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GROUP 2. *Fig 1.* LONGITUDINAL SECTION

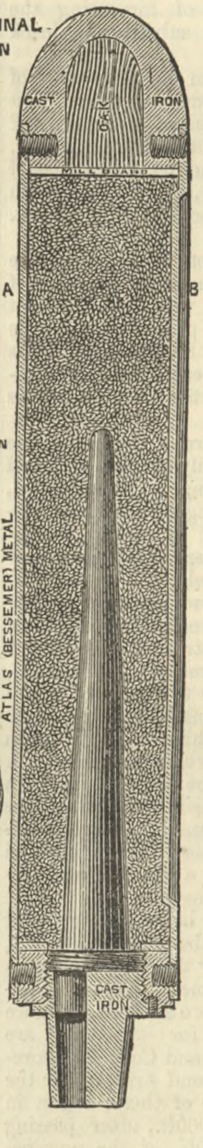


Fig. 4 SECTION ON LINE A.B

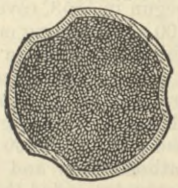
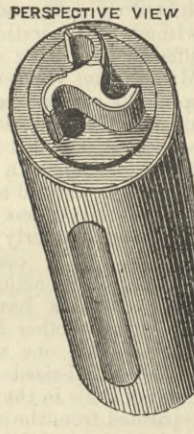


Fig 2. COMPOSITION PERSPECTIVE VIEW



REAR ELEVATION

Fig 3.

Fig. 6. GROUP 1

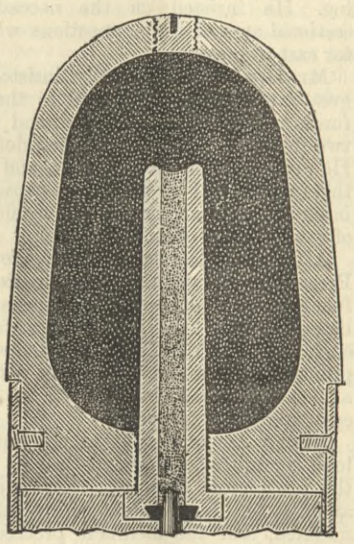


Fig 7.

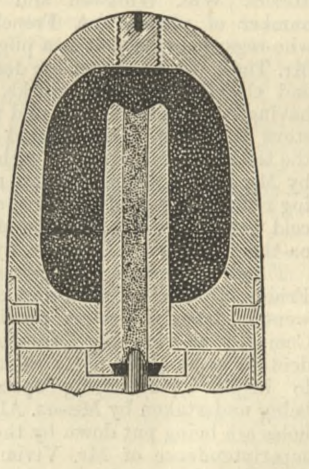
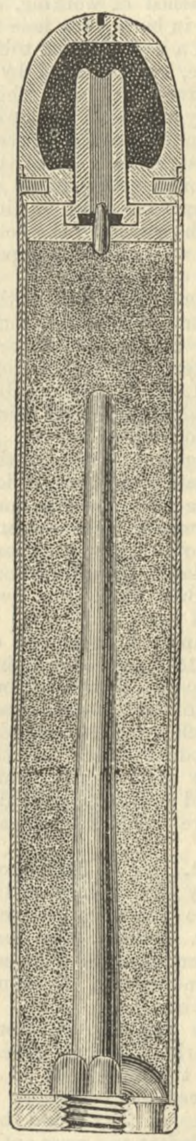


Fig 5



The process of inserting the composition has naturally been always regarded as one involving danger, although insignificant accidents only have occurred for a long stretch of years now. When pressure is employed amounting to nearly 100 tons on the head of a 24-pounder rocket, heat and friction may be generated by the slightest irregularity. The buildings, then, where rockets are charged and finished are small detached huts, situated in what may be described as a danger region in the marshes to the east of the Arsenal, while all the means of approach are wooden pathways carrying gun-metal rails for hand trucks. The men are made to wear special clothing and slippers, and all grit is carefully excluded. The buildings are small, and are separated by earth traverses in many cases. They have light roofs of corrugated iron, it being considered that it is better generally for a roof to be blown off easily than to oppose resistance that would generate a violent shock. The shed where the accident occurred is a small one where rockets are painted and packed, and where, of course, the existence of explosive composition and the presence of iron constitutes an element of danger, although a very small one, for it is generally necessary to direct a strong flame directly into rocket composition to ignite it. It seems very unlikely that this could occur.

We are unable at present to say in what way the explosion arose. This will now be inquired into by Government officials with special knowledge, as well as by a coroner's jury; but, as we say, while great care is taken to reduce the danger, the possibility must always exist. The risk is confined, of course, to as few men as may be. We may mention that there are processes where very much greater danger is present. We would instance the hut where cap composition is mixed. In this a solitary man brushes the percussion ingredients together through a very fine brass wire sieve. He employs a soft camel's hair brush, and needs the greatest skill. We remember many years since watching the process, and were informed by the operator that if anyone else attempted to try the process he would run for his life. He had seen the ingredients catch in the hairs of the brush, and had repeatedly known a flash to occur on the sieve, but the gauze, acting like a Davy lamp, kept it from reaching the composition that had already passed through, which, though in small bulk, would have killed him. His two predecessors had been eventually blown up, one in a private factory. The danger involved even in pressing rockets is hardly to be compared to this, and in the other processes it is comparatively nothing. On Monday morning, however, by some means yet to be arrived at, an explosion took place which brought a rush of men to the spot. The details have been capitally described in the morning and other daily papers. Driven back by the violence of flame and the danger of the burning rockets, which were playing about inside the building, and escaping in numbers, Colonel Lyon, the superintendent, and the staff, and such of the laboratory men as repaired to the spot at once, could only watch for an opportunity to act with effect. The man and boy employed in the shed were missing, but the roof had fallen in, and the state of the building was such that they could no more be expected to be alive than had they fallen into the interior of a furnace and remained there. Then followed a strange scene—we write from observation, for we happened to be in the arsenal and saw it. Rockets continued for a long time—over an hour we believe—to fly from the buildings in all directions. Then men of the various workshops came out of the doors and watched, till occasionally some rockets came whizzing over in their direction, when they would get under cover of the buildings for a minute. The appearance was as if the rockets were being discharged on purpose. Needing no sticks, they flew straight and true in whatever direction they happened to start. Happily, as we have seen, there was no danger of a burst at the end. At the same time, a 24-pounder rocket is a most dangerous and eccentric missile, which differs from a shot in being ready to make a fresh start after any stoppage until its composition is burnt out. Marshall Marmont, who was a great advocate of rockets, argued that a battle was always won, not by the number of men killed but the number of men frightened. He considered a rocket admirably adapted to effect this end. It may be conceived then that hundreds of iron rockets 2ft. long formed a startling surprise to the neighbourhood. We hear that one fell on the top of Shooter's Hill, one on a part of Plumstead Common called the Slade. These distances are about a mile as the crow flies. Many fell in Woolwich and Plumstead, in Green's-end, Artillery-place, and Hare-street; one or two are said to have gone over two miles, none, however, causing personal injury. Perhaps as narrow escapes as any are said to have happened in a street close to Woolwich Common, where a woman who was washing was startled by a rocket entering the building and cutting away the leg of her table, and a board school girl who had her desk cut through by a rocket.

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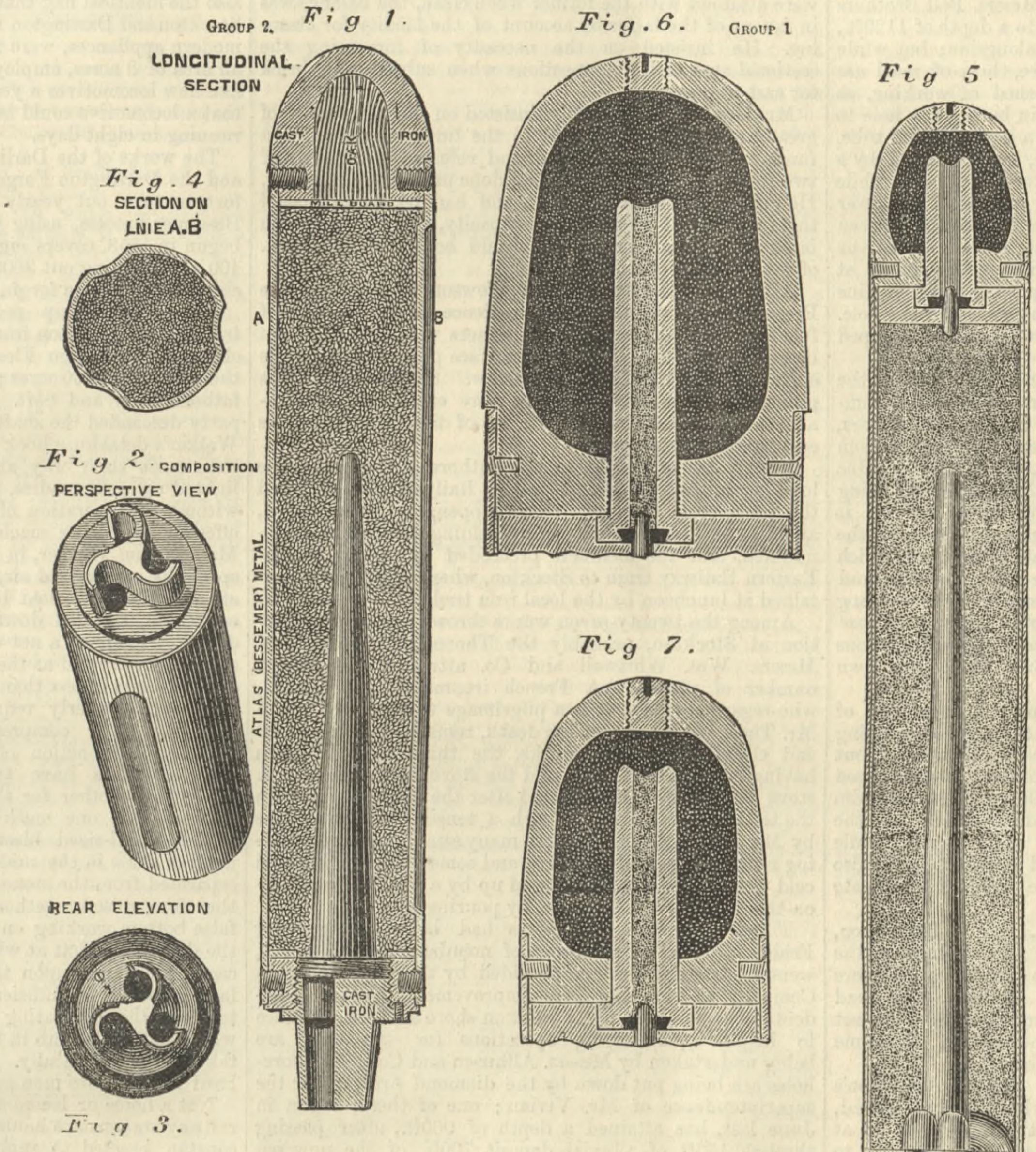

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Mr. Wood had been the last in the district to put up Mr. Cowper's stoves, and had hardly had time to derive the full benefit from their use; but he was working with 20·75 cwt. of coke, which was a good result, and the quality of the iron was improved, which was equal to a further reduction in the quantity of coke.

Mr. Jenkins here interposed and informed the meeting that a serious accident, as stated in our last impression, had occurred at the North-Eastern Steel Company's works, in some metal being spilt, and that Mr. Samuel Davison, of the Horbury Junction Ironworks, near Wakefield, who had been elected a member on the previous day, had been so seriously burnt that he was not expected to recover. Under the circumstances the meeting was adjourned by the president, and the excursion to the North-Eastern Steel Works abandoned.

The effect of this untoward circumstance was to cause more members to visit the works of Messrs. Bell Brothers, and to somewhat modify the order of the afternoon's excursion. The members first visited the salt bore hole on the north side of the Tees, put down by Messrs. Bell Brothers by the diamond drill. This was sunk to a depth of 1120ft., and the cores are laid in their order alongside; but while the red sandstone cores remain entire, those of marl are naturally crumbling away. The method of working, as described by Mr. T. H. Bell, consists in boring the hole to the bottom of the salt bed, putting in a wrought iron tube, which rests on the bottom of the hole, but supported by a ring on the surface. This tube is pierced with holes, while it receives an inner tube which is only pierced at the lower part. Fresh water flows into the annular space between the two tubes, and finds its way through the holes at the bottom, and an engine works the double-acting pump at fourteen strokes a minute, bringing up from eight to nine gallons of brine at each stroke from the bottom of the hole. The brine is collected in a reservoir, whence it is pumped into ordinary evaporating pans.

The party, divided into five sections, next visited the Clarence Ironworks of Messrs. Bell Bros., which were commenced in 1851, and now contain twelve blast furnaces, each 80ft. high. They vary in diameter at the boshes from 17ft. to 25ft., and in capacity from 11,500 to 25,000 cubic feet. All the ore is roasted in ovens adjoining before being charged into the furnace, an operation which renders it more fusible and gets rid of a large proportion of the water. The gases are utilised for heating the blast, which is supplied by ten engines, four of the old beam type and six vertical. The vertical hoists are worked by Armstrong hydraulic rams and chains passing over pulleys. These furnaces run exclusively on Cleveland phosphoriferous ore, which is raised by Messrs. Bell Bros., from their own mines, to the amount of 20,000 tons a week.

Thursday's excursion was wound up by an inspection of the Anderston Foundry, started in 1876, and employing nearly a thousand hands. It is capable of turning out 70,000 tons of castings per year, many of which are produced by the company's patent moulding machines. Cleveland iron is mainly used; and the finished products chiefly take the shape of cast iron railway chairs and sleepers, while wrought iron and steel switches and crossings, and also pressed steel and iron sleepers, are made in separate departments.

On Thursday, 20th, the president, Mr. B. Samuelson, announced that all the sufferers by the accident at the North-Eastern Steel Works on the previous day were progressing favourably except Mr. Davison, who had died on the previous night. A subscription had been set on foot for his widow and family, and several handsome subscriptions had already been received.

