

experiments as given in the first columns of our tables. It will be understood that we refer to the last three tables only. Although we have shown a Richards' indicator on the table, it must be understood that the diagrams were not taken on that instrument, which was used as a check, and for a different purpose. The indicator actually used we have omitted in order to avoid confusion; but its position was close to the recorder, and the pencil was thrown into gear at the same moment the indicator was started, but the gear is so contrived that the cylinder and paper are moved a short distance under the pencil, which then first describes a short straight line, so that no difficulty is experienced in determining the precise point at which the pressure fell. During the trials on the North British Railway the experimenters acted as follows:—As soon as the indicator showed, say, thirty miles an hour, a bell was rung by electricity on the engine, and the driver immediately shut off steam, applied the brake, and rung a bell in the van. At the first stroke of this second or return bell the cord was pulled, putting the indicator in gear, and the stop watches of the observers were started. These last were stopped with the train, and the time and speed recorded at the moment; the distances run being worked out afterwards on the diagrams.

An inspection of the diagrams will show at a glance in what the superiority of the automatic brake consists—this is, the early retardation of the train, and the shortness of the space required to bring it to a standstill. The diagrams speak so plainly for themselves that we shall say nothing more about them than commend them to our readers as deserving careful examination.

The figures contained in columns 9, 10, and 11 are worth notice. They were taken by a distinct observer on the engine, and are given for all stops, it will be seen, except one, whether the observations in the van were or were not recorded. It will be noticed that the vacuum brake uses a great deal of steam, reducing the pressure in a third of a minute by as much as three or four pounds, which agrees with certain experiments made on the Brighton Railway, when the steam fell 10 lb. per minute with the ejector full open. As fitted on the North British line, the ejectors work up the chimney and create a powerful draught, and in certain conditions of the fire this compensates for the loss; and the figures show that, in one or two cases, the engine actually gained a little in pressure. The point is probably one not deserving much consideration, but it proves that the vacuum brake is not economical in the use of steam. As regards the pumps in the vans, we are unable to say much. Concerning the aid which they lend to the ejector we have no data, but it is obvious that they must cause a good deal of resistance. So far as we know, they are not used on any railway where the vacuum brake is employed but the Great Northern, and there only to a limited extent. There are obvious objections to the adoption of such appliances, which railway men will understand.

The figures we have given demonstrate incontestably the superior efficiency of the Westinghouse brake. As to the cost of maintenance and repairs either of it or of the Smith brake we can say nothing. Mr. Maclaren will, no doubt, settle this point to his satisfaction during the next few months, and we have no doubt whatever that in arriving at their final decision the locomotive superintendents of Scotland will carefully weigh every argument for or against either system; and there is every reason to conclude that, from the cautious and important manner in which they have gone to work, they will be able, on the conclusion of their brake labours, to assert with propriety that they have chosen the best brake submitted to them, and then they will have nothing to regret in dealing with the money of their companies and the well-being and safety of their passengers.

PRINTING SPECIFICATIONS.

In a recent impression we gave the substance of some observations on the above subject which fell from the MASTER OF THE ROLLS during the hearing of the action of Hinks and Sons v. The Safety Lighting Company. These observations have attracted considerable attention, and we therefore think it well to give an accurate verbatim report from the shorthand writer's notes of the conversation which passed between Bench and Bar, on the occasion mentioned.

Rolls Court, 12th December, 1876.

THE MASTER OF THE ROLLS: to the officer: Go round and get me the original drawing of Mr. Hinks' patent. It is far better. These are very imperfect always—they must be—in fact they are not intended for judicial purposes, they are not certified copies.

MR. ASTON: And they are becoming worse under the new system. I wish I might call your lordship's attention to the very great deterioration which is now taking place in the office in the production of those copies. They are made on a very inconvenient scale, my lord.

THE MASTER OF THE ROLLS: I do not think so, Mr. Aston, and I have had great inquiry made into it.

MR. ASTON: I can only give your lordship the result of my experience.

THE MASTER OF THE ROLLS: I have taken the opinions of a number of people; the alteration was made after the greatest care and inquiry.

MR. ASTON: I wish I had heard of it. I should have been very glad.

THE MASTER OF THE ROLLS: All that I can tell you is, that a meeting of patent agents was summoned as to whether it was requisite to make the alteration; and they agreed, with one single dissentient, that it was a most valuable alteration, and it would facilitate business very much.

