates and the sliding scale, and alarmists are predicting its disuse. I do not think that there is the slightest fear of any such calamity. The scale has stood the test of many years' trial, and the mass of the colliers will be sure to uphold it; next, a large section of colliers are agitating for the eight hours' arrangement to be enforced in all collieries. They plead that this is long enough for continuous working in collieries, and should be thoroughly adopted.

Still another, with a satisfactory ending, the New Tredegar Colliery, "Elliott," at which a strike has been waged for some time, is again in action. Sir George Elliott brought his good offices into play in connection with a representative body of the men, and an arrangement has been brought about.

Colliery affairs are now passing through a crisis. The expected re-action from a stagnant condition has not taken place, the slight spurt having again subsided, and though some of the leading coalowners remain firm, and adhere to a lessened output and late quotations, it is but too evident that a quantity of steam coal is being cleared at low prices.

I hear of sales at 8s. 3d. and 8s. 6d., where formerly 9s. 3d. and 9s. 6d. prevailed, and small steam is in little request even at last week's low quotations.

House coal is quoted at 8s. 3d., and will likely move up, but coalowners in Monmouthshire are quoting large at 6s. pit, or 8s. delivered Cardiff or Newport. These figures are low, and not likely to remain long. I question if future deliveries beyond a month could be arranged at these prices.

The patent fuel trade is slack. Swansea, which used to despatch its 10,000 tons a week, sent less than 2000 last week.

An important coal find is announced at Pontypridd, the Darran Dda seam being struck on Lord Tredegar's estate in the Rhondda Valley.

Notwithstanding the depression in the coal trade, there are some instances of activity about, both in the Rhondda and Aberdare Valleys. Swansea despatched close upon 30,000 tons of coal last week, and in a degree figured better than its sister ports of Cardiff and Newport. Cardiff export was a little above the average, Newport coasting total was 20,000 tons. Pitwood is in active demand at 15s.

I have not much to record in connection with the steel works. Business is tolerably good, and with the slight exception of a furnace or two, all the works are now brisk, though more might easily be done. Quotations are decidedly firm. Heavy sections of rails are quoted at £4 5s., which is a shade lower than Barrow; light sections at various prices up to £5 2s. 6d. Bessemer blooms are at £4 5s.; bars, £4 15s. The last form the chief make.

At the Swansea exchange on Tuesday, home pig was quoted at 48s. In blooms there is a smart degree of competition both from the North and Scotland, and as the sea rate is light, there will soon be a railway rate agitation to enable home producers to stand their ground.

Some surprise was shown on the Exchange that tin-plate quotations were weaker than expected, though makers of best brands are as usual firm. During the week Swansea despatched over 80,000 boxes—one of its highest figures—and stocks in consequence fell considerably. Notwithstanding this and free inquiry, quotations, as I have stated, were not firm. Present prices at Swansea are, "generally speaking":—Coke tins, 12s. 9d. to 13s.; Bessemer steel, 13s. to 13s. 3d.; Siemens coke finish, 13s. 6d. to 14s. Best brands 3d. more in each case. As this is about 3d. less for the general run than was quoted up to the Exchange meeting, it may be regarded as only a temporary drop owing to some exceptional causes, and will not remain more than a few days. Swansea holds only a week's export in stock. Amongst the tin-plate exports of the week were 2200 tons to Baltimore, 2050 tons to New York, 1250 tons to Batoum, 2410 to home ports, and a consignment each to France and Hamburg.

Large quantities of iron ore are coming into Newport, and are being sent to the principal works. Prices maintained. Nothing under 12s.

I had an opportunity of inspecting the lighthouse on Bardsey Island lately, and could but commend the powerful engines used for the fog horn. They are kept in a very efficient state, and often serve good warnings out to the great coal fleet passing up from Cardiff and the other ports.

With this week most of the railways in Wales fall back to their ordinary arrangements, and the extra trains and through coaches will be withdrawn for another season. I cannot commend too highly the through coaches put upon the London and North-Western and Cambrian, serving Manchester and other large centres, and the mid-English counties, Herefordshire, &c., Swansea, Shrewsbury, &c. They are patterns of comfort, with arrangements such as hitherto have been sparingly given on English railways. Mr. Conacher has done excellent work this year as usual on the Cambrian.

The steel and coal districts are still subject to heavy casualties in the matter of accident. Numerous cases have occurred this week, and in many the result of individual carelessness.

The imposition of an extra tariff on iron to Canadian shores is the subject of a good deal of discussion. It would virtually destroy the trade between Canada and Wales.

Lately I announced the death of the Taff Vale Railway engineer. Last week Mr. Nicholson, the secretary, died. He was a man who had not reached the middle age, but was of great ability and sterling goodness of character.

## NOTES FROM GERMANY.

*(From our own Correspondent.)*

THE condition of the iron markets is thoroughly satisfactory; demand keeps good and prices have a rising tendency. The development of the iron trade in Rheinland-Westphalia has continued in a most gratifying manner during the week, and there is every appearance of its long continuance, as the desire to purchase increases rather than diminishes, and this not on the part of speculators, but on that of *bonâ fide* consumers.

The Silesian pig iron market is quiet, but with a firm tone. There are twenty-six blast furnaces now in full work, mostly on puddling sorts, whilst the Königshütte has six now going on basic pig for its own converters. Forge pig is noted M. 47, and foundry 53 to 54 p.t. The rolling mills are quite fully booked with orders for bars, girders, angles, hoops, and plates of all descriptions. In fact, they cannot turn the work out fast enough for customers; tank plates cannot be got for love or money during the remainder of the year. It is contemplated to raise the price of plates M. 20 p.t. now that the plate convention has been formed, and it has been affiliated with the sales bureau at Berlin. Steel goods are in less demand for the eastern market. Bars cost M. 135, best sorts 145, plates 150 to 155 p.t. The machine shops are quite well off for work, but prices are still unsatisfactory, and cannot be got to rise.

Iron ores in the western districts are in continued brisk demand. There is no alteration in prices of Siegerland sorts, but Luxemburg minette is a trifle dearer, and fetches from M. 1·80 to 3·20 p.t., according to sorts, at mines. There is a very active demand for them in Westphalia. Spiegel iron towards the close of last week was so much in demand for home and abroad that prices could be well maintained, and in some cases even raised. M. 50 to 51 is still quoted for sorts low in Mn. Forge pig is in increased demand, and many furnaces have been enabled to dispose of all their output to the end of the year, and some, indeed, beyond that again. M. 46·50 to 47 p.t. is the present quotation for best sorts. There is a quiet but steadily increasing demand for foundry sorts, as the machine shops and foundries are now better off for work, though at old, unremunerative prices. Bessemer and basic pig are both in good and regular request, and the latter is a little dearer, now quoted at M. 43 to 44, but dearer than this it cannot well become, or else it would be cheaper to import it—which, indeed, is to some extent being done.

The bar iron trade is looked upon as satisfactory on the whole, but specifications are coming to hand more sparingly than a week ago, and the business may be said to be quieter, but the comfort is that the convention ensures paying prices. These should pay still better, but pig iron is kept up too high in price, also by a convention. It would appear that the consolidated wrought iron convention has now been definitely arranged, and as soon as it comes into operation prices will again be raised, which will be justified by the present high price of the raw material. Girders have gone up on the week, and stand now at M. 113 to 115 and higher, and are in extra great request just at this season of the year. Hoops have maintained their price. Boiler and other plates are in good request, and all the mills are busy on them, but the price still remains at M. 150 p.t. Sheets are as lively as ever at M. 135 to 138 p.t. The near prospect of a wire rod convention coming into existence steadies the price of wire rods, and for home there is a brisk demand, but for abroad there has been a momentary check, especially for American account, caused probably by the late great failure in the metal trade there. Iron wire rods are noted M. 112; some houses require 115 for iron or steel rods; drawn ditto, 125 to 130; and wire nails, 135 p.t. Of the railway material works there is no new feature to note. The Hœrde works are making armour-plates, but what for or for whom does not transpire, and probably they are of no great size or weight. The result of the last tendering at Berlin has been that the lowest offers were M. 110 to 112 for steel rails, 106 for fish-plates, and 120 to 123, according to the pattern, for steel sleepers. Belgian works again competed, but no notice seems now to be taken of these offers, though they certainly tend to reduce the prices in favour of the railway administrations. The foundries, both of iron and brass, and most other workshops, are much better employed than of late was the case, but prices do not improve at all, so that these trades are quite disheartening.