The discussion on Mr. Cowper's and Mr. Howson's papers was then resumed. Mr. Charles Wood remarked, with reference to the former, that in the stoves put up at the Tees Ironworks, they had reduced the brickwork to one-third, leaving two-thirds air space, as they found that the blast holes were not big enough before and were apt to choke up. The main object of Mr. Howson's paper was to show why a new furnace should work better than an old one. In a new furnace, as long as the pressure of blast and regular blowing were kept up, the interior would be kept free from scaffolds; but if the temperature of the blast were reduced, through strikes or other causes, accumulations would at once begin to form; and then, when the blast was again increased, all this stuff had to be melted down, and, to bring back the quality of the iron to what it was before, an additional cwt. of coke per ton was required. Another reason why a new furnace worked better than an old one was that the lines altered in shape, the thick walls melted away, and, instead of the hearth being 9ft. or 10ft. in diameter, it would burn out to 12ft. or perhaps 14ft. The blast then circulated on the opposite side of the furnace to where it was wanted, and helped to bring down the scaffolds. If the original line of wall could be maintained, so as to confine the blast within a certain area, the furnace would work all the better. By making the walls thin round the hearth, immediately above the tuyeres, this burning away was prevented, the furnace worked steadily and made but little scaffolding, and the hearth remained clear, because it retained its original size.

Mr. Edward Williams considered that the Cleveland furnaces were using on an average 23 cwt. of coke per ton of iron produced, cast iron stoves being still largely used. He did not think any great saving would be effected by substituting brick stoves, but he should certainly adopt them on putting up new furnaces. Whatever kind were used they must be cleaned thoroughly and regularly, and whatever stoves answered this condition were best. It was a mistake to suppose that economy was effected by adding to the diameter of a furnace, whereas it was the height that should be increased. Acting on the advice of the late Mr. Menelaus, the furnaces at Treforest had been built 70ft. high and 17ft. in diameter; they worked for about two years with about $18\frac{3}{4}$ cwt. of coke to the ton, when suddenly the coke went up to over 19 cwt. He did not believe that this was due to the furnace wearing as it got older, according to Mr. Howson's supposition, but to the fact that a cheaper coal had been used for coke-making.

Mr. Wm. Whitwell observed that the use of the brick stove might be compared to trading with a balance at the bank, whereas the cast iron stove was like spending one's income as fast as it was received, and there was no guarantee that it might not be burnt out in a few hours. He claimed this advantage for the Whitwell stove, that it could be cleaned from top to bottom at a cost not exceeding £2.

Mr. T. Hugh Bell said that there had been at the Clarence furnace an economy in fuel from $32\frac{1}{2}$ cwt. in 1857 to 27 cwt. in 1864, amounting to 5 cwt. or 6 cwt. per ton; and this was due not to a change in the dimensions nor alteration of heating power, but to mechanical contrivances and care in charging the furnaces.

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coming down and leaving the coke behind, but from its coming down saturated with the ascending gas. He agreed with Mr. Howson that the furnace described was good, for everyone must admit that scaffolds were more likely to form on low than on high boshes. He found that that furnace worked best in which the charge and the fuel were charged in alternate layers, as the blast could penetrate to the centre, consume the coke, and melt the layer of ore above.

Mr. Wood had been the last in the district to put up Mr. Cowper's stoves, and had hardly had time to derive the full benefit from their use; but he was working with 20·75 cwt. of coke, which was a good result, and the quality of the iron was improved, which was equal to a further reduction in the quantity of coke.

Mr. Jenkins here interposed and informed the meeting that a serious accident, as stated in our last impression, had occurred at the North-Eastern Steel Company's works, in some metal being spilt, and that Mr. Samuel Davison, of the Horbury Junction Ironworks, near Wakefield, who had been elected a member on the previous day, had been so seriously burnt that he was not expected to recover. Under the circumstances the meeting was adjourned by the president, and the excursion to the North-Eastern Steel Works abandoned.

The effect of this untoward circumstance was to cause more members to visit the works of Messrs. Bell Brothers, and to somewhat modify the order of the afternoon's excursion. The members first visited the salt bore hole on the north side of the Tees, put down by Messrs. Bell Brothers by the diamond drill. This was sunk to a depth of 1120ft., and the cores are laid in their order alongside; but while the red sandstone cores remain entire, those of marl are naturally crumbling away. The method of working, as described by Mr. T. H. Bell, consists in boring the hole to the bottom of the salt bed, putting in a wrought iron tube, which rests on the bottom of the hole, but supported by a ring on the surface. This tube is pierced with holes, while it receives an inner tube which is only pierced at the lower part. Fresh water flows into the annular space between the two tubes, and finds its way through the holes at the bottom, and an engine works the double-acting pump at fourteen strokes a minute, bringing up from eight to nine gallons of brine at each stroke from the bottom of the hole. The brine is collected in a reservoir, whence it is pumped into ordinary evaporating pans.

The party, divided into five sections, next visited the Clarence Ironworks of Messrs. Bell Bros., which were commenced in 1851, and now contain twelve blast furnaces, each 80ft. high. They vary in diameter at the boshes from 17ft. to 25ft., and in capacity from 11,500 to 25,000 cubic feet. All the ore is roasted in ovens adjoining before being charged into the furnace, an operation which renders it more fusible and gets rid of a large proportion of the water. The gases are utilised for heating the blast, which is supplied by ten engines, four of the old beam type and six vertical. The vertical hoists are worked by Armstrong hydraulic rams and chains passing over pulleys. These furnaces run exclusively on Cleveland phosphoriferous ore, which is raised by Messrs. Bell Bros., from their own mines, to the amount of 20,000 tons a week.

Thursday's excursion was wound up by an inspection of the Anderston Foundry, started in 1876, and employing nearly a thousand hands. It is capable of turning out 70,000 tons of castings per year, many of which are produced by the company's patent moulding machines. Cleveland iron is mainly used; and the finished products chiefly take the shape of cast iron railway chairs and sleepers, while wrought iron and steel switches and crossings, and also pressed steel and iron sleepers, are made in separate departments.

On Thursday, 20th, the president, Mr. B. Samuelson, announced that all the sufferers by the accident at the North-Eastern Steel Works on the previous day were progressing favourably except Mr. Davison, who had died on the previous night. A subscription had been set on foot for his widow and family, and several handsome subscriptions had already been received.

The discussion on Mr. Cowper's and Mr. Howson's papers was then resumed. Mr. Charles Wood remarked, with reference to the former, that in the stoves put up at the Tees Ironworks, they had reduced the brickwork to one-third, leaving two-thirds air space, as they found that the blast holes were not big enough before and were apt to choke up. The main object of Mr. Howson's paper was to show why a new furnace should work better than an old one. In a new furnace, as long as the pressure of blast and regular blowing were kept up, the interior would be kept free from scaffolds; but if the temperature of the blast were reduced, through strikes or other causes, accumulations would at once begin to form; and then, when the blast was again increased, all this stuff had to be melted down, and, to bring back the quality of the iron to what it was before, an additional cwt. of coke per ton was required. Another reason why a new furnace worked better than an old one was that the lines altered in shape, the thick walls melted away, and, instead of the hearth being 9ft. or 10ft. in diameter, it would burn out to 12ft. or perhaps 14ft. The blast then circulated on the opposite side of the furnace to where it was wanted, and helped to bring down the scaffolds. If the original line of wall could be maintained, so as to confine the blast within a certain area, the furnace would work all the better. By making the walls thin round the hearth, immediately above the tuyeres, this burning away was prevented, the furnace worked steadily and made but little scaffolding, and the hearth remained clear, because it retained its original size.

Mr. Edward Williams considered that the Cleveland furnaces were using on an average 23 cwt. of coke per ton of iron produced, cast iron stoves being still largely used. He did not think any great saving would be effected by substituting brick stoves, but he should certainly adopt them on putting up new furnaces. Whatever kind were used they must be cleaned thoroughly and regularly, and whatever stoves answered this condition were best. It was a mistake to suppose that economy was effected by adding to the diameter of a furnace, whereas it was the height that should be increased. Acting on the advice of the late Mr. Menelaus, the furnaces at Treforest had been built 70ft. high and 17ft. in diameter; they worked for about two years with about 18¾ cwt. of coke to the ton, when suddenly the coke went up to over 19 cwt. He did not believe that this was due to the furnace wearing as it got older, according to Mr. Howson's supposition, but to the fact that a cheaper coal had been used for coke-making.

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The Cargo Fleet Ironworks, which were open to inspection, produce weekly 2000 tons of Cleveland pig, with five blast furnaces, which are among the best arranged in the district. Two furnaces, of a capacity of 15,178 cubic feet, were put up in 1866; two more, of 22,230 tons capacity, were added subsequently, and the fifth, of 20,000 tons, in 1875. They are all 75ft. high, but the diameters of both vary from 20ft. to 24ft. Owing to difference at the mouth, it is not the furnace that is widest in the bosh that has the greatest capacity. The blast is supplied by five blowing engines, of which one of 100-horse power is an old beam engine by Hawks, Crawshay, and Sons, Gateshead; two of 50-horse power each are by Coulter, of Blackburn; and one of 80-horse power is by Cochrane, Grove, and Co. The fifth, generally kept in reserve, of 90-horse power, is by Kitson and Co., of Leeds. It has an inverted direct-acting cylinder, of 40in. in diameter, and 4ft. 6in. stroke; the connecting rods from the crosshead working on to crank pins in the fly-wheels.

After visiting this company's mines, the members were entertained at luncheon in the school-room. Mr. J. G. Swan, the managing director, presided. The day's doings, and indeed the Middlesbrough meeting, were pleasantly brought to a close by a conversazione, given by Mr. and Mrs. Carl Bolckow, at Marton Hall. Art treasures were there in abundance, including busts, by Wyatt, of George and Robert Stephenson, Rendle, Fowler, Hawkshaw, and Nicholas Wood.

THE GIANT'S CAUSEWAY ELECTRICAL TRAMWAY.

THIS day, September 28th, the Portrush and Bush Valley Tramway, or as it is sometimes called the Giant's Causeway Tramway, will be opened by the Lord Lieutenant of Ireland and the Countess Spencer. This is the first electric tramway in the United Kingdom.

In the summer of 1881, Mr. W. A. Traill, late of H.M. Geological Survey, suggested to Dr. Siemens that the line between Portrush and Bushmills, for which parliamentary powers had been obtained, would be suitable in many respects for electrical working, especially as there was abundant water power available in the neighbourhood. Dr. Siemens at once joined in the undertaking, which has been carried out under his direction. The line extends from Portrush, the terminus of the Belfast and Northern Counties Railway, to Bushmills, in the Bush Valley, a distance of six miles. For about half-a-mile the line passes through the principal street of Portrush, and has an extension along the Northern Counties Railway to the harbour. For the rest of the distance, the rails are laid on the sea-side of the county road, and the head of the rails being level with the ground, a footpath is formed the whole distance, separated from the road by a kerbstone. The line is single, and has a gauge of 3ft., the standard of the existing narrow-gauge lines in Ulster. The gradients are exceedingly heavy, being in parts as steep as 1 in 35. The curves are also in many cases very sharp, having necessarily to follow the existing road. There are five passing places, in addition to the sidings at the termini and at the carriage depôt. At the Bushmills end the line is laid for about 200 yards along the street, and ends in the market place of the town. The system of working is almost identical with that adopted at the Crystal Palace, save that instead of the rails being used as conductors, a separate conductor is employed, consisting of a third rail, weighing 19 lb. to the yard, and standing close to the fence, and through this electricity is transmitted to the Siemens motors, which propel the cars in a way too well understood to need description here.

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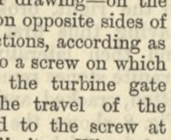

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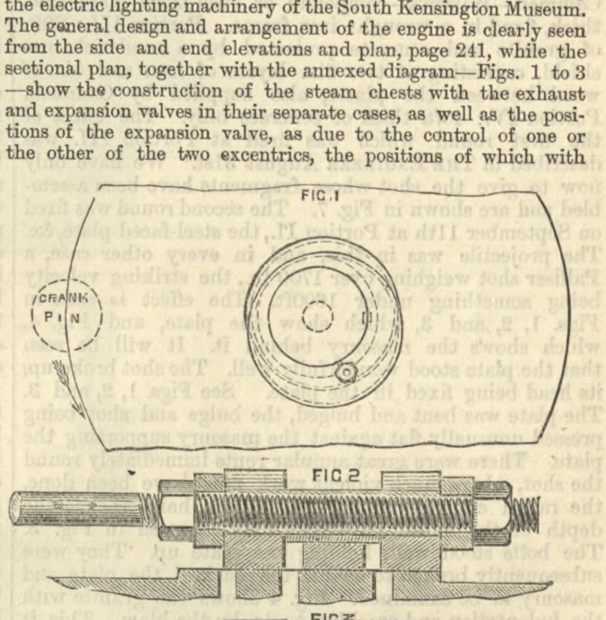
Regarding the primary cause of this explosion, there can scarcely be two opinions. The piston and valves were lubricated with olive oil, and the latter, becoming ignited by the heat of the compressed gas, had communicated its combustion to the steel and iron of the apparatus. Although the pump and receiver were not artificially cooled, yet this circumstance did not in all probability contribute materially to the ignition, because the oxygen was very slowly pumped into the receiver, the operation having to be frequently interrupted, to wait for the necessary quantity of gas which was being contemporaneously generated. Moreover, it had been found immediately before the explosion that the receiver was quite cold, and the head of the pump only just perceptibly warm. A few days previously sixty atmospheres of oxygen had been with impunity rapidly pumped into the same receiver, and equally without any external refrigeration. How, then, is this difference of result to be accounted for? The answer to this question is not difficult, when an apparently trivial alteration in the condition of the apparatus in the two operations is known. In the directions for the use of Natterer's apparatus, contained in the article "Kohlensäure"—*Handwörterbuch der Chemie*, vol. iv.—the writer states that before the pumping begins the space between the piston and the valve should be filled up with oil, so as to prevent the retention of any gas between the piston and the valve when the former in compression is pushed to the extreme limits of its stroke. Any gas so remaining in such space—schädlicher Raum—expands again on the return of the piston, and thus causes, if not an actual loss of power, at least a considerable retardation in the compressing process. In the operation above described, in which sixty atmospheres were compressed with impunity into the receiver, the directions of the *Handwörterbuch* were omitted to be taken; whilst in the subsequent experiment, in which ignition occurred, a layer of olive oil about 0·1in. in thickness was poured upon the piston, so as to exactly fill the space above mentioned.