MR. ASTON: After that, of course, I have nothing further to say; but it is quite new to me.

THE MASTER OF THE ROLLS: It was done very carefully, and after great deliberation. If you go to the patent agents they will tell you that it was done after they had made a written report, and the dissentient also made a written report.

MR. ASTON: It only shows how ignorant one may be of what one thought one knew a great deal about.

THE MASTER OF THE ROLLS: The leading patent agents were summoned together upon it.

MR. ASTON: All I can say is, I have heard nothing but complaints in my experience.

THE MASTER OF THE ROLLS: It is wonderful that you should not have heard of it. The people who were consulted about it were the patent agents. I was not at all in a hurry to sanction the alteration.

MR. ASTON: I was not aware that your lordship had sanctioned it.

THE MASTER OF THE ROLLS: It was not only sanctioned by me, but by all the Commissioners on written reports made at a special meeting, after the greatest care, and after the most patient inquiry, extending over a very long period.

MR. ASTON: I am much obliged for that information.

THE MASTER OF THE ROLLS: I may tell you how it works, from the reports of the officials at the Patent-office, and all the present officials were unanimous; there was not a single one who dissipated of it. When I tell you that we had a report from Mr. Atkinson, the Librarian, and from Mr. Lucas, the head of his office, who both agreed, and who probably have had greater experience than any man living, you will think it was not done carelessly.

MR. ASTON: I did not know it had been done by the Commissioners. I thought it was an official alteration.

THE MASTER OF THE ROLLS: Oh dear, no; they don't do those things without the knowledge of the Commissioners.

MR. ASTON: I am very glad to hear it, my lord.

THE MASTER OF THE ROLLS: I think the commissioners are masters in their own office; but I should be very much astonished if they made any alteration without my sanction.

MR. ASTON: I am very glad to hear it.

Wednesday, 13th December, 1876.

THE MASTER OF THE ROLLS: I see, Mr. Aston, there is a slip in the report of the Times which may be rather annoying to the gentleman who was in the minority. I stated that there was a minority of one at the meeting of the patent agents, who sent me a long written report, and took a great deal of trouble about it, and I do not think he would like to be left out, and I remember I said so yesterday. The Times makes it unanimous, but it was not so.

MR. ASTON: I was taken by surprise at hearing the alteration had the sanction of your lordship, but I hoped your lordship would give an opportunity for the matter to be reconsidered.

THE MASTER OF THE ROLLS: Mr. Aston, the matter was considered at the greatest length; it was months before it was resolved upon, and the greatest possible trouble was taken about it. You look at it only with regard to the patents used for litigation, which are very few. There are a numerous multitude which are never litigated at all.

MR. ASTON: But that has been my point on several occasions, as your lordship knows; and for one patent which is litigated in court, I have to read about 100 myself.

THE MASTER OF THE ROLLS: You may, but the number of litigated patents is so small, that in considering the convenience of the public you must not take them much into account, and a provision is made for obtaining full-sized copies, if any litigant requires it.

MR. ASTON: That I was not aware of either. I am exceedingly glad to hear it.

THE MASTER OF THE ROLLS: Any litigant may go to the office and get full-sized copies. The originals have not been reduced on that account, and have been kept of the old size.

MR. ASTON: I must apologise for my ignorance, only I had abstained from taking any active part in it.

THE MASTER OF THE ROLLS: I take a very active part, and know all that goes on, and I think nothing goes on without my knowledge.

MR. ASTON: I am glad to hear that that is so, and especially to know that there are some copies that are available for court purposes, if I may say so.

THE MASTER OF THE ROLLS: The originals are sent in exactly as they were before. They were compelled to send two copies; they are sent in of the same size as before; they have never been reduced, and are kept in the office as they were before; anybody choosing to pay for them could get copies of them.

MR. MACROBERT: I am sure the profession will be glad to know that.

THE MASTER OF THE ROLLS: When I tell you that the result has been to make the copies of the patents so accessible, that what used to take twenty-three volumes in the year, has come down to seven in the library this year, it will rather astonish you. You may imagine the comfort to readers.

MR. ASTON: True; but I hope that your lordship will also, notwithstanding that, be an advocate for the extension of the accommodation, and that the means provided by the Treasury are not accepted as being sufficient, notwithstanding your lordship may have made those alterations for the convenience of keeping the present numbers. I do think, my lord, that an extension of the accommodation is necessary.

THE MASTER OF THE ROLLS: What accommodation?