The Belgian iron market continues very brisk, and prices have an upward tendency, and more furnaces are to be blown in, whilst there is no improvement in the condition of the French market to be recorded.

A new armoured cruiser, named the Prinzessin-Wilhelm, was launched on the 22nd inst. from the yard of the Germania Company at Gaarden, near Kiel.

The sixtieth annual meeting of the "German Natural Philosophers and Doctors of Medicine"—the equivalent to our British Association for the Advancement of Science—took place last week at Wiesbaden, when Professor Dr. Preyer, of Jena, read a paper entitled "Natural Philosophy and School," which was cordially received and enthusiastically cheered at its conclusion. The professor condemned entirely the present German methods of teaching in the higher schools, as well as much of what is taught. He says there must be less sitting on benches and being crammed with a lot of subjects that are of little use, except for a certain few; that nature and practical objects must be more studied, there must be more activity out of school, that for a maximum of time spent a minimum of value is received, that the scholars about to matriculate for the University are devoid of practical sense, have no confidence in their judgment, have acquired no manual accomplishments, and says a great deal more besides. This is by no means the first time all this has been brought before the public. Last winter a professor of one of the first technical colleges gave three lectures on the same subject, and put it even more forcibly that education should be more practical and less theoretical. Again, a week or two ago a leading industrial paper was praising the introduction of examinations, such as some college in England had lately published, as just what Germany had been striving to obtain for years past, and much regretting that they were behind us in this particular.

When this is all put together, it leads to the idea that, as Germany is becoming more and more of an industrial country, it requires a more practical method of schooling for its members, and who can say, as time flows on, whether in the end the teaching in Germany and the Continent generally will not descend to practical methods not dissimilar to our own, which have grown up as practical necessity demanded? If so, which is very probable, does it not behove us to keep such technical education as we have at present, and to be cautious, instead of rushing in for new schemes as proposed by the late Bill, which may turn out in the end to become similar to what they are trying to get rid of on the Continent? If our attention were turned to giving the lower and lower middle classes a more thorough, better, and broader education, it would do more towards assisting us to compete with other nations than a new scheme of technical education, which, as far as engineers—and that is a wide field—goes, is scarcely required; but if anything should be wanting, it could be easily accomplished without a cumbersome Act of Parliament.

## AMERICAN NOTES.

(*From our own Correspondent.*)

NEW YORK, September 17th.

IMPORTERS have closed contracts for 30,000 tons of rails, Bessemer slabs, and billets, within a few days, and will probably increase their contracts to 50,000 tons within a few days. Active efforts are made to import beams, and four or five good orders have been secured. Home makers are shading prices to protect themselves where threatened.

The pig iron production has reached 20,000 tons per day, and stocks at furnaces are practically unknown. The bar mills are running more actively than for years, and all the merchant steel mills have work running into winter. Steel rails are 36 dols. to 38 dols. at mill, and orders are fully up to mill capacity. Copper is quiet; lead is selling well.

The distribution of tin and tin-plate is large. Over 100,000 tons of anthracite have been mined daily until this week, when a suspension of work in sixty-five collieries will restrict the output 40 per cent. The bituminous supplies to eastern markets will help to cover the deficit. The industries are all crowded with orders. Pipe mills are quite busy. The larger manufacturing establishments all along the North Atlantic coast are well sold up, and the tenor of latest interior advices are indicative of great activity. Textile mills are generally on full time. Hardware establishments, foundries, implement makers, and builders of all kinds of motive power are adding to their volume of business. Brokers and jobbers are crowded with orders for early delivery. The money market is somewhat stringent, owing to the great demand for funds and to the stronger disposition to scrutinise applications for loans. The shipyards are very busy, and at all interior boat-building centres, especially on the north-western lakes, are crowded with work. Railroad companies are not able to furnish all the cars wanted, and the car-builders are working overtime to hasten deliveries.

The export trade is satisfactory, and the gold importations have a good effect on domestic finances. The greatest solicitation of the Government is to devise measures by which the surplus of over one hundred million dollars per year can be prevented, without causing any complications with the protected interests.

## NEW COMPANIES.

THE following companies have just been registered:—

*Central Foxdale Silver Lead Mining Company, Limited.*

This company was registered on the 15th inst., with a capital of £45,000, in £1 shares, to purchase from the Liverpool Syndicate, Limited, their rights and interests in the Central Foxdale Silver Lead Mine, situate in the parishes of Patrick and Marown, in the Isle of Man, containing 266 acres, held under a lease from the Crown; also certain premises, plant, machinery, &c., together with a piece of land adjoining the mine, recently purchased by the Central Foxdale Company from the Isle of Man Mining Company, Limited. The subscribers are:—

| | Shares. |
|---|---|
| J. Senhouse Goldie-Taubman, Douglas, Isle of Man | 1 |
| A. Stuart, 9, Chapel-street, Liverpool, merchant | 1 |
| C. Ratcliffe, 74, South Castle-street, Liverpool, printer, &c. | 1 |
| G. H. Stuart, 9, Chapel-street, Liverpool, merchant | 1 |
| T. C. Clarke, 3, Lord-street, Liverpool, architect | 1 |
| T. Hughes, 3, Lord-street, Liverpool, mining agent | 1 |
| W. Todhunter, Douglas, iron merchant | 1 |

The number and names of the first directors will be determined by the subscribers, who act *ad interim*. The company in general meeting will determine remuneration.

*Empress Sewing Machine Company, Limited.*

This company was registered on the 17th inst., with a capital of £100,000, in £1 shares, to adopt an agreement of 16th ult., made with A. J. Burrowes-Close, on behalf of the Empress Sewing Machine Company, of Chicago, and to carry on business as manufacturers and dealers in sewing machines. The subscribers are:—

| | Shares. |
|---|---|
| E. Villiers, 5, Brechin-place, Gloucester-road, director Mutual Life Assurance Society | 1 |
| T. E. Byrne, Camberley, Surrey, director Conservative Land Company | 1 |
| Sir Stephen J. Hill, Caversham, Oxon | 1 |
| C. M. Barber, Ridgway, Wimbledon, Chairman Automatic Match Supply Company, Limited | 1 |
| W. Mullings, 7, Tavistock-place, W.C., solicitor | 1 |
| W. F. Parks, 12, Robert-street, Hampstead-road | 1 |
| Claude S. F. Mellor, 4, Lodge-road, St. John's Wood | 1 |

Director's qualification, £100 of capital; remuneration, £600 per annum.

*Universal Automatic Machines Company, Limited.*

On the 17th inst. this company was registered, with a capital of £120,000, in £1 shares, to acquire certain inventions for delivery of goods or information, referred to in an unregistered agreement with Messrs. Woodhouse and Rawson, Ellis Brown, Daniel Judson and Son, Limited, John Stewart Wallace, Robt. Willoughby Vining, and Wm. Samuel Oliver. The subscribers are:—

| | Shares. |
|---|---|
| F. H. Judson, 77, Southwark-street, merchant | 1 |
| J. Stewart Wallace, Belfast, merchant | 1 |
| F. L. Ball, 31, Palace-street, Westminster, accountant | 1 |
| H. A. Marshall, 15, George-street, E.C., secretary to a company | 1 |
| W. S. Oliver, 15, George-street, E.C., engineer | 1 |
| R. W. Vining, 279, Stretford-road, Manchester, engineer | 1 |
| O. E. Winslow, 4a, Chepstow-place, Bayswater, clerk | 1 |

The number of directors is not to be less than three, nor more than seven; the first four subscribers are to appoint the first; qualification, £500 in shares or stock. The remuneration of the board is to be at the rate of £200 per annum for each director.