Now a careful examination of the burnt parts of this apparatus left no doubt that the combustion began in the space between the piston and the valve, and that it was the layer of oil which first became ignited. The compression of oxygen to one twenty-fifth of its volume, should, according to thermo-chemical laws, raise the temperature of the oxygen to upwards of 2000 deg. C., but after making due allowance for the loss of heat to surrounding surfaces, there still remains a temperature sufficiently high for the ignition of oil under favourable circumstances. If the oil be spread in a thin film upon the surface of a mass of metal, the rapid absorption of heat by the latter prevents the temperature of the oil rising to its igniting point; but, in the form of a layer, 0·1 of an inch in thickness, no such rapid refrigeration can occur, and the surface of the oil in contact with the gas may become ignited by the rapid communication to it of the high temperature of the compressed oxygen. This should serve to caution those who may be disposed to use combustible lubricants in the compression of oxygen or nitrous oxide. If ignition of the oil occur at high pressure, it will assuredly be communicated to the iron of the receiver, which evidently burns in oxygen compressed twenty-five times, *with at least the same facility as tissue paper in atmospheric air*, the condition of the various parts of the apparatus, after the explosion, leading to the conclusion that the combustion from the beginning to end occupied only a short time, probably not more than three or four seconds. The risk attending the compression of oxygen and nitrous oxide may be avoided by the employment of a non-combustible lubricant, soft soap appearing to be the material best suited.

The facility with which a mass of iron thus becomes ignited, and the rapidity with which it burns in oxygen, at high pressures, suggests the possibility of employing shells of wrought or cast iron charged with compressed oxygen for warlike purposes. The interior of such a shell would scarcely be more difficult to ignite than gunpowder, and, once ignited, the pressure of the enclosed oxygen would, notwithstanding its absorption, be for some time augmented by the intense heat, whilst the walls of the shell would become thinner until they finally burst into fragments of burning and semi-molten iron. Andrews' calculations show that 780 cubic inches of oxygen in combustion with iron would evolve sufficient heat to raise 1 lb. of cast iron to its melting point. This amount of oxygen introduced into the receiver above described would exert a pressure of 20·5 atmospheres; it would require a quantity of oxygen exerting a pressure of 125 atmospheres to raise the whole receiver to the melting point of cast iron. These conditions are not encouraging, for although a less amount of oxygen would suffice for the purpose required, the thickness of the vessel when used as a projectile would doubtless have to be augmented, and little could probably be effected with less than 100 atmospheres of oxygen forced into the shell—a pressure, which, it is to be feared, would prove not only dangerous, but unmanageable.

HORIZONTAL ENGINE WITH AUTOMATIC EXPANSION GEAR.

THE engravings which we give on page 241 illustrate the horizontal engine by which most of the machinery was driven in the recent Electric Light Exhibition at the Aquarium. A pair of the same engines working on one shaft and indicating about 400-horse power, is also fixed in the Fisheries Electric Lighting installation, as illustrated in our impression of the 14th inst., this pair having been purchased by the Government for working the electric lighting machinery of the South Kensington Museum. The general design and arrangement of the engine is clearly seen from the side and end elevations and plan, page 241, while the sectional plan, together with the annexed diagram—Figs. 1 to 3—show the construction of the steam chests with the exhaust and expansion valves in their separate cases, as well as the positions of the expansion valve, as due to the control of one or the other of the two excentrics, the positions of which with



relation to the crank pin are shown at Fig. 1. It will be seen that the range of movement of the link connecting the ends of the two expansion excentric rods is but small, so that the governors by which the link is controlled need also but a small range of vertical movement to make a considerable difference in the point of cut-off. The cylinder of the engine is 18·5in. in diameter, and the stroke is 32in. It makes the same number of revolutions as the double engine at the Fisheries Exhibition, namely, 68, and may be taken as half the power. Although not shown on the engraving, a dash-pot is connected with the governor lever to steady the action on the link. The weight of the reciprocating parts is balanced by the crank disc, which is made of varying thicknesses. The whole engine is mounted on a strong bed-plate, which is extended in length when a condenser is attached, and its performance is such as to give a very high efficiency, while the arrangement of automatic cut-off gear described secures notable uniformity of rotation.

The Cargo Fleet Ironworks, which were open to inspection, produce weekly 2000 tons of Cleveland pig, with five blast furnaces, which are among the best arranged in the district. Two furnaces, of a capacity of 15,178 cubic feet, were put up in 1866; two more, of 22,230 tons capacity, were added subsequently, and the fifth, of 20,000 tons, in 1875. They are all 75ft. high, but the diameters of both vary from 20ft. to 24ft. Owing to difference at the mouth, it is not the furnace that is widest in the bosh that has the greatest capacity. The blast is supplied by five blowing engines, of which one of 100-horse power is an old beam engine by Hawks, Crawshay, and Sons, Gateshead; two of 50-horse power each are by Coulter, of Blackburn; and one of 80-horse power is by Cochrane, Grove, and Co. The fifth, generally kept in reserve, of 90-horse power, is by Kitson and Co., of Leeds. It has an inverted direct-acting cylinder, of 40in. in diameter, and 4ft. 6in. stroke; the connecting rods from the crosshead working on to crank pins in the fly-wheels.

After visiting this company's mines, the members were entertained at luncheon in the school-room. Mr. J. G. Swan, the managing director, presided. The day's doings, and indeed the Middlesbrough meeting, were pleasantly brought to a close by a conversazione, given by Mr. and Mrs. Carl Bolckow, at Marton Hall. Art treasures were there in abundance, including busts, by Wyatt, of George and Robert Stephenson, Rendle, Fowler, Hawkshaw, and Nicholas Wood.

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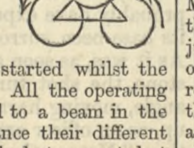

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Regarding the primary cause of this explosion, there can scarcely be two opinions. The piston and valves were lubricated with olive oil, and the latter, becoming ignited by the heat of the compressed gas, had communicated its combustion to the steel and iron of the apparatus. Although the pump and receiver were not artificially cooled, yet this circumstance did not in all probability contribute materially to the ignition, because the oxygen was very slowly pumped into the receiver, the operation having to be frequently interrupted, to wait for the necessary quantity of gas which was being contemporaneously generated. Moreover, it had been found immediately before the explosion that the receiver was quite cold, and the head of the pump only just perceptibly warm. A few days previously sixty atmospheres of oxygen had been with impunity rapidly pumped into the same receiver, and equally without any external refrigeration. How, then, is this difference of result to be accounted for? The answer to this question is not difficult, when an apparently trivial alteration in the condition of the apparatus in the two operations is known. In the directions for the use of Natterer's apparatus, contained in the article "Kohlensäure"—*Handwörterbuch der Chemie*, vol. iv.—the writer states that before the pumping begins the space between the piston and the valve should be filled up with oil, so as to prevent the retention of any gas between the piston and the valve when the former in compression is pushed to the extreme limits of its stroke. Any gas so remaining in such space—schädlicher Raum—expands again on the return of the piston, and thus causes, if not an actual loss of power, at least a considerable retardation in the compressing process. In the operation above described, in which sixty atmospheres were compressed with impunity into the receiver, the directions of the *Handwörterbuch* were omitted to be taken; whilst in the subsequent experiment, in which ignition occurred, a layer of olive oil about 0·1in. in thickness was poured upon the piston, so as to exactly fill the space above mentioned.

Now a careful examination of the burnt parts of this apparatus left no doubt that the combustion began in the space between the piston and the valve, and that it was the layer of oil which first became ignited. The compression of oxygen to one twenty-fifth of its volume, should, according to thermo-chemical laws, raise the temperature of the oxygen to upwards of 2000 deg. C., but after making due allowance for the loss of heat to surrounding surfaces, there still remains a temperature sufficiently high for the ignition of oil under favourable circumstances. If the oil be spread in a thin film upon the surface of a mass of metal, the rapid absorption of heat by the latter prevents the temperature of the oil rising to its igniting point; but, in the form of a layer, 0·1 of an inch in thickness, no such rapid refrigeration can occur, and the surface of the oil in contact with the gas may become ignited by the rapid communication to it of the high temperature of the compressed oxygen. This should serve to caution those who may be disposed to use combustible lubricants in the compression of oxygen or nitrous oxide. If ignition of the oil occur at high pressure, it will assuredly be communicated to the iron of the receiver, which evidently burns in oxygen compressed twenty-five times, *with at least the same facility as tissue paper in atmospheric air*, the condition of the various parts of the apparatus, after the explosion, leading to the conclusion that the combustion from the beginning to end occupied only a short time, probably not more than three or four seconds. The risk attending the compression of oxygen and nitrous oxide may be avoided by the employment of a non-combustible lubricant, soft soap appearing to be the material best suited.

The facility with which a mass of iron thus becomes ignited, and the rapidity with which it burns in oxygen, at high pressures, suggests the possibility of employing shells of wrought or cast iron charged with compressed oxygen for warlike purposes. The interior of such a shell would scarcely be more difficult to ignite than gunpowder, and, once ignited, the pressure of the enclosed oxygen would, notwithstanding its absorption, be for some time augmented by the intense heat, whilst the walls of the shell would become thinner until they finally burst into fragments of burning and semi-molten iron. Andrews' calculations show that 780 cubic inches of oxygen in combustion with iron would evolve sufficient heat to raise 1 lb. of cast iron to its melting point. This amount of oxygen introduced into the receiver above described would exert a pressure of 20·5 atmospheres; it would require a quantity of oxygen exerting a pressure of 125 atmospheres to raise the whole receiver to the melting point of cast iron. These conditions are not encouraging, for although a less amount of oxygen would suffice for the purpose required, the thickness of the vessel when used as a projectile would doubtless have to be augmented, and little could probably be effected with less than 100 atmospheres of oxygen forced into the shell—a pressure, which, it is to be feared, would prove not only dangerous, but unmanageable.

HORIZONTAL ENGINE WITH AUTOMATIC EXPANSION GEAR.

THE engravings which we give on page 241 illustrate the horizontal engine by which most of the machinery was driven in the recent Electric Light Exhibition at the Aquarium. A pair of the same engines working on one shaft and indicating about 400-horse power, is also fixed in the Fisheries Electric Lighting installation, as illustrated in our impression of the 14th inst., this pair having been purchased by the Government for working the electric lighting machinery of the South Kensington Museum. The general design and arrangement of the engine is clearly seen from the side and end elevations and plan, page 241, while the sectional plan, together with the annexed diagram—Figs. 1 to 3—show the construction of the steam chests with the exhaust and expansion valves in their separate cases, as well as the positions of the expansion valve, as due to the control of one or the other of the two excentrics, the positions of which with

FIG. 1

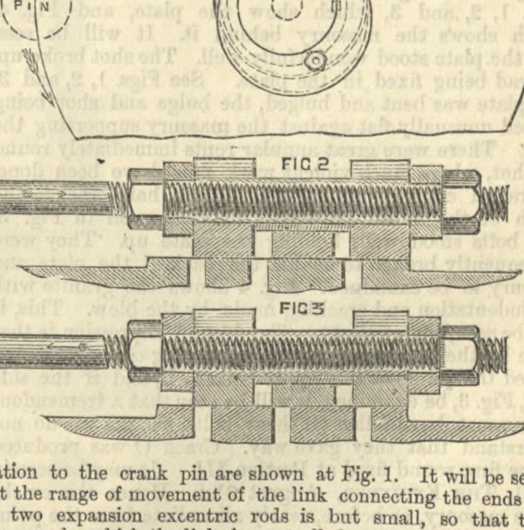


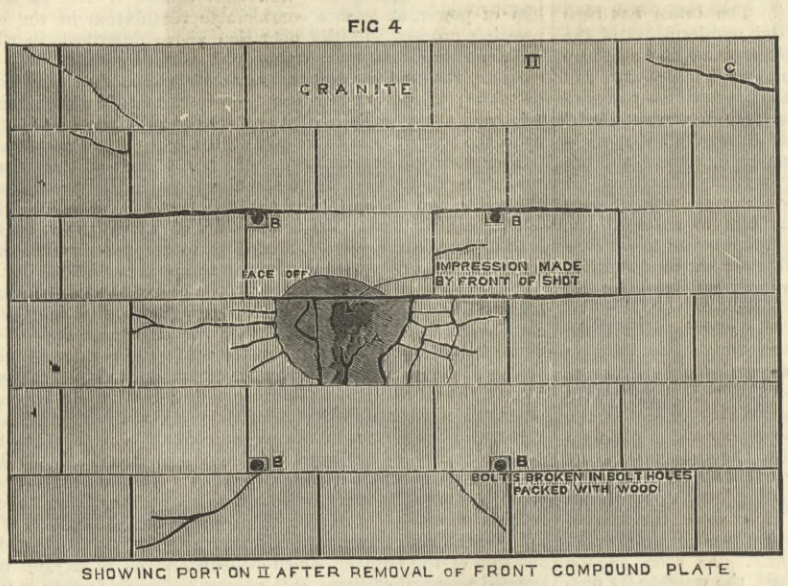
FIG. 2

FIG. 3

relation to the crank pin are shown at Fig. 1. It will be seen that the range of movement of the link connecting the ends of the two expansion excentric rods is but small, so that the governors by which the link is controlled need also but a small range of vertical movement to make a considerable difference in the point of cut-off. The cylinder of the engine is 18·5in. in diameter, and the stroke is 32in. It makes the same number of revolutions as the double engine at the Fisheries Exhibition, namely, 68, and may be taken as half the power. Although not shown on the engraving, a dash-pot is connected with the governor lever to steady the action on the link. The weight of the reciprocating parts is balanced by the crank disc, which is made of varying thicknesses. The whole engine is mounted on a strong bed-plate, which is extended in length when a condenser is attached, and its performance is such as to give a very high efficiency, while the arrangement of automatic cut-off gear described secures notable uniformity of rotation.

ARMOUR PLATE FORT AT SHOEBURYNESS.