MR. ASTON: Library accommodation.

THE MASTER OF THE ROLLS: I have done all I could to do it, and I believe the Treasury are equally willing, but the difficulty is to find a place. If you can find a new site for us, we shall be glad. We have been looking out a long time, and have had various offers from the Government and others. It was only the other day that I directed the officers to go down and look at Sergeant's-inn, to see if that site was big enough. I am afraid the report was not as favourable as I anticipated as to size, but we have been looking out a long time.

MR. ASTON: I am receiving information this morning, which I hear with very great pleasure.

We may supplement the above by reminding our readers that the full-sized copies of the drawings alluded to by the Master of the Rolls are, no doubt, the office copies, which have always been procurable, and are not, therefore, new benefits to the public.

THE LATE SIR TITUS SALT.

By the death of Sir Titus Salt, which took place on the 29th ult., another of the founders of our manufacturing prosperity, and of the few to whom England is for her greatness so largely indebted, has passed away. Few can be said to have done so much unmixing good for his country's welfare. From what was a useless material he has built up a great industry which has for years in his own model town supported several thousand people whose life has been made the happier by comforts and institutions which many a far larger community would gladly boast of. He has given rise to various smaller industries, has helped to clothe millions with an excellent material, and has assisted many thousands by his great generosity. Sir Titus Salt, who is probably known all over the world as the inventor of alpaca as a clothing material, was born in 1803, and educated at the Heath School, near Wakefield, and afterwards taken into partnership in his father's business of wool dealing, which he had just then removed from Wakefield to Bradford. At that time the place was a mere manufacturing village. The chief seat of the woollen trade had been at Wakefield, but the manufacturers there adhered to the old system of home-spinning, and the new

factory system of manufacture established itself at Bradford. A wool called Donkool, grown on the banks of the Don in the south-east of Russia, first attracted his notice, and his success in making a useful fabric of this coarse article laid the foundation of his more important enterprise. His fortune is said to have been to some degree due to an accident. In the year 1836 a Liverpool broker showed him some bales of shining hair which had been sent to him, and which nobody would look at. They were from the fleeces of the alpaca, a creature which had been brought by the Spaniards from Peru. Young Mr. Salt took home one bale, and soon returned and bought as much more as the Liverpool merchant could supply. After much persistent effort he invented a method not merely of utilising the alpaca wool in the manufacture of stuff, but in producing an entirely new substance which had in it all the elements of commercial value. The new stuff speedily became a vast article of commerce; and the inventor was rewarded by a great increase of his business. He had, in fact, increased the resources of the country, and brought a new trade to the Yorkshire district where he lived. He had made an article which was before useless, and made it into a producer abroad, to the manufacturer at home, and to the consumer all over the world. His firm became, of course, the head of the alpaca manufacture, and the centre of the wealth and activity of a prosperous district.

The "accident" was, therefore, limited, to his being shown the bales of dirty hair which had already been seen by thousands. Had not Sir Titus combined a contempt for the prejudices which had prevented the new use of an untried material, with inventive skill and good judgment, we should never have heard of him any more than of his father, whose name is now known through the fame which has attended the persevering efforts of a talented son. About the time of the Great Exhibition Sir Titus Salt determined to take his works and workshop into the country. A strip of land was bought at Shipley near the Midland Railway and the river Airedale, and a building was erected on it which was then regarded as the largest and handsomest factory in the world. The whole range of buildings covered six acres and a-half, and the ventilation, the lighting, and the sanitary precautions were as perfect as they could be made. The workpeople, some four thousand in number, were housed in good cottages, and the village thus created was supplied with park, cricket ground, public institutions, lecture halls, and places of worship, by its founder. At the last census it contained 820 houses and 4389 persons, and probably there is no other community which is so young and which has already possessed itself of so many public institutions. One of his latest deeds was the offer of a piece of land for a board school. He had previously built a handsome Congregational Church, to which only last year a new Sunday-school was added at a cost of £10,000. He had long since provided baths and washhouses, large schoolrooms, and a hospital and infirmary, and he has added to these a range of forty-five almshouses for widows and aged couples, with an endowment of ten shillings a week for the latter and seven and sixpence for the former. His care for the welfare of the workpeople who were carrying on his own manufacture did not limit Sir Titus Salt's munificence, for Bradford owes a park, a club, institute, and library to his generosity. In 1829 Sir Titus married Caroline, daughter of Mr. George Whitlam, of Grimby, by whom he has had a family of eleven children. Several of his sons have become partners in the firm now known as Sir Titus Salt, Bart., Sons, and Co.