*Harris-Reeves Syndicate, Limited.*

The object of this syndicate is to purchase and work two inventions in connection with the ventilation and deodorisation of sewage, the patents for which are numbered and dated respectively, No. 10,268, 17th July, 1884, and No. 13,313, 19th October, 1886. It was registered on the 17th inst., with a capital of £12,000, in £50 shares. The subscribers are:—

| | Shares. |
|---|---|
| Wm. Howard, 92, Woodchurch-street, clerk | 1 |
| W. Stuart, 9, Santley-street, Brixton, accountant | 1 |
| V. Treacher, 14, Ampthill-square | 1 |
| J. J. Millar, 101, St. James'-road, Brixton, clerk | 1 |
| W. Rickinson, Leytonstone | 1 |
| H. Hentsch, Upper Halliford, Middlesex | 1 |
| R. Howard, 26, Claude-road, Peckham Rye | 1 |

The number of directors is not to be less than three, nor more than five; qualification, £100 in shares or stock. The company in general meeting will determine remuneration.

*Nidd Valley Stone Quarry Company, Limited.*

This company was registered on the 19th inst., with a capital of £50,000, in £1 shares, to purchase leasehold rights of quarries, situate at Bishop's Side Moor, Pateley Bridge, York. The subscribers are:—

| | Shares. |
|---|---|
| J. Jones, 5, Wesley-street, Salford, general agent | 1 |
| W. R. Millward, Seacombe, ship broker | 1 |
| J. H. Costerton, Strangeways, Manchester, solicitor | 5 |
| J. Young, 12, King-street, Manchester, merchant | 1 |
| H. Chilly, Kersal, Manchester | 1 |
| A. Murray, jun., Kersal, Manchester, accountant | 1 |
| H. Geddes, 17, St. Ann's-square, Manchester, estate agent | 1 |

Registered without special articles.

*Cwmgorse Colliery Company, Limited.*

This company proposes to acquire and work the seam of coal known as "The Red Vein," situate in the parish of Llanguicke, in the county of Glamorgan, with power to acquire any other mineral properties in Glamorgan and Carmarthen or elsewhere in Wales. It was registered on the 24th ult., with a capital of £2000, in £25 shares. The subscribers are:—

| | Shares. |
|---|---|
| D. Meredith, Gwaun Caeguron, Glamorgan, colliery manager | 1 |
| D. Jenkins, Gwaun Caeguron, Glamorgan, grocer | 1 |
| G. Edmund, Gwaun Caeguron, Glamorgan, schoolmaster | 1 |
| S. Jenkins, Gwaun Caeguron, Glamorgan, timber merchant | 1 |
| M. James, Brinorgan, Glamorgan, farmer | 1 |
| D. Morgan, Garth Farm, Glamorgan, farmer | 1 |
| B. Beran, Pwllwraith, Glamorgan | 1 |

Registered without special articles.

*Mount Carrington Mining Company, Limited.*

This company was registered on the 23rd inst., with a capital of £50,000, in £1 shares, to carry on in Australia the business of a mining and smelting company. The subscribers are:—

| | Shares. |
|---|---|
| A. J. De La Mare, Chichester-road, Croydon | 1 |
| G. B. Baman, 182, Earl's Court-road | 1 |
| C. H. Bell, 37, Sumutra-road, West Hampstead, clerk | 1 |
| R. Gleigal, 9, Hertford-terrace, Shepherd's Bush | 1 |
| H. R. Saunders, 20, Womersley-road, Stroud Green, clerk | 1 |
| C. J. Ely, 36, Mamosa-street, Fulham | 1 |

The number of directors is not to be less than five, nor more than seven; the subscribers are to appoint the first; qualification, £100 in shares or stock; remuneration, £250 per annum.

*Sir B. Samuelson and Co., Limited.*

Capital of £275,000, divided into 13,750 shares of £20 each. Object, to purchase, take over, and carry on as going concerns, on the terms of an agreement made between Sir Bernhard Samuelson, Bart., M.P., of the one part, and the company of the other part, or on any other terms, the businesses of an ironmaster and coal and ironstone owner, now carried on by the said Bernhard Samuelson under the style or firm of B. Samuelson and Co., at Middlesbrough-on-Tees, in the county of Durham, and at the Hedley Hope Collieries, in the county of Durham, and at the ironstone mines, near Guisborough, in the county of York, consisting of the Hollin Hill and the Tinkenhow royalties, and known as the Slapewath mine, and all real and personal property owned by the said firm in connection with the said businesses or either of them; to carry on all or any of the trades or businesses of ironmasters, iron-founders, coal and ironstone owners, manufacturers of iron and steel, miners, smelters, engineers, colliery proprietors, coke manufacturers, and any other trade or business subsidiary or ancillary to the businesses aforesaid, or which it may for the time being be expedient to carry on therewith or in aid thereof. The first subscribers are:—

| | Shares. |
|---|---|
| Sir B. Samuelson, 56, Prince's-gate, W. | 1 |
| H. B. Samuelson, Chelston-cross, Torquay | 1 |
| G. B. Samuelson, 56, Prince's-gate, W. | 1 |
| H. W. Samuelson, 56, Prince's-gate, W. | 1 |
| F. A. E. Samuelson, 56, Prince's-gate, W. | 1 |
| James Stockton, solicitor, Banbury, Oxfordshire | 1 |
| W. Hanson, ironmaster, Middlesbrough | 1 |

The number of directors shall not be less than seven, nor more than seven, and the first shall be Sir Bernhard Samuelson, of Bodicote Grange, Banbury, and No. 56, Prince's-gate, South Kensington, Bart., M.P., chairman of the company; Francis Arthur E. Samuelson, of No. 56, Prince's-gate; Wm. Hanson, of Middlesbrough-on-Tees; and James Stockton, of Banbury, Oxon. The said Sir Bernhard Samuelson shall continue in the office of chairman of the company until the ordinary general meeting in the year 1888, if he shall so long live and be able and willing to discharge the duties thereof. At any time before the ordinary meeting in the year 1888 the board may from time to time add to their number by the appointment of duly qualified members as directors, so as the whole number of directors shall not exceed seven. The qualification of a director shall be the holding of shares in the company of the nominal value of £2000 or upwards or such other sum as the company shall from time to time in general meeting determine.

## THE PATENT JOURNAL.

*Condensed from the Journal of the Commissioners of Patents.*

### Application for Letters Patent.

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

*19th September*, 1887.

12,697. REGULATION of ELECTRIC CURRENTS, F. V. Maquaire, London.
12,698. PRODUCTION of ARTIFICIAL DRAUGHT in STEAM BOILER FURNACES, H. F. Green and G. W. Newall, London.
12,699. METALLIC PACKING for PISTON-RODS, &c., A. D. Marshall, London.
12,700. PRODUCING ANHYDROUS SULPHURIC ACID, S. Pitt.—(*V. Ragosine and P. Dvorkovitch, Russia.*)
12,701. BOILERS for HEATING GREENHOUSES, &c., G. F. Redfern.—(*V. Brasseur, Belgium.*)
12,702. OVENS, G. F. Redfern.—(*A. A. E. P. Dormoy, France.*)
12,703. MANURE DISTRIBUTORS, C. and A. Lins, London.
12,704. MACHINE for PRINTING BOXES, J. H. Swift, London.
12,705. AUTO-COPYING or PRINTING PRESSES, T. Reiner, London.
12,706. WASHING MACHINES, P. Lochmann, London.
12,707. CHANGING the GAUGE of RAILWAY, &c., WHEELS, S. R. Wilson, London.
12,708. CARRIAGE and other SEATS, T. Mabbutt and W. Phillips, London.
12,709. DRYING WOOL, W. Nelson and E. Bowen, London.
12,710. PORTABLE BUILDINGS, D. Grove, London.