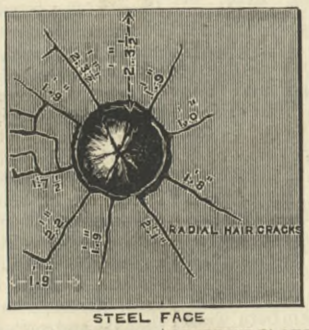
FIG 4



SHOWING PORTION II AFTER REMOVAL OF FRONT COMPOUND PLATE

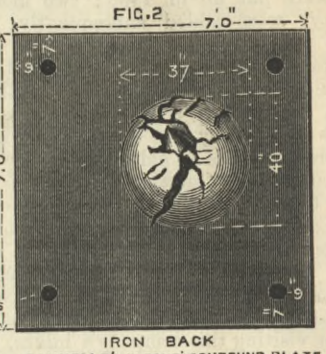
FIG.3

FIG.1



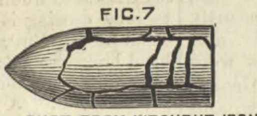
STEEL FACE
CAMMELLS (WILSONS) COMPOUND PLATE
FRONT VIEW REMOVED FROM PORTION II

FIG.2



IRON BACK
CAMMELLS (WILSONS) COMPOUND PLATE
BACK VIEW

FIC.7

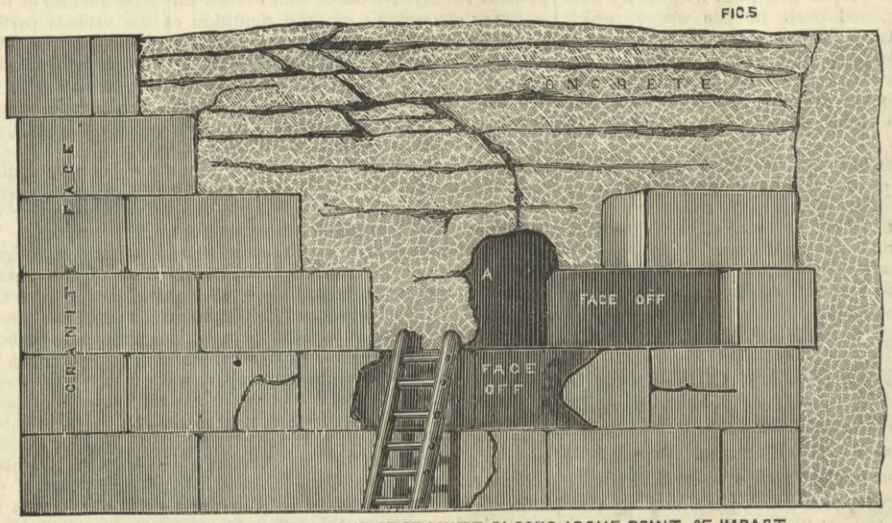


SHOT FROM WROUGHT IRON PLATE PORTION III

FIG.8

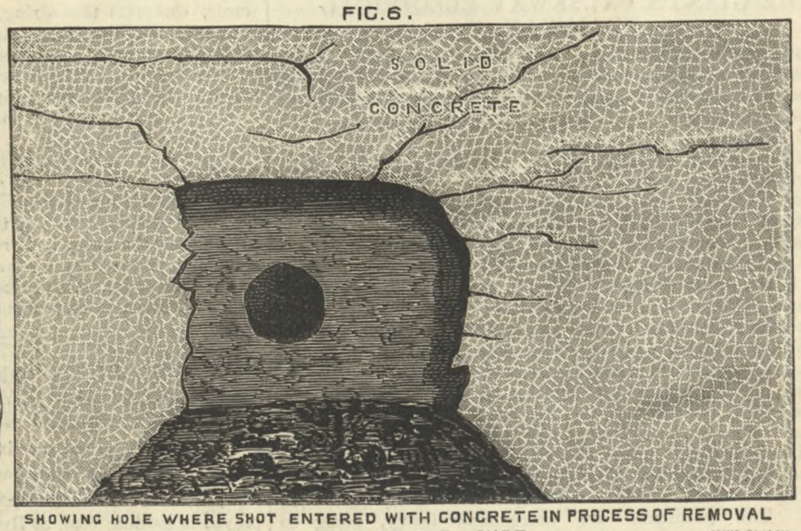
SHOT FROM GRANITE PORTION I

FIG.5



SHOWING PORTION I AFTER REMOVAL OF GRANITE BLOCKS ABOVE POINT OF IMPACT SHOWING GENERAL CONDITION OF CONCRETE

FIG.6.



SHOWING HOLE WHERE SHOT ENTERED WITH CONCRETE IN PROCESS OF REMOVAL ROUND IT TO GET OUT SHOT PORTION IV

JOHN SWAIN

IN our impression of August 31st we gave figures of the general plan of the coast fort target recently fired at by the 80-ton gun at Shoeburyness; also the effect of the first round fired on August 22nd last. The three remaining portions have been now attacked, with results which we give below. Before doing so it may be well to state again briefly the nature of each structure attacked, and also to make a slight correction on what we said before. The front consists of four portions, viz.: Portion I.: Granite and concrete, 40ft. thick in all; that is 5ft. of granite in front, then 13ft. of concrete, next 5ft. of granite and concrete behind it. Portion II.: 20ft. of granite and concrete protected by a Cammell—Wilson's—compound or steel-faced plate 12in. thick, fixed in a wrought iron frame. Portion III.: 20ft. of granite and concrete protected by a sandwich iron shield, consisting of two 8in. layers of iron and 5in. of wood between the plates, also supplied by Cammell. Portion IV.: 40ft. thick of concrete only. The effect of the first round which was fired at Portion III. was described in THE ENGINEER August 31st. We have only now to give the shot whose fragments have been assembled and are shown in Fig. 7. The second round was fired on September 11th at Portion II., the steel-faced plate, &c. The projectile was in this, and in every other case, a Palliser shot weighing over 1700 lb., the striking velocity being something under 1600ft. The effect is seen in Figs. 1, 2, and 3, which show the plate, and Fig. 4, which shows the masonry behind it. It will be seen that the plate stood wonderfully well. The shot broke up, its head being fixed in the plate. See Figs. 1, 2, and 3. The plate was bent and bulged, the bulge and shot being pressed unusually flat against the masonry supporting the plate. There were great annular rents immediately round the shot, where much violent work must have been done, the radial cracks were nearly all fine hair cracks—the depth of the most important may be seen in Fig. 3. The bolts stood well, holding the plate up. They were subsequently broken to enable the back of the plate and masonry to be examined. Fig. 4 shows the granite with the indentation and cracking made by the blow. This, it may be seen, is very slight. The deepest impression is that made by the shot point at A. The spring of the plate has opened the joints at the upper bolts B B, and if the side view, Fig. 3, be examined, it will be seen that a tremendous strain must have fallen on these bolts, though we do not understand that they gave way. Crack C was produced by the first round fired at Portion III. It may be seen in Fig. 1, THE ENGINEER, August 31st. Hence the cracks in the masonry, as before, nearly all radiate from the point of impact.

Taking this round as nearly the same as No. 1, we may say that about 30,000 foot-tons work have been delivered on this shield, and that a compound 12in. plate has, under the conditions before us, borne the blow of a shot capable of perforating about 25in. of iron. The plate is an admirable one. We stated in our previous article that we expected the shot and plate to suffer more and the masonry to be less penetrated in the case of the steel-faced plate than in the case of the iron; but we confess we did not expect to see the plate stop the shot altogether, as it has done in this instance. How is this to be accounted for? The natural suggestions are inferiority in shot, special excellence in plate, or special support given to this nature of plate by hard backing. There does not appear to be any reason to call the shot bad. The plate is certainly excellent, but we think that the last-named cause told most—that is to say, that very hard backing specially brings out the powers of steel-faced plates. This supports the opinion of the Italian committee, who considered that the yielding backing at Spezia told much more against the compound plates than the steel. Any one who looks at the indication of concentric hair cracks which are apt to be formed in compound plates, almost like the circles round a stone in water, will perhaps concur in thinking that the value of hard backing to this class of armour is peculiarly great. Look at Fig. 3, and judge what would have been the effect on this plate if the backing had allowed it to bend much more. Would not the line of rupture from the point of the shot to the cracks about A have been completed? The bulged back of the plate and the shot have received a tremendous pressure against the backing. Can we doubt that if the backing had not been an extraordinary one the plate must have snapped across? We are in no way detracting from the qualities of the plate, which is apparently beautiful. It would, however, we think, be manifestly impossible for any 12in. plate to stand the blow we have to consider under any ordinary conditions. Giving it all credit for excellence then, we have to explain why it bore much more than twice the blow that would generally smash such a plate up. We suggest the following. The plate with its hard surface and hard backing resisted the shot very sharply, and rigidly; this being a chilled shot, broke under such a shock much more easily than a good steel shot would do. In fact, under these particular conditions, a softer shot with more tenacity might have done better. Still, an enormous force was at work, breaking and tearing out rings of metal close round the shot, and actually crushing in the face of the granite behind it, and it is to be noticed that there are no detached bruises on the plate face, so that the work was delivered well at point of impact. The plate had been cracked from the front to a depth of 9½in. at the edge, as shown in Fig. 3, but the shot was unable to bend it back and tear open the remaining thickness from the opposite side, and so the blow was borne.

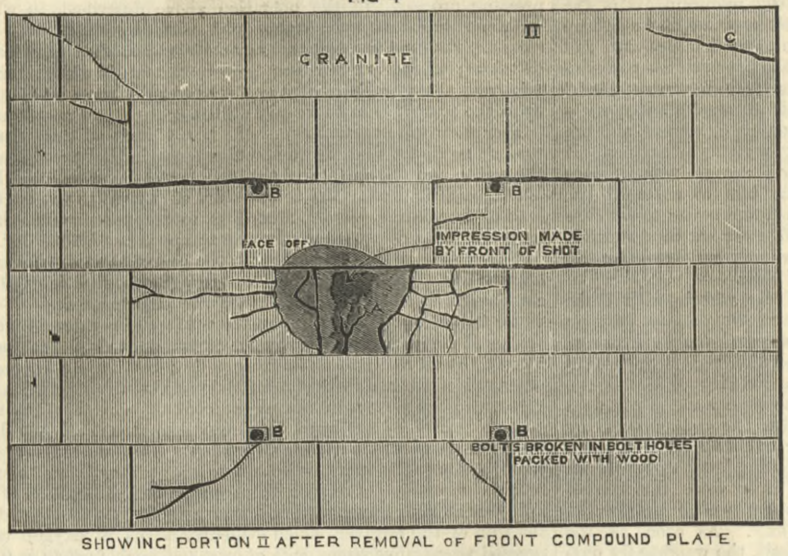
We have spoken of the magnitude of the blow; let us compare it with that borne by other plates, taking as a measure the number of foot-tons total energy in the blow divided by the number of tons weight in the plate. This gives us the number of foot-tons for every ton of plate. The 38-ton gun at Shoeburyness was fired on July 21st, 1880, at a steel-faced plate, 18in. thick. The shot had a calculated penetration of 18·6in., and 12,980 foot-tons energy. The plate weighed about 24 tons. Hence the blow was 541 foot-tons per ton of metal. The effect was very slight, the shot breaking up badly. At Spezia, in November last, the compound plates weighed about 31·5 tons, and the heaviest blow on them was 33,960 foot-tons, that is, 1046 foot-tons per ton of metal. Under this each plate broke to pieces. It is fair to say that it was the second blow, the previous one having been 654 foot-tons per ton of metal. The two together then make 1700 foot-tons per ton of metal. At Ochta the steel plate was broken with a blow of 711 foot-tons per ton of metal. The plate now before us probably weighed about 10·5 tons only; a blow of 30,000 foot-tons then implies a shock of 2857 foot-tons per ton of metal, that is, four times as heavy a shock as any single blow at Ochta on a plate of the same thickness. This was borne without breaking the plate asunder or penetrating it. Unquestionably, then, the shield is a wonderfully good combination, and very far better than the sandwiched iron one, which has not the hard steel face, and whose soft layers give the shot the opportunity of getting its head in, and attacking the granite fairly well. We have referred to Fig. 7, showing the recovered shot from the sandwich target; it would be interesting to compare the point of the shot now bedded in the compound plate with it.

To pass on to the granite and concrete portions. Round 3 was at Portion I., the granite and concrete. The projectile, fired with approximately the same energy as in the previous rounds, entered the masonry about the spot marked A in Fig. 5, dislodging and breaking the stones in the immediate vicinity, and penetrated through the 5ft. of granite and 13ft. of concrete, keeping a fairly direct line until it came against the second granite layer; here its point, after destroying a little of the granite face, turned sharp off to the right, broke, and it soon came to rest, the shot having thus first gone directly to a depth of 18ft., and then laterally about 7ft. Fig. 5 shows the upper granite stones removed. The concrete may be seen to be lifted, cracked, and in a "demoralised" condition generally. Fig. 8 shows the shot fragments assembled. The fourth round, which nearly resembled those already fired as to its velocity, was discharged on September 20th. It entered Portion IV., concrete only. Fig. 6 shows the present condition of the target. The shot has attained a depth of considerably over 24ft., perhaps over 30ft., but at the time we obtained our information it had not been found. It is not entirely through the 40ft. or even nearly so, or there would be more signs of its presence at the back.

With regard to these two masonry targets, it is difficult to speak exactly; as we before remarked, we think that the concrete has not a fair chance, owing to its having been made so short a time. Apparently the granite bears something the same sort of relation to the concrete as the steel-faced plate bears to the iron one: that is to say, it stops the shot much more abruptly. The arrangement of alternate layers may be good for the shot in Portion I., which, turned off from the second layer of granite, would probably have experienced more difficulty in doing so had its base been surrounded by granite instead of concrete. As it was, as soon as its point had felt the second face of stone, the shot turned off at something beyond a right angle, moving harmlessly for short distance and breaking-up, as an officer expressed it, by its attitude almost protesting, "Not another layer of granite." If instead of shot, charged shell had been used, the effect on concrete might have been disastrous, but concrete might be faced with a comparatively thin steel plate which would explode the shell, and so save the backing.

ARMOUR PLATE FORT AT SHOEBURYNESS.