EDINBURGH AND LAMB ENGINEERS' SOCIETY.—A meeting of this society was held on the 27th ult. Mr. Robert C. Reid, C.E., in the chair. A paper was read by Mr. Robert Little, C.E., on "Railway Tunnels." The author gave a description of the methods usually adopted in the construction of railway tunnels, and the difficulties experienced in such works were illustrated by reference to the Birnam Tunnel, on the Highland Railway, near Dufkeld, in which for a distance of 128 yards the enormous amount of 41,700 cubic feet of timber was left in it in consequence of the soft nature of the material rendering it impossible to withdraw it. Several other tunnels were described, and their costs of construction given, which ranged from £15 to £80 per lineal yard. Mention was also briefly alluded to, his steep gradient and extended angle being considered objectionable. The St. Gotthard, it was stated, was not M. Favre's most stringent conditions to be constructed in eight years at the rate of £118 8s. per lineal yard, and at the present rate of progress M. Favre might be expected to finish it within the stipulated time.

A YEAR'S SHIPBUILDING IN LIVERPOOL.—The general depression of trade during the year has caused a slight diminution in the amount of shipbuilding on the shores of the Mersey. About 37,250 tons of sailing and steam shipping have been turned out from the various work yards. Messrs. Bowdler, Chaffor, and Co., of Seacombe, have launched since January seven vessels, of which four were steamers, the total tonnage being 7338 tons. Messrs. Laird Brothers, Birkenhead, have launched or completed during the year eight vessels, with a total tonnage of 6150 tons, of which seven were steamers, including H.M. sloop of war Griffon. The troop ship Euphrates has also been refitted and repaired at Messrs. Laird's yard, and the engines of H.M.S. Shannon have been renewed. The yards at the south end of Liverpool have been tolerably busy during the year. Messrs. W. H. Foster and Co. have sent out 8474 tons in the form of eleven vessels, and the same firm was a steamer. In addition to shipbuilding this firm has done a large amount of forgings, both for its own use and the use of other firms. Messrs. Thomas and Sons have turned out seven vessels, one of which was a steamer, the total tonnage being 7010 tons. Messrs. H. and J. Evans have built four vessels, one of them a steamer, of the total tonnage of 4918 tons. In connection with the shipbuilding trade of the port it may be stated that a large amount of work has been turned out of the north-end foundries. The firm of Fowles, Ansdall, and Co., have been largely commissioned by Government.

TORPEDOES IN THE UNITED STATES.—Mr. Jeffers, chief of the American Bureau of Ordnance, states in his report, that the subject of movable torpedoes has made no progress during the past year. The station, Lay, and Ericsson torpedoes were sent to the Centennial Exhibition as part of the naval exhibit. Captain Ericsson has improved the simple torpedo of his design, with a view to increase of speed, and further trials will be made in the spring. Mr. Lay offered a second boat for trial, but has not yet succeeded in obtaining a satisfactory speed with his device. It is of the opinion that the ability to direct the course from the shore would not warrant accepting a rate of speed of twenty-five miles, as a compensation for the great cost and complex nature of this device and apparatus.

He has succeeded in obtaining but little more than one-half that speed. The fish torpedo of Whitehead is launched with great accuracy at the rate of eighteen knots in smooth water for a distance of 200 yards, but from latest information it does not appear to be successful at sea. The development of the locomotive torpedoes is of the highest interest, and, as yet, we are only groping for a solution. There has been completed and put in service a fast torpedo launch—the Lightning—designed by Mr. Z. B. Henshaff, of Bristol, Rhode Island, under the direction of the Bureau, which has made a run of twenty miles in one hour, and for short distance a speed of upwards of twenty-five miles, fulfilling all the conditions required. Some experiments have also been made with a service launch supplied with a safety coil boiler and engine steered very promptly, weighs very much less than service fittings, and is entirely safe from damage by the explosion of the torpedo attached to the launch. Professor Farmer, who has been identified with the electrical attachments for guiding the Lay submerged boat, has also, at my suggestion, arranged a very compact attachment to be placed in any steam launch, which—without alteration in her fittings—starts, stops, steers her, and explodes at will the torpedo attached. This device can be fixed in place or removed in ten minutes, but is very little of an encumbrance if permanently fixed.