*20th September*, 1887.

12,711. STAND for CLOCKS, &c., J. McClelland, Selly Oak.
12,712. PAPER MACHINERY, G. Mills and G. H. May, Glasgow.
12,713. SELF-FEEDING TARGET THROWER, G. H. Hockey, Bishopston.
12,714. DEVELOPING PHOTOGRAPHIC NEGATIVES, G. Gillman, London.
12,715. FURNACES of ENGINES, I. F. Cuttler and W. P. Green, Bradford.
12,716. SADDLE for BICYCLES, H. Lucas and J. Forster, Birmingham.
12,717. CONSTRUCTION of METAL DOOR PLATES, C. R. Peak, London.
12,718 ELECTRICAL SPEED INDICATORS, J. Tate, Bradford.
12,719. GIVING INTERMITTENT MOTION to MACHINERY, J., T., and J. Vicars, jun., Liverpool.
12,720. THATCHING APPLIANCES for HAY STACKS, &c., H. McGregor, Langside.
12,721. OVAL PARTS of LAMPS, W. T. Webber, Birmingham.
12,722. BEARINGS for AXLES of ROLLERS of WASHING, &c., MACHINES, A. Hirst, Halifax.
12,723. BASSINETTES, &c., W. H. Brassington, Manchester.
12,724. CURE of RHEUMATISM, E. Wheeler, Oldbury.
12,725. FURNITURE CASTORS, I. Chorlton and G. L. Scott, Manchester.
12,726. RAIL-MAKING MACHINERY, L. Goddu, London.
12,727. WIRE for SECURING SOLES of BOOTS, L. Goddu, London.
12,728. MACHINE BELTS, H. J. Allison.—(*C. A. Schieren, United States.*)
12,729. FORMING THREADS upon WOOD SCREWS, C. D. Rogers, London.
12,730. DIES for FORMING THREADS upon WOOD SCREWS, C. D. Rogers, London.
12,731. MATTRESSES for WATER BEDS, H. H. Judson, London.
12,732. STRETCHERS for INVALIDS, H. H. Judson, London.
12,733. PHOTOGRAPHER'S CHAIRS, T. Endean and F. G. Clark, London.
12,734. ACCORDIONS, J. F. Stratton, London.
12,735. REPEATING MATCHES, D. Grünfeld and H. J. Schumann, London.
12,736. PREPARING BLUE, R. Ashton, Manchester.
12,737. COATING FELT HAT BODIES, J. and O. Oldham, London.
12,738. BRUSHING CARPETS, C. Parker, London.
12,739. BANDAGE SHELL, E. Nienstaedt, Glasgow.
12,740. STEAM BOILERS, &c., G. Paxton, Glasgow.
12,741. PURIFYING, &c., IRON, G. G Mullins, London.
12,742. MECHANISM, J. Hahn, London.
12,743. AMMUNITION for GUNS, B. Burton, London.
12,744. ATTACHING EYELETS, &c., to LEATHER, W. R. Comings, London.
12,745. GRIPPERS for CABLE RAILWAYS, W. H. Paine, London.
12,746. VIEWING TRANSPARENT PICTURES, W. T. Dennis, London.
12,747. WELDING METALS, A. J. Boult.—(*E. E. Ries, United States.*)
12,748. SNATCH BLOCKS, H. A. Rooke, Liverpool.
12,749. GAS ENGINES, A. J. Boult.—(*J. Charter, T. A. Galt, and G. Tracy, United States.*)
12,750. CROSS TIES for PERMANENT WAY, A. J. Boult.—(*D. C. Heller, R. W. Flower, jun., and S. L. Wiegand, United States.*)
12,751. ROLLERING MACHINE, W. P. Thompson.—(*A. J. A. Lagane, France.*)
12,752. UNDERGROUND CONDUITS for ELECTRIC RAILWAY APPLIANCES, A. J. Boult.—(*E. E. Ries, United States.*)
12,753. METALLIC CYLINDERS or DRUMS, W. Groom, London.
12,754. METALLIC CYLINDERS or DRUMS, W. Groom, London.
12,755. INDOOR FIRE EXTINGUISHER, J. Ashdown, Brighton.
12,756. LAWN TENNIS BALLS, R. Slazenger, London.
12,757. SHARPENING HARDENED STEEL MILLING CUTTERS, R. Martin, Old Charlton.
12,758. AUTOMATIC SIGHT-FEED LUBRICATOR, R. McDowell, London.
12,759. TOBACCO PIPES, J. M. T. Fieux, London.
12,760. SEPARATING COTTON, J. E. Platt and J. Fidler, Manchester.
12,761. PRESSES for FORGING, &c., S. Massey, Manchester.
12,762. TREATING VEGETABLE MATERIALS, P. E. E. Pesier, London.
12,763. ELECTRIC METERS, G. Forbes, London.
12,764. DISINFECTING and FUMIGATING MACHINE, T. P. Hollick, London.
12,765. PLASTIC COMPOUNDS, M. W. Samuel, London.
12,766. COLD DRAWING RODS and TUBES, V. I. Feeny, London.
12,767. OUTSIDE SUN-BLIND, T. S. Simpson, Leyton.
12,768. SASH LOCK and FASTENER, W. R. Lake.—(*G. W. Hance, United States.*)
12,769. MUMMIFICATION of CORPSES, J. de Nueda, London.
12,770. CARDING MACHINES, W. R. Lake.—(*H. W. Mason, United States.*)
12,771. FACILITATING ESCAPE from BURNING BUILDINGS, W. R. Lake.—(*R. Sutherland, United States.*)
12,772. FAMILY WASHING MACHINES, H. A. Hancock, London.
12,773. DOMESTIC FIRE-ESCAPE, H. A. Hancock, London.
12,774. COMBINED KNIFE, PEN, and INK HOLDER, &c., S. M. y Valdivielso, London.
12,775. RED or WHITE FACED STOCK BRICKS, W. R. Manders, London.
12,776. APPARATUS for STEAMING YARNS, P. Heilmann-Ducommun and C. V. Steinlen, London.
12,777. AUTOMATIC SALE and DELIVERY APPARATUS, T. J. Hewson, London.
12,778. SHAPING BOOT and SHOE COUNTER STIFFENERS, A. M. Morin, London.

*21st September*, 1887.