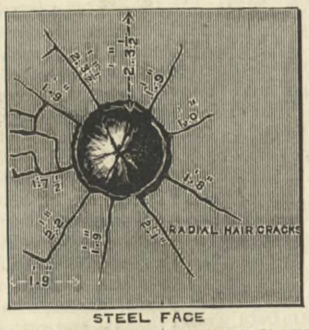
FIG 4



SHOWING PORTION II AFTER REMOVAL OF FRONT COMPOUND PLATE

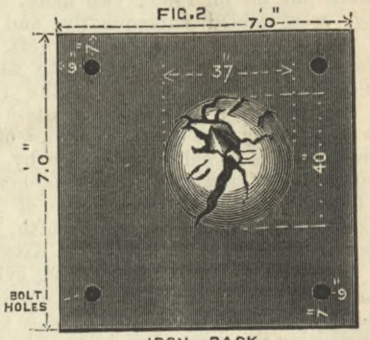
FIG. 3

FIG. 1



STEEL FACE
CAMMELLS (WILSONS) COMPOUND PLATE
FRONT VIEW REMOVED FROM PORTION II

FIG. 2



IRON BACK
CAMMELLS (WILSONS) COMPOUND PLATE
BACK VIEW

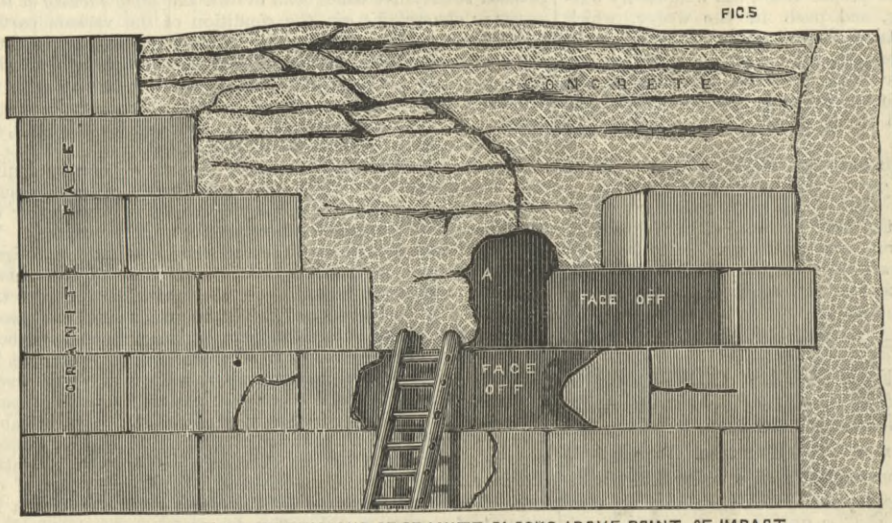
FIG. 7

SHOT FROM WROUGHT IRON PLATE PORTION III

FIG. 8

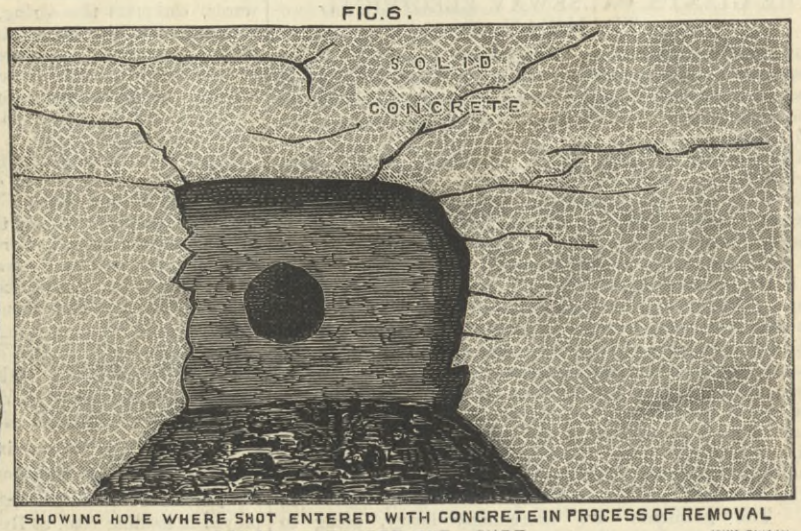
SHOT FROM GRANITE PORTION I

FIG. 5



SHOWING PORTION I AFTER REMOVAL OF GRANITE BLOCKS ABOVE POINT OF IMPACT
SHOWING GENERAL CONDITION OF CONCRETE

FIG. 6.



SHOWING HOLE WHERE SHOT ENTERED WITH CONCRETE IN PROCESS OF REMOVAL ROUND IT TO GET OUT SHOT
PORTION IV

JOHN SWAIN

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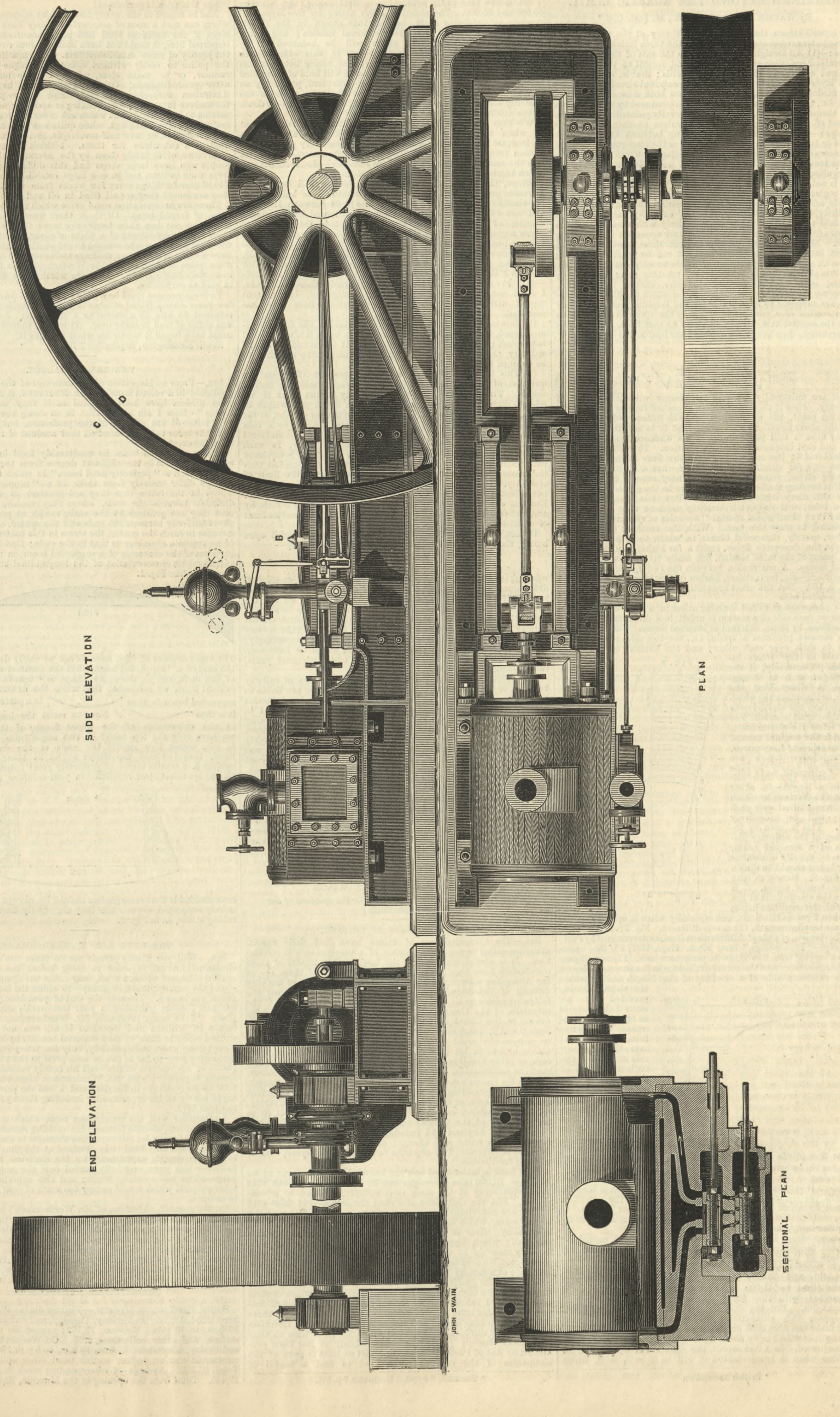
HORIZONTAL ENGINE WITH AUTOMATIC EXPANSION GEAR,

MESSRS. DAVEY PAXMAN AND CO., COLCHESTER, ENGINEERS.

(*For description see page 239.*)



HORIZONTAL ENGINE WITH AUTOMATIC EXPANSION GEAR,

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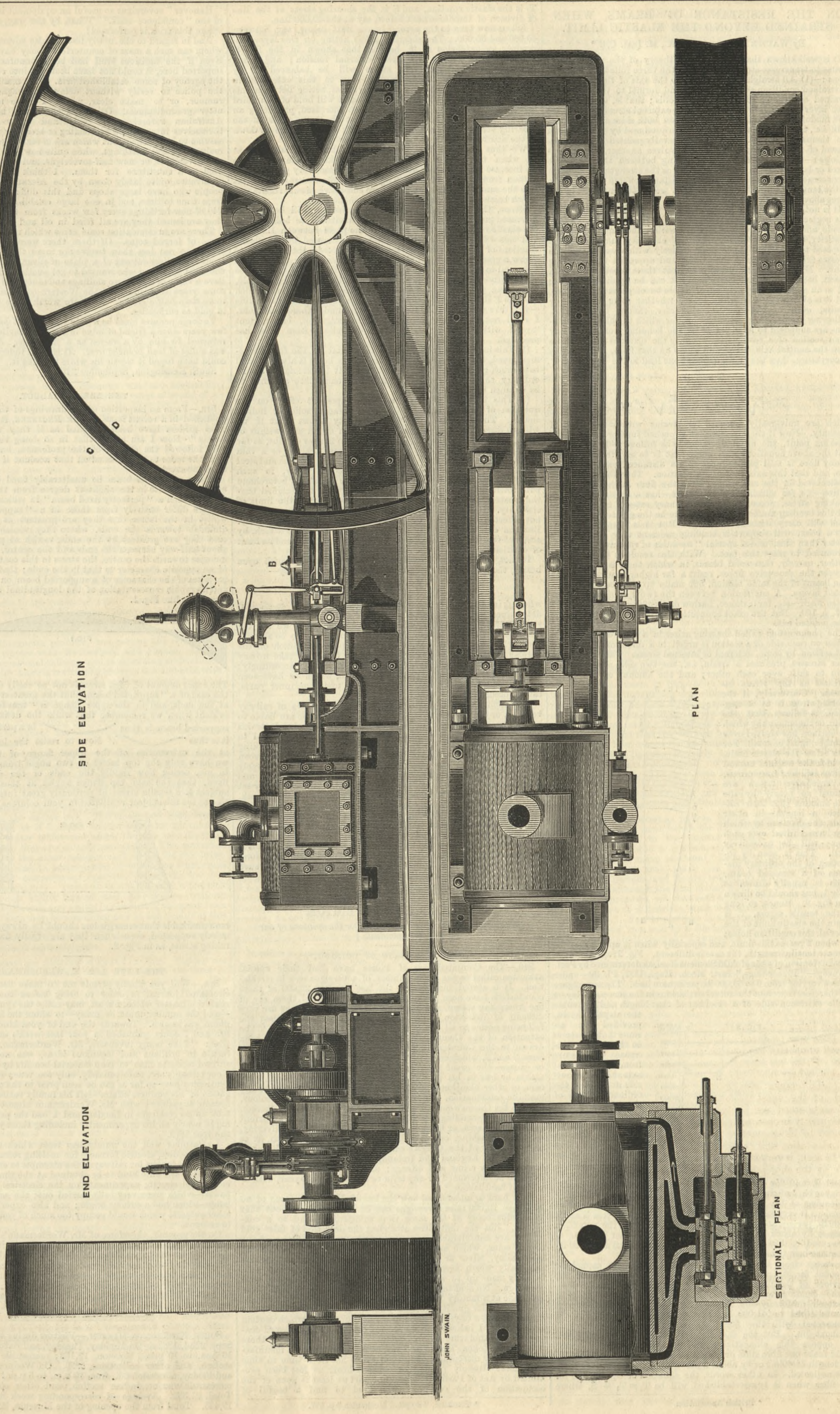


ON THE RESISTANCE OF BEAMS, WHEN STRAINED BEYOND THE ELASTIC LIMIT.

By Walter R. Browne, M.A., M. Inst. C.E.*

It is well known that the ordinary theory of the resistance of beams to transverse strain depends on the three following assumptions:—(1) All straight lines normal to the axis of the beam in its unstrained condition remain straight and normal to the axis in its strained condition; (2) Hooke's law holds; that is, the strain on each layer or fibre is proportional to the external stress upon it; (3) The modulus of elasticity is the same on both sides of the neutral axis, *i.e.*, the extension and compression produced by equal stresses are themselves equal. It is not generally pointed out that the second of these assumptions tacitly involves another, which is as follows:—(4) The shearing stress acting between the successive fibres or layers may be neglected, so far as the strength of the beam is concerned. In other words, the resistance offered by each fibre to the tensile stress is the same as if it were not connected to the fibres above and below it in any way.