12,779. DUPLEX DIRECT-ACTING STEAM PUMPS, J. H. Carruthers, Glasgow.
12,780. TYPE PLATES, &c., T. R. Weston, Bristol.
12,781. OUT-DOOR AMUSEMENT, T. Needham, Huddersfield.
12,782. LOOMS for WEAVING LOOP or SPOT FABRICS, J. Mathieson and J. Dewar, Glasgow.
12,783. INSTRUMENT for TURNING over LEAVES of MUSIC, &c., J. O'Connor, Dublin.
12,784. FORK and SPOON CLEANER, D. Appleton, Manchester.
12,785. PICKS for QUARRYING, &c., J. Pickles, T. Wild, and W. Mitchell, Keighley.
12,786. FITTINGS for INCANDESCENT ELECTRIC LAMPS, S. Sudworth and C. K. Falkenstein, London.
12,787. ORGANS, HARMONIUMS, &c., G. Cummings, Blyth.
12,788. RAG ENGINES, J. Kenyon, Manchester.
12,789. STENCIL PRINTING APPARATUS, O. F. P. Spitzel, London.
12,790. RAILWAY and STEAMBOAT CHAIRS, J. Reilly Manchester.
12,791. CAST MALLEABLE IRON GRATING FRONT, J. Parker, Derby.
12,792. CLIPS, W. A. Murray, London.
12,793. AXLETREE and ARMS applicable to CARTS, &c., G. Weston, Sheffield.
12,794. DUPLEX BOOT HEEL and TOE TIP, S. V. Fontana, London.
12,795. ROTARY SHUTTLES of SEWING MACHINES, W. H. Beal, Halifax.
12,796. CLOSE FIRE COOKING RANGE, F. Moore and W. J. Fieldhouse, Birmingham.
12,797. WEAVING PLUSH CARPETS, W. Fox, Bradford.
12,798. STANDS for EXHIBITING UMBRELLAS, F. Fuller, London.
12,799. BALANCE-SPRING COLLET-SHIFTER, T. Baxter, London.
12,800. ICE MACHINERY, L. Frere —(*G. Dubern, India.*)
12,801. FIRE-LIGHTERS, A. McK. Margerison, London.
12,802. BAKING of BREAD, &c., E. and E. T. Clark, London.
12,803. TYPE-WRITING MACHINES, F. Myers, Liverpool.
12,804. PREVENTING INCRUSTATION in STEAM BOILERS, J. Parsons, Liverpool.
12,805. WALKING, &c., STICKS, M. P. Baxter, London.
12,806. BRACE TABS, T. Walker, London.
12,807. PRODUCING PRINTED MATTER by LIGHT, H. J. Shawcross, Liverpool.
12,808. GAS STOVES, G. E. Wright, Birmingham.
12,809. CURTAIN GUIDES, A. M. Haswell, Toronto.
12,810. BUILDING a NEW WARSHIP, J. Carter, London.
12,811. AXLES, H. Edwards, London.
12,812. INJECTORS, L. Rouviere, London.
12,813. RUDDER ATTACHMENT, J. D. Hickman, London.
12,814. RUDDER ATTACHMENT, J. D. Hickman, London.
12,815. CYCLE LAMPS, F. Haisman, London.
12,816. ROWLOCKS for BOATS, J. Brown and J. Hedger, London.
12,817. FIREPROOF CURTAINS for THEATRES, M. W. H. Clarke, London.
12,818. TOY SEWING MACHINE, J. R. Mally, London.
12,819. KNITTED FABRICS, A. Lees London.
12,820. DOG-KENNELS, R. R. Fowler, London.
12,821. WEATHER GUARD for DOORS, S. Pitt.—(*P. P. Negroponte, United States.*)
12,822. FABRICS for BURNISHING METAL, A. M. Mason, London.
12,823. TELEPHONIC ARRANGEMENTS, A. A. Campbell-Swinton, London.
12,824. ELECTRICAL DISTRIBUTION, A. McEwen.—(*C. G. McEwen, South Africa.*)
12,825. DRESS STAND, M. Batchelor, London.
12,826. STOPPERING BOTTLES, T. Terrell, London.
12,827. WINDOW BLINDS and TENT CLOTHS, A. Ford, London.
12,828. CONVERTIBLE WIRE BASKETS, A. S. Greenwood, London.
12,829. FURNACE GRATES, H. P. Tallmadge, London.
12,830. ELECTRIC LAMPS, W. R. Lake.—(*O. H. L. Lindemann, Germany.*)
12,831. TRANSPORTING DEVICE, W. R. Lake.—(*A. Kahl, Germany.*)
12,832. TOILET SET HOLDER, W. R. Lake.—(*E. Ph. Hinkel, Germany.*)
12,833. TELEPHONIC ARRANGEMENTS, A. A. Campbell-Swinton, London.
12,834. PRODUCING REFINED SUGAR, N. Tscherikowski, London.
12,835. BOX CRANKS or RINGS for BAKING CHINA, &c., T. A. and S. Green and H. Leak, London.

*22nd September*, 1887.

12,836. TYPE-WRITING MACHINERY, T. D. Worrall, London.
12,837. DELIVERING MACHINES, T. Burns and J. S. Dumbell, London.
12,838. BOOT RACK, J. Platt, London.
12,839. PROTECTING the CLOTHES in MANGLING, &c., MACHINES, E. Powell, Chester.
12,840. WATER-MOVING MACHINES, C. Procopides, Manchester.
12,841. FASTENER for UMBRELLAS, &c., F. Sampson, Sutton Coldfield.
12,842 EXHIBITING SECTIONS of COMB HONEY, T. B. Blow, Welwyn.
12,843. AUTOMATIC DELIVERY of POSTAGE STAMPS, &c., F. C. Lynde, Manchester.
12,844. RAISING, &c., LIGHTS in CARRIAGES, A. A. Govan, Glasgow.
12,845. LIFE-SAVING JACKET, S. M. y Valdivielso, London.
12,846. HAND PROTECTOR, P. Isherwood, Darwen.
12,847. APPLYING STEAM to YARN, J. White, Burnley.
12,848. PERMANENT MAGNETS, R. Scott, Newcastle-on-Tyne.
12,849. FINISHING WOVEN PILE FABRICS, Sir T. Salt, Bart., Sons, and Co., and J. W. Pearson, London.
12,850. PIPES, &c., J. King and H. W. Lonsdale, Hull.
12,851. TOOL HOLDER, A. Mills, Rochdale.
12,852. ATTACHING APPARATUS for RAILWAYS, W. P. Thompson.—(*J. Dunstan, United States.*)
12,853. SOCKET BOLTS, C. Showell, Birmingham.
12,854. CAP SPINNING MACHINERY, G. Clegg, J. Thomas, and W. H. Harrison, Halifax.
12,855. HANDLE for BELL PULLS, J. Empson and J. Hewitt, Birmingham.
12,856. ALUMINIUM, C. A. Burghardt and W. J. Twining, Manchester.
12,857. VENTILATOR, H. Waddington, Accrington.
12,858. ANTI-FRICTION BEARINGS, B. S. and A. Longfellow, Halifax.
12,859. RING SPINNING MACHINES, A. Ambler, Halifax.
12,860. PICTURE NAILS, H. Munslow, Birmingham.
12,861. CONVERTING IRON into STEEL, S. Dawes and W. Smith, London.
12,862. COUPLING RAILWAY WHEELS, J. Darling, Glasgow.
12,863. GAS ENGINES, E. Körting, London.
12,864. ROOFING MATERIAL, J. C. Lyman.—(*J. H. Lyman, United States*)
12,865. ROTARY ENGINES, H. J. Haddan.—(*J. M. Whitney, United States.*)
12,866. LOOMS for WEAVING, T. Hirst and J. Middleton, London.
12,867. FOLDING BATH for SHIPS, &c., G. Sparrow and W. S. Kelly, London.
12,868. INDICATING GAMES, J. Graves, London.
12,869. CONNECTING MATTRESSES to BEDSTEADS, J. R. C. Taunton and H. Ferrer, London.
12,870. CLEANING KNIVES and FORKS, R. B. Wheeler, London.
12,871. COVERING FELT HAT BODIES, G. C. Taylor and T. Webb, Manchester.
12,872. BRICKS for WELLS, &c., M. H. Blanchard, London.
12,873. HANGING PICTURES, H. A. Couchman, London.
12,874. ROTARY ENGINES, &c., T. Jones, London.
12,875. STEAM ENGINES, E. Edwards, London.
12,876. STEAM GENERATOR, F. Livet, London.
12,877. REGULATING the SUPPLY of GAS to GAS ENGINES, E. Schrabetz, London.
12,878. AUTOMATIC STEAM TRAP, A. D. Marshall, London.

12,879. Lighting and Extinguishing Gas, W. McAuliffe, London.
12,880. Producing Solid Metal Sheets, W. J. Reynolds, London.
12,881. Boxes for Bottles, R. H. Saul, London.
12,882. Breech-loading Fire-arms, H. Bischoff and A. Mieg, London.
12,883. Producing Fine-divided Metal, C. Philippart, London.
12,884. Linoleum, T. J. Flynn, London.
12,885. Dynamo-electric Machines, G. E. Cabanellas, London.

*23rd September*, 1887.

12,886. Tap Filters, S. and E. Adams, Sheffield.
12,887. Hardening or Tempering Steel, W. P. Thompson.—(*A. Schneider and Co., France.*)
12,888. Valise Equipment, J. S. Romans, Halifax.
12,889. Locomotives, &c., F. J. Burrell and C. J. Nicholson, Thetford.
12,890. Washing Machines, T. Frater, Glasgow.
12,891. Platen Printing Machines, A. Morfit and C. Butterfield, Nottingham.
12,892. Treatment of Gout, &c., F. Bale, Droitwich.
12,893. Testing Gas Pipes and Fittings, S. Harrison, Manchester.
12,894. Instrument to Show the Focus of Lenses, J. Anderton, Birmingham.
12,895. Power-saving Apparatus, E. Paul, Liverpool.
12,896. Closing the Collar of Coats, &c., N. and W. Tupholme.—(*J. Maden, United States.*)
12,897. Burnishing and Polishing Foundry, W. G. Macvitie, Sutton Coldfield.
12,898. Winding Work for Marine Chronometers, F. J. Britten, London.
12,899. Velocipedes, S. Martin, London.
12,900. Driving Gearing, T. E. Morris, Carnarvon.
12,901. Machines for Printing Fabrics, S. Knowles, Manchester.
12,902. Combing Machines, W. H. Shepherd, Bradford.
12,903. Paper Pulp, A. Wright, Langside.
12,904. Instrument for the Treatment of Enlargement of the Testicle, W. McKenzie, Dublin.
12,905. Weighing Machines, T. Finney, Langside.
12,906. Air Door Regulators, T. Murphy, London.
12,907. Hot-air Engines, H. Robinson, Manchester.
12,908. Transit between two Points, H. F. Solaini and H. W. Pugh, Liverpool.
12,909. Luggage Carriers for Velocipedes, J. B. Brooks, Birmingham.
12,910. Copper Wire, &c., B. and G. Shorthouse, Birmingham.
12,911. Waterproofing Composition, K. McLea and R. Punshon, London.
12,912. Rolls for Rolling Metal, R. R. Gubbins, London.
12,913. Cure of Eruptions of the Skin, E. Ireland, London.
12,914. Match-box, T. Collard, London.
12,915. Travelling Machine for Advertising, J. Mayors, London.
12,916. Screw Gill Machinery, J. C. Walker and J. E. Stephenson, London.
12,917. Preparing Paper for Paper Bags, C. Beadle, London.
12,918. Telegraphy, J. H. Robertson, London.
12,919. Revolving Wood Shutters, A. Wells, London.
12,920. Gas Motor Engines, F. W. Crossley and H. P. Holt, London.
12,921. Facilitating Hearing by Deaf Persons, W. H. Tylor, London.
12,922. Loading Coal into Ships, C. L. Hunter, Cardiff.
12,923. Sewing Machines, J. S. Edwards, Eastbourne.
12,924. Incandescent Electric Lamps, &c., G. Zanni, London.
12,925. Brakes for Vehicles, C. Pilcher and W. Sayer, London.
12,926. Pocket Appliance for Industrial Uses, W. Body, London.
12,927. Sanitary Pails, H. Whiley, Manchester.
12,928. Soles of Boots, J. Mangin, London.
12,929. Apparatus for Gymnastic Exercises, S. Wild, London.
12,930. Manufacture of Screws, L. E. Parfitt, London.
12,931. Shirt Cuffs, &c., J. Welsh, J. Margetson, J. J. Morrish, and E. A. Price, London.

*24th September*, 1887.

12,932. Lifeboat, G. Fowler, London.
12,933. Manufacture of Cigars, O. Wartmann, London.
12,934. Cutting Rags, N. Browne.—(*H. Pitzler, Germany.*)
12,935. Wind Guards, J. A. Macmeikan, London.
12,936. Breech-loading Guns, L. E. Parfitt, King's Heath.
12,937. Pocket Requisite Cases, G. Townsend, London.
12,938. Stoppers for Bottles, M. L. Macauley, Glasgow.
12,939. Beer Casks, &c., B. Brooks, Manchester.
12,940. Photographic Shutters, F. W. Branson, Leeds.
12,941. Modes of Transit, R. C. Sayer, Redland.
12,942. Mountings, &c., for Mangling Boards, H. L. Wilson, Halifax.
12,943. Water Cartridge Case, &c., J., B. Jones, and J. Thomason, Runcorn.
12,944. Adjusting Nut Spanner or Wrench, L. Cooper, Coventry.
12,945. Supplying Goods, &c., in Exchange for Coin, J. D. Churchill and D. J. Callard, London.
12,946. Taking Waste Gases from Coke Ovens to Fire Boilers, &c., W. Guest, T. Guest, G. Guest, and A. Guest, Mapplewell, London.
12,947. Forming the Connecting Joints between Jack Levers and Blades of Wytch Engines, F. N. Priestley and M. Hirst, Bradford.
12,948. Knitting Single-knot Noose Healds for Looms, J. Kitson, C. A. Kitson, F. Kitson, and H. Kitson, Bradford.
12,949. Constructing Sanitary Receptacles, J. Parkinson and D. Sweaney, Manchester.
12,950. Tires of Wheels, G. P. Lee, Manchester.
12,951. Miners' Safety Lamps, J. Dennis, Sheffield.
12,952. Gas-burner, C. M. Walker, London.
12,953. Curling and Cleaning Flocks, R. Ellis and A. Longfellow, Halifax.
12,954. Gravitation Power or Motion, C. Barnett, jun., Godalming.
12,955. Watch Key, H. E. Webb, London.
12,956. Elastic Tubing for Penholders, &c., T. Wilson, London.
12,957. Stretching Trousers, J. Pinchbeck, London.
12,958. Regenerative Gas Lamps, J. Breeden, London.
12,959. Nozzle for Producing Spray, G. A. Goyder and the Hon. D. Murray, London.
12,960. Mounting the Bodies of Railway Carriages, &c., A. L. Féraud, London.—[Received 24th September, 1887. Antedated 14th June, A.D. 1887. Under International Convention ]
12,961. Extinguishing of Fire, H. Clifford, Bleadon.
12,962. Hydraulic Presses, &c., R. Kohfahl, London.
12,963. Measuring the Density of Gases, A. Siegert and W. Dürr, London.
12,964. Parallel Rulers, A. J. Boult.—(*F. Pereles and F. Liska, Bohemia.*)
12,965. Mineral Oil and other Lamps, J. Hutchison, Liverpool.
12,966. Grinding, &c., Apparatus, W. P. Thompson.—(*Schiffer and Kircher, Bavarian Palatinate.*)
12,967. Lubricant, W. M. Simpson.—(*Simpson, Roberts, and Co., Nova Scotia.*)
12,968. Tension Apparatus for Beams for Lace and other Machines, A. W. Smith, London.
12,969. Band Label, M. Brundrett, London.
12,970. Weighing Machinery, F. de Trémandan, London.
12,971. Sharpener for Knives and Razors, W. S. Simpson, London.
12,972 Embrocation for the Cure of Bronchitis, W. H Westmacott, London.
12,973. Hoisting and Lowering Gear, T. Elwell, London.
12,974. Two-wheeled Carriages, R. Woods and J. Holmes, London.
12,975. Door Latch, W. W. Horn.—(*T. Bason and S. Hazlehurst, United States.*)
12,976. Paper Bottles and Boxes, G. A. Wilkins, London.
12,977. Rigging Woollen Fabrics, W. R. Lake.—(*S. Schofield, United States.*)
12,978. Checking the Receipt of Money in Vehicles, J. M. Black, London.

*26th September*, 1887.