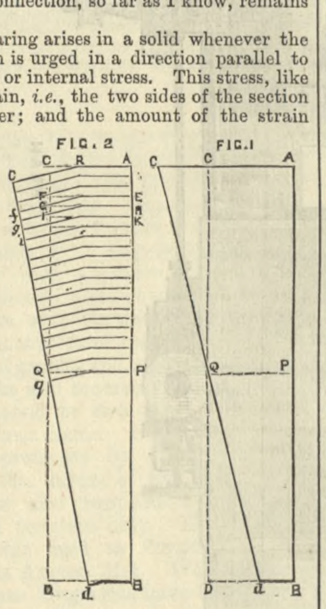
It is not here intended for a moment to dispute the fact that this neglect of the shearing stresses is fully justified so long as the tensile and compressive stresses are within the limit of perfect elasticity, as in the ordinary theory of elasticity they are always supposed to be. This paper deals entirely with cases where the stresses are much beyond that limit, and approach the breaking point. Mathematicians usually neglect these cases, and with reason, because no quantitative analysis can be applied to them; but to an engineer they may nevertheless be of great importance, and it is at least worth while to see whether some trustworthy results, even of the roughest character, cannot be obtained. Following the ordinary investigation, for which the above assumptions are supposed to hold, let M be the bending moment at any given section of a rectangular beam, y the distance of any fibre from the neutral axis, T the unit stress on that fibre, R the radius of curvature, then the above assumptions lead to the equations

$$T = \frac{E}{R} y$$

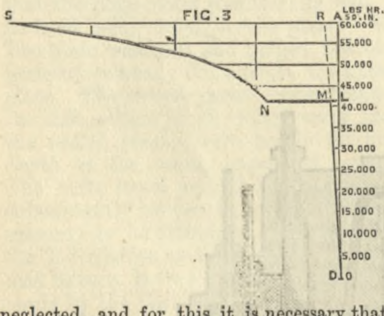
$$M = \int T\, dy \times y = \frac{E}{R} \int y^2\, dy$$

which are universally accepted for strains within the limit of elasticity. Now if the investigation is pushed further towards the breaking point, the usual operation is as follows:—It is assumed that the above equations still hold, that is to say, that the stress on any fibre is still proportional to its distance from the neutral axis, and that this axis retains its position. Then the value of M is calculated on the supposition that the fibre at the edge of the section—*i.e*, for which y is a maximum—has a stress equal to its breaking stress, according to the ordinary rates of tensile stress; and this bending moment is assumed to be the greatest which the beam will carry without breaking. But it is found in practice that a beam will support a bending moment very considerably greater than this, and a special "modulus of rupture" has to be introduced to meet this fact. With this result is to be taken another, namely, that solid beams, in which there is an adhesion between the successive fibres, resist a far higher bending moment than beams of the same section, but made up of successive unconnected layers. A connection between the two has naturally suggested itself—see, for instance, Barlow on "Strength of Materials," 1867, p. 160. But the exact connection, so far as I know, remains to be pointed out.

The phenomenon called shearing arises in a solid whenever the matter on each side of a section is urged in a direction parallel to that section by some external or internal stress. This stress, like other stresses, produces a strain, *i.e.*, the two sides of the section begin to shift over each other; and the amount of the strain increases as the stress increases. Conversely, if the shearing stress is to be neglected, it follows that the strain, or the amount by which one surface has shifted over the other, must be small. For cases below the elastic limit, in which the original normal sections still continue normal, two successive layers are strained so nearly by the same amount that their difference in length—in other words, the distance by which they have shifted over each other—will be excessively small. This is seen by inspection of the ordinary diagrams of a strained beam, which is usually drawn as in Fig 1, but should be drawn as in Fig. 2. Hence, so long as the tensile stress, T, is within the elastic limit of the material, this condition holds;



but when T passes this limit, and especially when it approaches the ultimate tensile strength, the case is different. Fig. 3 represents the actual extension of a bar of mild Siemens steel, as determined by Prof. Kennedy—"Proceedings," Inst. Mech. Eng., 1881, Pl. 30—under stresses varying from 0 to 60,000 lb. per square inch. The same figure will therefore represent the actual extensions in the successive layers of the extension side of a steel bar of that length and of double the depth shown, provided we assume that the stress on these layers increases uniformly from the neutral axis at P to the outside at A, as in the ordinary theory of elasticity it is supposed to do. This assumption, as we have seen, involves the hypothesis that the shearing stress between the different layers may be neglected, and for this it is necessary that the extension of any one layer beyond that next to it should be small. Is this the case? On looking at the figure we see that the difference in successive extensions is very small up to a point L, where the stress is about 41,000 lb. per square inch. At this point, however, the extension increases by about ¾in. in 40in., without any further increase of stress; and it then goes on increasing rapidly until at 60,000 lb. per square inch it has reached the length A S.



It seems clear, then, that the shearing resistance cannot be neglected for the part between L and A. Let us consider the behaviour of the fibre at L, taking it to be the outside fibre, as the bending moment is increased. We may suppose it to extend uniformly—by Hooke's law—till the stress upon it becomes equal to 41,000 lb. per square inch, as shown. If unconnected with the fibres below it would then elongate by about ¾in. But the shearing resistance of the fibre below will oppose this elongation; and a shearing stress, which would make one fibre slide over another by a distance of about ¾in. in a length of 40in., or by about 2 per cent., is certainly too large to be neglected. In other words, the equation of equilibrium for this fibre when it is re-established will be $T = T_1 + S$, where T_1 is the elastic reaction, and S is the shearing stress at the line of division of the fibres next below, say at the 40,000 line.

Let us now turn to the second layer, next below, say between 40,000 and 35,000. The shearing stress acting on this layer will produce an extension in it, beyond that shown in the figure, which is that due to the direct external tension; and when equilibrium is restored this stress will be balanced (1) by an increase in the elastic reaction due to this extension in length; (2) by an increased shearing stress acting between this fibre and the next below. And the same will hold of the third layer—that is to say, its length will be increased, producing an increase of the elastic reaction, and at the same time of the shearing stress between it and the fourth layer, and so on down to the neutral axis.

We thus see that the effect of the shearing resistance at L, when the strain approaches the breaking point, will be to increase the elastic tensile resistance T for every point of the section from L to P, where P is a point on the neutral axis. But it is the sum of the moments of these successive tensile resistances which balances the external bending moment.

Hence, the effect of this shearing resistance will be that an increased proportion of this bending moment will be balanced by the elastic reaction of the material in the parts between L and P, and this will leave a smaller part to be balanced by the elastic reactions of the parts beyond L. In other words, the effect is to throw a greater duty upon the parts of the beam near the neutral axis, and to relieve those at a distance from it, and so to increase the effective strength of the beam. It would, no doubt, be possible, by making particular assumptions, to determine the form which the line P M N S, Fig. 3—which we may call the extension outline—will take when equilibrium is established under these conditions. I shall not, however, attempt this investigation, but content myself with drawing two practical deductions from what has preceded.

(1) This investigation seems fully to account for the fact abovementioned, that the transverse strength of a beam is always found to be much greater in practice than when it is calculated by the ordinary theory of elasticity, and the outside fibre assumed to be strained by its breaking load.

(2) This investigation has a very important effect on the question of employing solid or open beams, solid or hollow shafts. The ordinary theory of elasticity shows that if we wish to carry the greatest load with a given depth and weight of beam, we should dispose the material in two flanges or ribs, as far apart as possible, and only connected by cross bracing or a thin web, such as will enable them to work together. All iron and steel girders, &c., are constructed on this theory. Now, in such structures the maximum load can usually be calculated beforehand with tolerable accuracy, and the girder is always so designed that the greatest stress this load can impose is well below the limit of elasticity. Hence, in such cases the ordinary theory—which is not affected by this investigation—may be used with safety. But the case will be quite different for any structure which, by accident or otherwise, is liable to be strained much beyond its limit of elasticity.

In fact, Mr. Barlow's experiments* showed that for such open beams, the modulus of rupture was given, empirically, by—

$$f_0 + f^1 \frac{H}{h},$$

where f_0 is the direct tenacity of the material, f^1 is a co-efficient determined empirically; H, the depth of solid metal in the cross section, and h the total depth. If we recur to Fig. 3 we see the reason of this. For suppose the metal from P to L to be absent; then when the stress equals 41,000 lb. per square inch on the fibre at L, there is no shearing resistance below to take up any part of it; the fibre will extend the full distance to N accordingly; and the relief to the outer parts of the beam, which we have seen to be given by the increased strain thrown upon the inner parts, cannot occur.

This applies especially to shafts, such as the axles of railway vehicles, or the crank shafts of steamers. Both these are liable to be broken, and are not unfrequently broken, by special strains induced under peculiar circumstances. It has been attempted to render them stronger—for the same weight of metal—by making them hollow. In the case of railway axles the attempt was soon abandoned, but in the case of marine shafts it has been largely carried into effect since the introduction of steel as a material; and its advantages, so far as stiffness is concerned, have been lately set forth in a paper of Professor Greenhill—Proceedings, Inst. Mech. Eng., April, 1883. In the discussion on that paper, however, Mr. Edw. Reynolds, of Sheffield, quoted some experiments made by him on hollow and solid shafts, under the impact test, in which the hollow shaft was much the inferior of the two, and gave way very rapidly when once the blow exceeded a certain limit. This is exactly what the theory points out. It would seem, therefore, that the provision of hollow shafts is a serious error in all such cases, and should not be continued.

* British Association.

* Rankine, "Applied Mechanics," p. 297.

LETTERS TO THE EDITOR.

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

PRESENT ASPECTS OF COINING.

Sir,—The Commissioners of Police have had their special attention called to the large number of sovereigns now in circulation. It is stated that within the last few days 20,000 of these counterfeits have been put in circulation. Many of them are of the Australian stamp, and are so highly finished that they are very difficult of detection. The Commissioner has just issued the following notice to all the superintendents and inspectors: "The attention of the Commissioner of Metropolitan Police has been drawn to the Counterfeit Medal Act, 1883, 46 and 47 Vict. c. 44, Secs. 2 and 2, which enacts: If any person, without due authority or excuse—the proof whereof shall lie on the person accused—makes or has in his possession for sale or sells any medal, cast, coin, or other like thing, made wholly or partially of metal or any metallic combination, and resembling in size, figure, and colour, any of the Queen's current gold or silver coin, or having thereon any device resembling any device on any of the Queen's current gold or silver coin, or being so formed it can by gilding, silvering, colouring, washing, or other like process to be dealt with, as to resemble any of the Queen's current gold or silver coin, he shall be guilty, in England and Ireland, of a misdemeanour, and in Scotland of a crime and offence; and being convicted, shall be liable to be imprisoned for any term not exceeding one year, with or without hard labour."

It is hard to understand how the knowledge of the issue of no less than 20,000 false sovereigns can be arrived at without that knowledge being at the same time sufficient to lead to a conviction. But the difficulties attending the detection of false gold money are considerably increased by the superior make of the forged coins, which are made of very good gold, with a little more alloy, silver or copper, as the case may be, and which are really worth seventeen shillings and sixpence. The coin is really made up to weight, and is a little thicker than a good sovereign. No acid test is of any avail. It is believed that these are made at a factory in Barcelona, where a number of 20-franc pieces of similar quality are also issued. A correspondent of the *Standard* a few days ago spoke of certain sovereigns which contain tin as alloy; I believe that no lawful coins have been issued containing an admixture of this metal. The manufacture of those troublesome tokens known as "Hanover" sovereigns—a manufacture, the very disreputable nature of which has from time to time been most strongly pointed out—has, I hear, at last been prohibited by Act of Parliament, and one part at least is gone of the occupation of the swindlers who used to find a bagful of "Hanover" sovereigns so useful an equipment in the performance of the "confidence trick." What, by the way, are the people on whom this trick is performed?

And in regard to the newly-issued false sovereigns, how and by whom can such a mass of counterfeit money have been circulated? Even if the fictitious stuff had been manufactured abroad and imported here, it could not have been put into circulation without the agency of some established firm. It is manifestly the duty of the police to verify without delay this vague and disquieting rumour, or to make clear, which I hope may be done, its utter groundlessness. Otherwise there will be a scare against Australian sovereigns, or silly and hasty people will get themselves into trouble by bending or breaking those which they assume to be spurious, but which are in reality genuine coin of the realm. Bronze farthings, when quite new, are astonishingly like new sovereigns, or new half-sovereigns, and are not unfrequently used as a substitute for them. I think I heard of such an occurrence quite lately down by the Alexandra Palace. Tradespeople who have large shops find this difficulty presenting itself from time to time, and in one large establishment the head gets £40 of new farthings every few weeks from the Bank, and before they are issued they are all fried in oil and discoloured.

There are in circulation some coins which may be called the converse of forged coins. Of these there were issued about twenty years ago not less than twelve nor more than seventeen florins, made from discs cut out of a plate of silver, which were issued at the Mint by a man who wanted to get another into trouble, which have a value of about two shillings and ninepence each. One taken some years since in one of the Western counties I found to weigh more than half-a-crown. They are worth more than their weight in gold as curiosities.

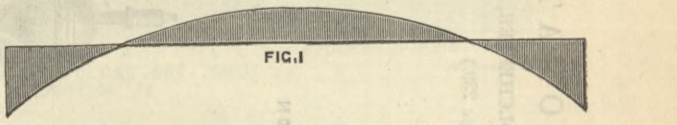
To forge pennies must be a poor trade. Yet such there are. A few years since a friend of mine in a club in Savile-row had a penny returned to him by a waiter as a false one. And so it was. It was a disc of lead bronzed over. It is hard indeed to imagine who could have found it worth his while to make it. F. W.

South Kensington, September 24th.

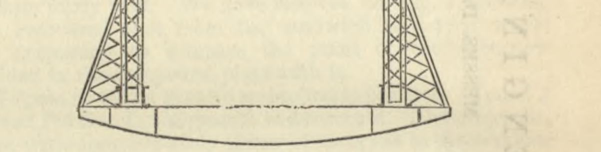
THE BRENT VIADUCT.

Sir,—From an inspection of the drawings of the Brent Viaduct published in a recent issue of The Engineer, it appears that the cross girders have been designed as if they were "supported beams." Now I am aware that in so doing the engineers have only followed the custom of the profession, but the practice is none the more to be defended on that account if it can be shown to be incorrect.

If the ends of a beam be unalterably fixed in direction, *i.e.*, unable to deviate in the slightest degree from the perpendicular, we have then a "perfectly fixed beam" in which the longitudinal stresses differ entirely from those in a "supported beam," for whilst in the latter case they are greatest at the centre, and diminish towards the ends, where they vanish, in the former case they are greatest at the ends, vanish at points somewhere about half-way between the ends and the centre, and from thence increase towards the centre, the stress in this central portion being of an opposite character to that in the ends; that is, a fixed beam partakes of the character of a supported beam on two cantilevers, and a graphic representation of the longitudinal stresses would be somewhat like Fig. 1.



The exact amount of each stress is not so easily determined as in the case of a "supported beam," but the greatest stress is always at the ends, and in the upper flange is "tensile." This will be evident when we remember that while the deflection curve of a supported beam is thus ◡, in a perfectly fixed beam it is thus ∼. Now to resist the longitudinal stress at the extremities of the upper flange of the cross girder we have only the top tables of two angle irons, and it appears to me, seeing how rigidly the ends of the cross girders are fixed, that the said top flange angles at those points will be subject to a tensile stress of perilously great intensity. I should like to see the subject ventilated in your columns, for it seems to



me remarkable that cross girders should be always designed as if merely supported, even when they are rigidly fixed by the aid of raking struts, as in Fig. 2. Enquirer.