12,979. Domestic Fire-grates, A. Knevett, London.
12,980. Telescope Stanchion for Awning Sheet, J. Gulley, Belfast.
12,981. Handles for Bicycles, &c., J. T. Trench, Dublin.
12,982. Automatically Supplying Oil to Lamps, C. Knight, Newport.
12,983. Necktie Fastenings, F. R. Baker, Birmingham.
12,984. Fastenings for Gloves, F. R. Baker, Birmingham.
12,985. Elevators, J., T., and J. Vicars, jun., Liverpool.
12,986. Furnaces of Steam Generators, J., T., and J. Vicars, jun., Liverpool.
12,987. Combined Tap and Back-pressure Valves, E. Birch, Manchester.
12,988. Brewing, J. and R. B. Bonthorne, Falklands.
12,989. Preparing Machinery, J. Wallace, jun., Belfast.
12,990. Engine Locomotion, R. Glover, Stratford.
12,991. Gates, W. A. Murray, London.
12,992. Air-tight Gas and other Heating Stoves, C. H. Wood, Sheffield.
12,993. Cigarettes with Enclosed Mouthpiece Perforated with One or more Holes, W. Holder, Dublin.
12,994. Coverings for Steam or Hot-water Pipes, C. Brader, Manchester.
12,995. Pen or Pencil Holders, W. G. Dinkelmeyer, Berlin.
12,996. Machine for Washing Clothes, T. G. and H. E. Normanton, Barrow-in-Furness.
12,997. Steel Tree for Riding Saddles, C. MacMahon, London.
12,998. Saving Fire Bars from Burning, F. Coghill, South Shields.
12,999. Holding Copy to be attached to Type-writing Machines, A. B. Reid, United States.
13,000. Automatic Feed-water Regulators, D., D. J., J. H., and S. J. Parsons, London.
13,001. Automatic Fire Sprinklers, J. C. Hudson, London.
13,002. Hydraulic Water Sprays, &c., E. Aldous, Essex.
13,003. Hats, J. Jenkins, London.
13,004. Manufacture of Cellulose, W. P. Thompson.—(*S. Wolf, Germany.*)
13,005. Boxes, F. Villiers-Stead, E. R. Hedgman, and J. Spratt, London.
13,006. Petroleum and Gas Engines, W. P. Theerman, London.
13,007. Hot-water or Steam Heating Apparatus, T. Heaps, London.
13,008. Adjustable Reading and Writing Tables, M. Robinson, London.
13,009. Launching and Raising Ships' Boats, W. Absalom, Liverpool.
13,010. Optical Instruments, G. C. Rice, London.
13,011. Pipe Cutters, W. Jones, London.
13,012. Tanning, C. J. V. d'Hauterive.—(*A. Bedu, France.*)
13,013. Spirometers, W. F. Stanley, London.
13,014. Bags for Distributing Oil on Water, E. A. Hayes, New York.
13,015. Raising Liquids, W. R. Lake.—(*M. Marcoux, née A. Morel, France.*)
13,016. Cradle Splint, C. W. Krohne and H. F. Sesemann, London.
13,017. Cooling Air, P. A. Newton.—(*Messrs. Theisen and Langen, Germany.*)
13,018. Sliding Windows, R. W. Prowse and D. Doig, London.
13,019. Signal Apparatus, J. Hill, W. Smith, J. P. O'Donnell, New Maldon.
13,020. Printing Machines, A. Godfrey, London.
13,021. Steering Ships by Water Jet, T. V. Trew, London.
13,022. Formation of Tiles for Roofing, J. F. Carey, London.
13,023. Toy Velocipede, G. Carette, London.
13,024. Lamps, J. H. Ross, London.
13,025. Fireproof Curtains, J. A. Fisher and L. Booth, London.
13,026. Kneading Dough. P. C. Kjellberg, London.
13,027. Furnace Doors, A. W. Robertson, London.
13,028. Flushing Closets, E. Gotto and F. Beesley.—(*J. Ried, Brazil.*)
13,029. Fuzes for Projectiles, T. Nordenfelt, London.
13,030. Firing Mechanism for Guns, G. Stuart, Newcastle-on-Tyne.
13,031. Securing Glass Enclosures in Strong Safes, S. and S. R. Chatwood, London.
13,032. Digestive Condiments, W. M. Clear, London.
13,033. Medicine Bottles, F. W. Child, London.
13,034. Filtering Alcoholic Beverages, A. de Gaulne, London.
13,035. Combined Shoes and Skates, M. Dannhorn, London.
13,036. Corrugated Washing Boards, &c., J. H. Wilson, Glasgow.
13,037. Weighing, F. B. Rawes, London.

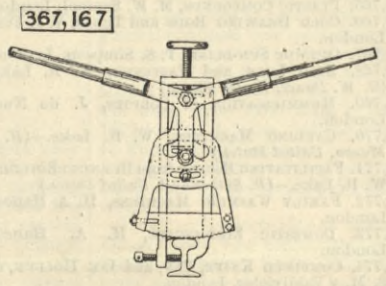
## SELECTED AMERICAN PATENTS.

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

**367,167.** Rail-sawing Machine, *E. C. Smith, Brooklyn, N.Y.—Filed April 29th*, 1886.

*Claim.*—(1) In a rail-sawing machine, the main frame, a vertically sliding carriage, with suitable means for moving said carriage, combined with a saw-carrying frame pivotted to the movable carriage so as to swing outside of the main frame, and provided with horizontal arms for operating it, and having a slot-

367,167

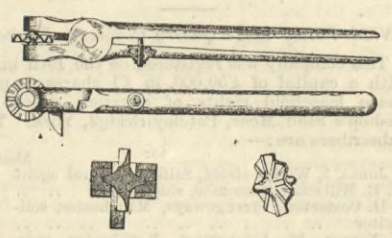


and-pin connection with the sliding carriage, as set forth. (2) The combination, in a rail-sawing machine, of a main frame, a sliding carriage, means for moving said carriage, a saw frame pivotted on a shaft projecting from the movable carriage, and a triple-armed frame secured to said saw frame and shaft and provided with sockets for receiving lever bars, as set forth. (3) In a rail-sawing machine, the combination of a main frame, a movable carriage mounted in said frame carrying an oscillating saw frame, with an arm pivotted to the said carriage and provided with a movable pawl adapted to engage with a ratchet wheel mounted on a vertical screw shaft, and a stud arranged to contact with lugs on the saw frame for feeding the saw to the rail, as set forth. (4) The combination, with the main frame, sliding carriage, and screw shaft mounted in said carriage, of an arm pivotted to the sliding carriage carrying a spring-actuated pawl arranged to engage a ratchet wheel on the screw shaft, and an oscillating saw-carrying frame provided with lugs, arranged to contact with a stud on said arm for operating the same, as set forth.

**367,287.** Tool for Dressing Emery Wheels, *H. K. Forbis, Columbus, Ohio.—Filed June 2nd*, 1886.

*Claim.*—(1) In a tool for trueing emery and other like wheels, the combination of the pivotted levers having bearings in their forward ends, of the cast zig-zag abrading wheel provided with a suitable spindle, the ends of which rest in the bearings in the pivotted levers, substantially as specified. (2) In a tool for trueing emery and other like wheels, the combination, with an abrading tool, of a holder consisting of the

367,287

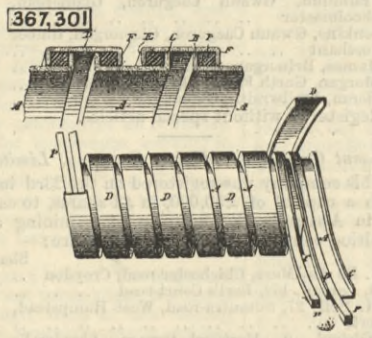


two arms or levers pivotted together, said arms having inserted in their forward ends, in suitable eyes therein, bearing blocks for the reception and retention of the said abrading tool, substantially as specified. (3) In a tool for trueing emery or other like wheels, the combination, with the pivotted levers, of the abrading wheel held between the shorter arms of the levers, and the set screws passing through one of the arms of said levers, substantially as specified. (4) An abrading wheel consisting of a body having a zigzag periphery, and a spindle cast integral therewith, substantially as described.

**367,301.** Flexible Tube, *H. Knight, New York.—Filed April 28th*, 1887.

*Claim.*—(1) A tube formed of two or more continuous strips of metal which are helically wound one upon the other and made to interlock with each other, and independent strips between the flanges of the strips of metal, providing an elastic packing at the joints, substantially as shown and described. (2) The combination of the metallic strip A, having outwardly extending flanges B C, and the corresponding strip D, having the inwardly extending flanges E F, with the elastic

367,301

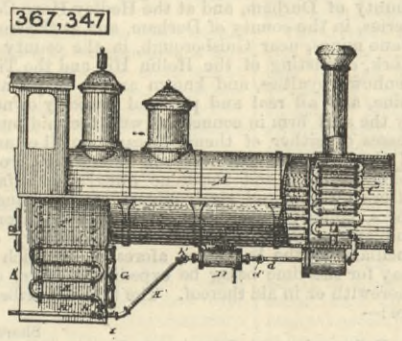


packing P, all arranged substantially as and for the purposes set forth. (3) The combination of the metallic strips overlapping each other, as shown, and provided with the elastic packing between the contiguous flanges, the said flanges having rounded edges, whereby they are adapted to turn on the opposite flat surfaces of the strips without unnecessary friction. (4) The combination of the inner metallic strip wound helically and having the outwardly extending flanges, the outer strip with the inwardly extending flanges wound around the inner strip, and the two strips of elastic packing located as shown, the two metallic strips being so formed as to press toward each other for the purpose of maintaining a tight joint.

**367,347.** Means for Heating Railroad Cars, *T. Lanahan and G. W. Roberts, Louisville, Ky.—Filed February 26th*, 1887.

*Claim.*—(1) In a car-heating and ventilating device, the combination of the pump D, heater C, composed of the return bends *c*, connected therewith and situated in the smoke-box of the locomotive, with the series of return bend pipes F, G, and H located on the outside walls of the fire-box and connecting with

367,347

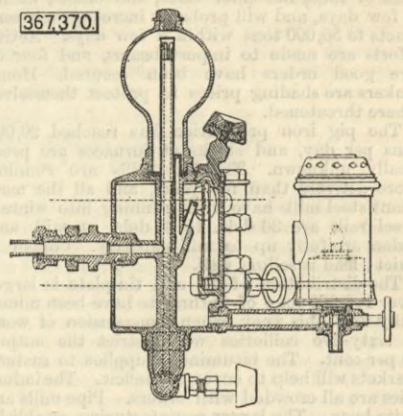


heater C and delivery pipe to the cars, all constructed and arranged substantially as and for the purpose specified. (2) The combination of air engine D, pipe *d*, heater C, composed of the concentric series of return bends *c*, with the series of return bends F, G, and H, the pipes *h* and $H^1$, the three-way valve I, and the valves $h^1$ and $d^1$ in pipes $H^1$ and *d*, all constructed and arranged to operate substantially in the manner and for the purpose described.

**367,370.** Lubricator for Locomotives, *W. H. Craig, Lawrence, Mass.—Filed March 23rd*, 1887.

*Claim.*—(1) The oil reservoir provided with the central vertical tubular steam induct leading into the condenser, and with the lateral branch or induct opening out of the lower part of the vertical one and through the side of the reservoir, all being essentially as set forth. (2) The combination of the tubular supporting shank, having the steam passage extending through it, with the oil reservoir provided with the central vertical tubular steam induct leading up from such reservoir into the condenser, and with the lateral induct opening out of the lower part of the vertical one, and extending to the side of the reservoir and opening into the said supporting shank, all being essentially as set forth. (3) The oil reservoir provided with the pocket in its lower part and at one side of it, as represented, and having thereto an oil induction tube extending up from such pocket nearly to the top of the said reservoir, and also having the two educts leading from it—the said pocket—to the sight-feed glass tubes arranged in the same side of such reservoir, all being substantially as set forth. (4) The combination, with the oil reservoir, of two sight-feed glass chambers or tubes arranged on one side of and in the same horizontal plane with the oil-reservoir, substantially as and for the purpose represented. (5) A sight-feed lubricator having its two sight-feed glass cham-

367,370.

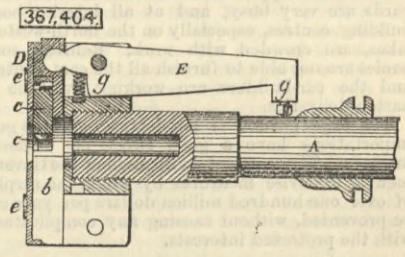


bers or tubes arranged at one side only of and on a level or in the same horizontal plane with the oil reservoir, and also having its oil educts leading from it to the valve chests of the engine cylinders arranged to extend in opposite direction from the reservoir, as set forth.

**367,404.** Bolt Cutting Machine, *W. H. Johnson, Racine, Wis.—Filed January 15th*, 1886.

*Claim.*—(1) In a bolt cutting machine, the combination, with head B, having grooves *b b*, studs *e e*, as described, projecting from its face, levers E, and dies

367,404.



C, of the plate D, having holes therein elongated in a direction struck from the centre of the plate and having a central opening, as and for the purpose set forth (2) In a bolt cutting head, the combination of a mandrel A, head B, dies C in radiating grooves in the face of said head, levers E and set screws *g g* in the ends of said levers.

**367,470.** Regulator for Dynamo-electric Machines and Motors, *E. Thomson, Lynn, Mass.—Filed April 14th*, 1886.

*Claim.*—(1) The combination, with a dynamo-electric machine having its field coils in derived circuit to the work, of a field-varying device and means for simultaneously and automatically moving the commutator brushes backward when the field magnetism is diminished, and *vice versâ*. (2) In a regulator for dynamo-electric machines or motors, the combination, with an adjustable commutator, of an operating electro-magnet coil C, included in a circuit with a variable resistance and the field magnet coil, as and

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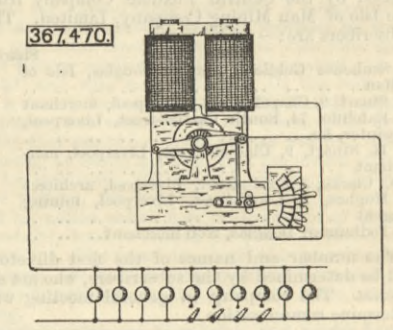

for the purpose described. (3) The combination, with a dynamo-electric machine supplying working resistances in multiple arc, of a field coil in a derived circuit thereto, a variable resistance in said circuit, and an adjustable commutator having an operating magnet included in the variable resistance circuit. (4) In a dynamo-electric machine, the combination of an adjustable commutator and a magnet for operating the same, said magnet having its coils connected with a variable field circuit, so that variations in the latter for changing the field strength will change the strength of the magnet and effect a simultaneous adjustment of the commutator.

**367,604.** Speed Governor, *A. Dieu, New York, N.Y.—Filed April 29th*, 1887.

*Claim.*—The combination, in a speed governor, of a liquid-containing receptacle, an axially movable screw therein, having a cylindrical core A, formed with a series of vertical passages P in its lower part, and a series of lateral slots O in its upper hollow part, and a valve plate $B^1$ mounted to slide vertically in said hollow part and adapted to close more or less the passages P, substantially as shown and described. The

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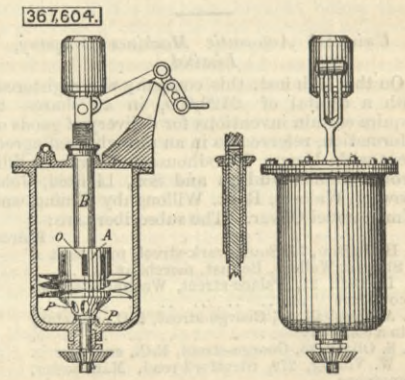

combination, in a speed governor, of a liquid-containing receptacle, an axially movable screw therein, having a passage extending upward through its core, a non-rotary rod resting loosely open the screw, a sleeve adjustable vertically on said rod and projecting through the top of the receptacle, and a valve plate carried by said sleeve for regulating the passage in the screw core, substantially as shown and described.