THE LATE R. S. K. WERDERMANN.

Sir,—Will you kindly permit me to make use of your widely circulated journal in order to bring before the notice of your readers a matter which, I trust, may enlist the sympathies of those—and the number must be many—to whom the late Mr. Werdermann was known. Towards the end of your kindly notice of his life and labours, published in your last week's issue, you observe that: "Like many inventors, Mr. Werdermann, although very fertile in brilliant and ingenious ideas, was not a sufficiently shrewd business man to reap material benefits by his inventions." Your remarks are, unfortunately, only too true; for the deceased gentleman has—so far as can be seen prior to the complete investigation of his business affairs—left his family entirely destitute. I became acquainted with Mr. Werdermann almost immediately he took up his residence in London, and I had the privilege of assisting in nearly all his experiments, including those you mention, till the year 1879.

I remember well the numberless tests which were made with electric candles, electric furnaces for melting refractory materials, and electric brakes for railways; the attempts to employ "Serrin" arc lamps—the only kind to be obtained at the time—in series and in parallel circuit; experiments on the electrical transmission of power—which were very fully carried out; the semi-incandescent lamp—which had a curious origin; and also experiments on many other subjects which would occupy too much of your valuable space to recount.

On the grounds, therefore, of Mr. Werdermann's long and useful connection with electrical science, I beg leave, with your permission, to state that it has been decided to open a subscription list to alleviate the immediate and pressing necessities of the Werdermann family, and that cheques or Post-office Orders from the charitably disposed will be thankfully received and acknowledged by Alabaster, Gatehouse, and Co., 22, Paternoster-row, London, E.C.

T. E. Gatehouse.

South Kensington Museum.—Visitors during the week ending Sept. 22nd, 1883:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 12,162; mercantile marine, Indian section, and other collections, 5936. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 5 p.m., Museum, 1531; mercantile marine, Indian section, and other collections, 1762. Total, 21,392. Average of corresponding week in former years, 19,445. Total from the opening of the Museum, 22,411,686.

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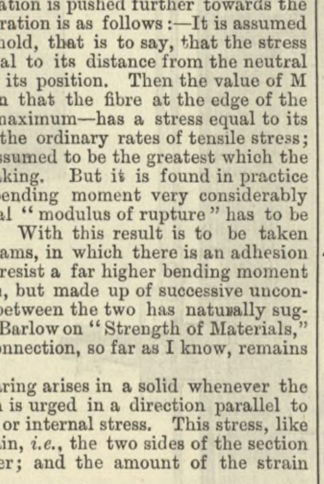

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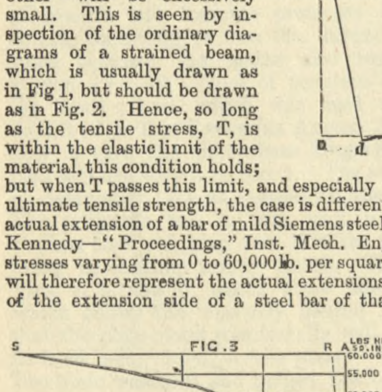

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It seems clear, then, that the shearing resistance cannot be neglected for the part between L and A. Let us consider the behaviour of the fibre at L, taking it to be the outside fibre, as the bending moment is increased. We may suppose it to extend uniformly—by Hooke's law—till the stress upon it becomes equal to 41,000 lb. per square inch, as shown. If unconnected with the fibres below it would then elongate by about ⅝in. But the shearing resistance of the fibre below will oppose this elongation; and a shearing stress, which would make one fibre slide over another by a distance of about ⅝in. in a length of 40in., or by about 2 per cent., is certainly too large to be neglected. In other words, the equation of equilibrium for this fibre when it is re-established will be $T = T_1 + S$, where T_1 is the elastic reaction, and S is the shearing stress at the line of division of the fibres next below, say at the 40,000 line.

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We thus see that the effect of the shearing resistance at L, when the strain approaches the breaking point, will be to increase the elastic tensile resistance T for every point of the section from L to P, where P is a point on the neutral axis. But it is the sum of the moments of these successive tensile resistances which balances the external bending moment.

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

PRESENT ASPECTS OF COINING.

Sir,—The Commissioners of Police have had their special attention called to the large number of sovereigns now in circulation. It is stated that within the last few days 20,000 of these counterfeits have been put in circulation. Many of them are of the Australian stamp, and are so highly finished that they are very difficult of detection. The Commissioner has just issued the following notice to all the superintendents and inspectors: "The attention of the Commissioner of Metropolitan Police has been drawn to the Counterfeit Medal Act, 1883, 46 and 47 Vict. c. 44, Secs. 2 and 2, which enacts: If any person, without due authority or excuse—the proof whereof shall lie on the person accused—makes or has in his possession for sale or sells any medal, cast, coin, or other like thing, made wholly or partially of metal or any metallic combination, and resembling in size, figure, and colour, any of the Queen's current gold or silver coin, or having thereon any device resembling any device on any of the Queen's current gold or silver coin, or being so formed it can by gilding, silvering, colouring, washing, or other like process to be dealt with, as to resemble any of the Queen's current gold or silver coin, he shall be guilty, in England and Ireland, of a misdemeanour, and in Scotland of a crime and offence; and being convicted, shall be liable to be imprisoned for any term not exceeding one year, with or without hard labour."

It is hard to understand how the knowledge of the issue of no less than 20,000 false sovereigns can be arrived at without that knowledge being at the same time sufficient to lead to a conviction. But the difficulties attending the detection of false gold money are considerably increased by the superior make of the forged coins, which are made of very good gold, with a little more alloy, silver or copper, as the case may be, and which are really worth seventeen shillings and sixpence. The coin is really made up to weight, and is a little thicker than a good sovereign. No acid test is of any avail. It is believed that these are made at a factory in Barcelona, where a number of 20-franc pieces of similar quality are also issued. A correspondent of the *Standard* a few days ago spoke of certain sovereigns which contain tin as alloy; I believe that no lawful coins have been issued containing an admixture of this metal. The manufacture of those troublesome tokens known as "Hanover" sovereigns—a manufacture, the very disreputable nature of which has from time to time been most strongly pointed out—has, I hear, at last been prohibited by Act of Parliament, and one part at least is gone of the occupation of the swindlers who used to find a bagful of "Hanover" sovereigns so useful an equipment in the performance of the "confidence trick." What, by the way, are the people on whom this trick is performed?

And in regard to the newly-issued false sovereigns, how and by whom can such a mass of counterfeit money have been circulated? Even if the fictitious stuff had been manufactured abroad and imported here, it could not have been put into circulation without the agency of some established firm. It is manifestly the duty of the police to verify without delay this vague and disquieting rumour, or to make clear, which I hope may be done, its utter groundlessness. Otherwise there will be a scare against Australian sovereigns, or silly and hasty people will get themselves into trouble by bending or breaking those which they assume to be spurious, but which are in reality genuine coin of the realm. Bronze farthings, when quite new, are astonishingly like new sovereigns, or new half-sovereigns, and are not unfrequently used as a substitute for them. I think I heard of such an occurrence quite lately down by the Alexandra Palace. Tradespeople who have large shops find this difficulty presenting itself from time to time, and in one large establishment the head gets £40 of new farthings every few weeks from the Bank, and before they are issued they are all fried in oil and discoloured.

There are in circulation some coins which may be called the converse of forged coins. Of these there were issued about twenty years ago not less than twelve nor more than seventeen florins, made from discs cut out of a plate of silver, which were issued at the Mint by a man who wanted to get another into trouble, which have a value of about two shillings and ninepence each. One taken some years since in one of the Western counties I found to weigh more than half-a-crown. They are worth more than their weight in gold as curiosities.

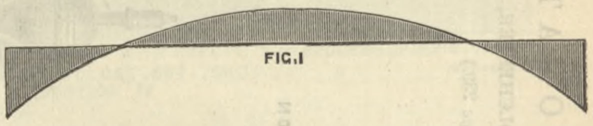
To forge pennies must be a poor trade. Yet such there are. A few years since a friend of mine in a club in Savile-row had a penny returned to him by a waiter as a false one. And so it was. It was a disc of lead bronzed over. It is hard indeed to imagine who could have found it worth his while to make it. F. W.

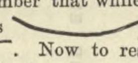
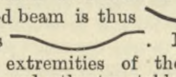
South Kensington, September 24th.

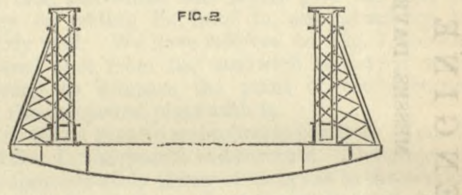
THE BRENT VIADUCT.

Sir,—From an inspection of the drawings of the Brent Viaduct published in a recent issue of The Engineer, it appears that the cross girders have been designed as if they were "supported beams." Now I am aware that in so doing the engineers have only followed the custom of the profession, but the practice is none the more to be defended on that account if it can be shown to be incorrect.

If the ends of a beam be unalterably fixed in direction, *i.e.*, unable to deviate in the slightest degree from the perpendicular, we have then a "perfectly fixed beam" in which the longitudinal stresses differ entirely from those in a "supported beam," for whilst in the latter case they are greatest at the centre, and diminish towards the ends, where they vanish, in the former case they are greatest at the ends, vanish at points somewhere about half-way between the ends and the centre, and from thence increase towards the centre, the stress in this central portion being of an opposite character to that in the ends; that is, a fixed beam partakes of the character of a supported beam on two cantilevers, and a graphic representation of the longitudinal stresses would be somewhat like Fig. 1.



The exact amount of each stress is not so easily determined as in the case of a "supported beam," but the greatest stress is always at the ends, and in the upper flange is "tensile." This will be evident when we remember that while the deflection curve of a supported beam is thus , in a perfectly fixed beam it is thus . Now to resist the longitudinal stress at the extremities of the upper flange of the cross girder we have only the top tables of two angle irons, and it appears to me, seeing how rigidly the ends of the cross girders are fixed, that the said top flange angles at those points will be subject to a tensile stress of perilously great intensity. I should like to see the subject ventilated in your columns, for it seems to



me remarkable that cross girders should be always designed as if merely supported, even when they are rigidly fixed by the aid of raking struts, as in Fig. 2. Enquirer.

THE LATE R. S. K. WERDERMANN.

Sir,—Will you kindly permit me to make use of your widely circulated journal in order to bring before the notice of your readers a matter which, I trust, may enlist the sympathies of those—and the number must be many—to whom the late Mr. Werdermann was known. Towards the end of your kindly notice of his life and labours, published in your last week's issue, you observe that: "Like many inventors, Mr. Werdermann, although very fertile in brilliant and ingenious ideas, was not a sufficiently shrewd business man to reap material benefits by his inventions." Your remarks are, unfortunately, only too true; for the deceased gentleman has—so far as can be seen prior to the complete investigation of his business affairs—left his family entirely destitute. I became acquainted with Mr. Werdermann almost immediately he took up his residence in London, and I had the privilege of assisting in nearly all his experiments, including those you mention, till the year 1879.

I remember well the numberless tests which were made with electric candles, electric furnaces for melting refractory materials, and electric brakes for railways; the attempts to employ "Serrin" arc lamps—the only kind to be obtained at the time—in series and in parallel circuit; experiments on the electrical transmission of power—which were very fully carried out; the semi-incandescent lamp—which had a curious origin; and also experiments on many other subjects which would occupy too much of your valuable space to recount.

On the grounds, therefore, of Mr. Werdermann's long and useful connection with electrical science, I beg leave, with your permission, to state that it has been decided to open a subscription list to alleviate the immediate and pressing necessities of the Werdermann family, and that cheques or Post-office Orders from the charitably disposed will be thankfully received and acknowledged by Alabaster, Gatehouse, and Co., 22, Paternoster-row, London, E.C.

T. E. Gatehouse.

South Kensington Museum.—Visitors during the week ending Sept. 22nd, 1883:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 12,162; mercantile marine, Indian section, and other collections, 5936. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 5 p.m., Museum, 1531; mercantile marine, Indian section, and other collections, 1762. Total, 21,392. Average of corresponding week in former years, 19,445. Total from the opening of the Museum, 22,411,686.

RAILWAY MATTERS.

THE Pontypridd, Newport, and Caerphilly line is expected to be opened on the 1st of November.

ON the Hudson River Railroad, some years ago, whistles having a very low tone were used, when it was found that they could not be readily heard amid the noise of the train. The bells were consequently partly filled up with wood, which made their sound more shrill, and remedied the evil.

IT is said that the Philadelphia and Reading Railroad Company proposes hereafter to use rails 60ft. long instead of 30ft., and will begin their manufacture at once. The rails will also be increased in weight from 68 lb. to 70 lb. per yard. The decreased number of joints to care for will lessen expenses, it is thought, but there are difficulties in the way of handling and transporting the 60ft. rails, which trackmen will understand.

THE Union Pacific, the Central Pacific, the Northern Pacific, and the Atchison, Topeka, and Santa Fa railway companies have contracted for the Westinghouse automatic freight brake for their entire freight equipment. The cost of this brake, as furnished by the Westinghouse Air Brake Company, is 50 dols. per freight car, the engine fixtures costing 300 dols. per engine and 60 dols per tender. The Westinghouse Company, however, offers to give a discount of 20 per cent. on the car fixtures to companies contracting for their entire equipment before June 30th, 1884, and a discount of 10 per cent. on contracts made for that date until the close of the year.

IN 1871 General Duane made a series of experiments at Portland, Me., on locomotive engine whistles. In his report of them he says:—"The experimental whistles were of the following dimensions, viz., 2½in., 3in., 4in., 5in., 6in., 10in., 12in., and 18in. diameter. Those of 2½in., 3in., 5in., and 10in. were fitted, instead of the ordinary bell with long cylinders, provided with movable pistons, so that the effective length of the bell could be altered at pleasure. The pitch of the blast was found to vary with the length of the bell, and the power of the whistle with its diameter. The ratio of the power to the diameter was not accurately obtained, but it is probable that the extreme range of sound of a whistle is proportional to the square root of its diameter."

A LIST has recently been compiled by Mr. Pfarsk of the length of the principal railway viaducts in the world, the figures of which are as follows:—Parkesburg, U.S., 2150 yards; St. Louis, over the Missouri, 1993; Louisville, over the Ohio, 1635; across the Fast River, 1520; and the same for the Delaware at Philadelphia and for the Victoria Bridge over the St. Lawrence; the Volga Bridge, near Syssran, 1495; the Moersdyk Bridge, Holland, 1490; Pongabuda (India), 1148; the Dneister Bridge, near Kiew, 1090; over the Rhine at Mayence, 1038; the Dneiper at Pultawa, 980; the Mississippi, at Quincy, 980; the Missouri, at Omaha, 860; across the Weichsel, near Dirschau, 845; the Danube, near Stadlau, 775; the Po, near Mezzana-Corti, 765; the Tamar, at Saltash, 673; the Mississippi at Dubugue, 542; the Gorai (India), 535; the Britannia Bridge, 480; over the Saone at Friburg, 392; across the Theiss at Szegedin, 365.

THE making of the Arlberg Railway is proceeding with great rapidity. The tunnel is now within 1180 metres of completion; the boring will probably be finished by the end of October, and the line opened for traffic in the course of 1884. The total length of the great tunnel will be 10,270 metres—nearly 6⅓ miles—and no similar work of equal magnitude was ever before so rapidly accomplished. The Arlberg Railway will form an important outlet for Austrian and Hungarian produce, and cannot fail to increase the trade of the empire with Switzerland and France. But in making a new international railway, and maintaining an irrational and restrictive tariff, Austria is virtually blowing hot and cold with the same breath. The Swiss commercial papers express a fear that for this reason the Arlberg Railway may, after all, not realise the expectations of its promoters, and they are urging the Federal Council to propose to the Austro-Hungarian Government a revision, in a liberal sense, of the existing commercial relations between the two countries. The tunnel has already been described and illustrated in our columns.

A SMOKE consumer, invented by R. L. Walker, is being applied to locomotives of the Illinois Central R.R. A vertical water bridge divides the fire-box or furnace into two compartments, one of which is charged with fresh coal, while the other contains freely burning coal. The compartment containing the fresh coal is closed at the top by a damper which confines the gases and is regulated by the fireman in the engine cab. The smoke and gases arising from the fresh coal as it becomes heated pass through a small opening over the water tables and above the fire into the next compartment, where they are entirely consumed. The operation is then reversed by the other compartment of the fire-box being charged with fresh coal, in consequence of which the smoke and gases pass into the compartment opposite, where the fire has reached a high temperature. There is in the fire-box a firebrick arch, which becomes highly heated and preserves a uniform temperature in the furnace and assists in consuming the gases from the fresh coal. There may be something new in the details of this invention, but the same idea has often been worked out in other ways. It is a curious fact that very high temperatures prevent the complete combustion of carbonic oxide.

WEATHER forecasts are distributed by rail in Ohio. Signals are placed on the sides of the baggage cars. The signals are three in number as to form and two as to colour—red and blue. The shapes are sun, moon, and star. The signal is made as large as possible, and the disc can be seen at a long distance. The red sun and blue moon mean higher temperature and general rain. The crescent means lower temperature; the full disc of blue means general rain; the star represents local rains. The road goes through an agricultural region of considerable importance. It is the line connecting the cities of Columbus and Cleveland. Two trains start out in the morning at the middle point between those cities. The signals are put on the cars at five o'clock in the morning, and as they run through the morning hours the farmers along the line can have an opportunity of seeing them and predicting the weather for the day. The railway company circulated through the whole line little cards having these signals displayed in colours, with their meaning in every combination, which enable everybody to understand what is meant. A recent communication from General Hazen indicates a disposition on the part of the general Government to take hold of the matter and bring it into general operation as far as possible.

ACCORDING to statistics issued by the German Railway Department there were 4123 instances of broken tires amongst forty-two railway companies running over 21,000 miles during the winter of 1880-81. During the same period thirteen companies, representing 300 miles of railway, were free from such accidents. The greatest proportion occurred during the month of January—37·89 per cent. The temperature at the time of breaking was only ascertained in two-thirds of the cases, and of these 1080 were at or above freezing point, while 1553 were at a lower temperature, the latter being specially recorded in connection with steel tires. Crucible cast steel seems to have been the substance most liable to fracture, and fine-grained iron the least subject to it. The facts recorded are considered by the *Wochenblatt für Architekten und Ingenieure* to indicate that longitudinal sleepers are more favourable than other systems to the avoiding of the accidents referred to. About one-half of the defects in question were discovered during the examination at railway stations, and the remainder, in about equal proportions, were found out while the train was going on, or during examination in the workshops. It is further stated that a sudden and forcible action of the brake is specially apt to cause the breaking of tires. The instances on goods trains were the most numerous, and on express trains the least frequent. In this country broken tires are almost unknown. The mischief is done abroad by the way in which the tires are put on.

NOTES AND MEMORANDA.

M. TOMMASI has devised an arrangement to make the luminous point of the Jablochkoff candle practically stationary. A selenium regulator acts as an automatic elevator of the point as the candle burns down.

ACCORDING to the *Sanitary Engineer* the Gramme Electrical Company, together with its members, the Brush, Edison, Fuller, Jablochkoff, Thomson-Houston, United States and Weston companies, own or control nearly 500 patents.

THE best quality of charcoal is made from oak, maple, beech, and chestnut. Wood will furnish, when properly charged, about 20 per cent. of coal. A bushel of coal from pine weighs 29 lb.; a bushel of coal from hardwood weighs 30 lb.; 100 parts of oak make nearly 23 of charcoal; red pine, 22·10; white pine, 23.

ON Tuesday the electrical launch, which forms the most novel and attractive feature of the Electrical Exhibition at Vienna, conveyed a distinguished party on the longest trip yet made in such a vessel. The launch started from Vienna and followed the course of the Danube to Pressburg, a distance of about fifty miles, accomplishing the journey in four hours, or at the rate of about 12½ miles an hour, with the stream. The launch is the joint production of the Electrical Power Storage Company, Messrs. Siemens Brothers and Co., and Messrs. Yarrow and Co.

AN arrangement for producing brilliant light by the combination of gas and electricity has been brought out by M. Somzee, which consists of an ordinary gas flame, through which passes a curved metallic rod provided with means for preventing overheating under the action of the electric current, which is derived from a secondary battery. The light is said to be white, and much cooler than a corresponding light from gas alone. The platinum does not require a great intensity of current, and that "one or two small elements will suffice to supply an ordinary light, and make it give four or five time more light at a cost three times less than gas."

M. FRIEDEL, having contested the announcement of M. Spring that a pressure of 5000 atmospheres exerted upon amorphous pulverulent matters causes them to become aggregated into crystalline masses, MM. E. Jannettaz, Neel, and Clermont determined to repeat his experiments, using pressures of from 6000 to 8000 atmospheres. They operated upon pulverised antimony, bismuth, zinc, iron, tin, copper, and lead, Darcet's alloy and brass, lead, and zinc sulphides, sodium lead and mercurous chlorides, mercuric iodide, magnesia, alumina, silica, chalk, and copper sulphate. All these powders were agglutinated into solid masses, but even those which acquired some degree of transparency were not crystallised. Many of the substances, however, such as steatite, graphite, clays, and metals, acquired a schistous structure, and assumed the thermic properties characteristic of such structure.

AN interesting example of the originality which American ironmakers bring to bear upon the solution of exceptional problems is furnished by the manner in which the managers of the Lucy furnace, at Pittsburg, got over the difficulty of handling their cinder. There was no room for dumping in the vicinity of the works; and after many and expensive experiments, cars were designed which allow the cinder to be carried over long distances in a liquid condition. It is related that the cinder was thus in one winter carried a distance of forty miles, to help to break up an ice-gorge, or rather melt it away—a feat which was successfully accomplished. In this country we have no ice-gorges, so we cannot follow the Yankee example; but we build breakwaters of slag, and utilise it now and then to even more advantage than in melting ice.

A HEAD, says the *Panama Star and Herald*, taken from a monolith at Tiahuanaco has been erected in La Paz, Bolivia. Some time ago General Ballivian attempted to transport the monolith intact, but, after removing it some distance, the work was found to be difficult and the effort was given up. This stone is eight metres in length. The head which has now been taken to La Paz weighs 2700 lb. It must be remembered that the ruined city at Tiahuanaco is celebrated for the massive nature of the stones employed in the erection of its temples, fortresses, and houses. In one of the walls there is a gigantic mass of rock which has been carefully measured and proved to weigh 250,000 lb., or 125 short tons. Who were the builders and how they contrived to handle these enormous masses of rock remain enigmas to the present day, although fancy and tradition have been busily employed endeavouring to solve them. Tiahuanaco is situate in Bolivia on the south shore of Lake Titicaca.

COMMENTING on the behaviour of arsenic in contact with putrefying animal substances, the *British Medical Journal* says that the existence of volatile arsines formed when arsenic is in contact with decaying animal matter, may serve to throw light upon the anomalies attending the use of arsenical wall papers. It is well known—and has hitherto not received any satisfactory explanation—that some highly arsenical wall papers have been used without manifest injury to health; whilst others, on the other hand, though containing much less arsenic, have produced distressing results. It may be that in the one case volatile arsenical bases have been formed, and not in the other. The fact that the frequenters of dissecting-rooms, where bodies are injected with preparations of arsenic, do not suffer from arsine poisoning is, however, adverse to the theory of the formation of these bodies under the influence of putrefaction, unless in very exceptional cases.

IN order to ascertain to what extent aniline colours might be injurious to health, notice was, for some years, taken of the health of the employés of the aniline colour works at Höchst-on-the-Main, where 672 persons are employed. Reporting the result, the *Journal of Gas Lighting* says that it is known that nitro-benzol is poisonous, yet among the twenty-four men employed at Höchst, in the nitro-benzol house, during the last four years, symptoms of "nitro-benzolismus" appeared in only five cases. Aniline, also, is admittedly poisonous; and of the twenty-nine men employed in the aniline house at Höchst there were eighteen cases of specific aniline poisoning, none of which proved fatal. The workmen in the magenta house were always reddened with dye, even to the inside of the mouth, and some of the material must therefore have been swallowed; yet not a single case of specific ailment has occurred among them for eighteen years. Neither magenta nor its derivatives, when made without arsenic, can be considered in the least degree harmful. Naphthaline is observed to be deleterious only when in the form of hot vapour. On the whole, Dr. Grandhomme finds that the average mortality of the workpeople was 4·2 per cent., which is a distinctly favourable result, and should go far to dispel any lingering dread of coal tar colours, on the ground of their supposed possession of poisonous qualities.

MESSRS. COCKSHOTT AND JOWETT, of Thornton-road, Bradford, well-known makers of phosphor tin, inform us that they have produced an entirely new alloy. They have, after a long series of experiments, succeeded in alloying manganese with phosphorus and tin and copper, producing a metal which, for tensile strength and durability, they think will be found superior to any alloy in the market. This phosphor manganese tin may be used exactly in the same manner, and in similar proportions, as phosphor tin—though it is better to cast at a little higher temperature—but the result will be found much superior both as regards hardness and tensile strength. Phosphor manganese tin will be found a very convenient form in which to have the combination of manganese and phosphorus, as it will enable the brassfounder to produce the bronze of a quality exactly suitable to the purpose for which it is required by adding a greater or lesser proportion of copper, &c., accordingly as the bronze is required to be tougher or harder. This phosphor manganese bronze is made in two qualities, No. 1 and No. 2, both the same price. The former is very tough and suitable for purposes where the castings are required to withstand a great strain. Mr. Kirkaldy, of London, has found this alloy to withstand the enormous strain of 34,754 lb. per square inch. The latter is for bearings and wearing parts of machinery, and is exceedingly hard, but at the same time very tough, the tensile strength being, according to Mr. Kirkaldy, 29,979 lb. per square inch.

MISCELLANEA.

THE Franklin Institute, of Philadelphia, proposes to arrange for the holding of an international electric exhibition, to open on the 3rd of September, 1884.

THE authorities of Wednesbury, together with those of Willenhall, are each preparing sewerage schemes of considerable magnitude, the water council of the Birmingham Corporation having increased their vigilance as to the pollution of the river Tame.

MR. C. R. BOWLING, the senior inspector of factories and workshops in Birmingham, who has administered the Factory Acts in that city for thirteen years, has accepted the charge of one of the Metropolitan districts, and will shortly remove to London.

THE French Ministry of Commerce is engaged in drawing up particulars of the patents for inventions granted in France since the foundation of the present Republic. The work so far is complete up to the end of 1878. During the eight years from the end of 1870 there were 55,000 applications for patent rights, or an annual average of nearly 7000. In the succeeding years the applications have considerably increased.

THE Philadelphia City Councils have passed an ordinance which, if faithfully observed, will go far toward keeping the street pavements in good order. All openings in the streets made for any purpose and by any person must be, when the object of the opening is accomplished, filled in with earth and rammed in layers and immediately repaved. If any settlement occurs within sixty days thereafter the pavements must be renewed at once.

ON the 17th instant the Pilsen Company was requested to light up the western and foreign wing of the Fisheries Exhibition, and on the evening of Wednesday, the 19th inst., fourteen Pilsen arc lamps of 2000-candle power were running successfully, fourteen other lamps of the same kind being added on the 20th inst. Considering that this installation involved the running of nearly a mile of leads, besides the fixing of dynamo machines and other apparatus, this was good work.

MESSRS. PIGOU, WILKES, AND LAWRENCE, Limited, gunpowder manufacturers of Dartford, wish to erect an extensive magazine capable of containing 20,000 lbs. of blasting powder on Wren's Nest Hill, Sedgely. The consent of the Home Secretary has been obtained to an application being made to the local justices, and this will be considered appropriately enough on the 5th November. Other applications to erect dynamite and gun-cotton magazines in the same locality have been abandoned through the opposition of local authorities.

WE are informed that Messrs. W. H. Allen and Co., of York-street Works, Lambeth, S.E., are manufacturing the circulating engines for the new steamers being built on the Clyde for the Cunard line. These pumping engines will demonstrate the enormous size of the ships, the pumps being capable of circulating 16,000 gallons per minute, and discharging 4200 tons per hour from the bilge. The main engines will indicate 13,000-horse power, and these together with the ships are being constructed by Messrs. John Elder and Co., of Fairfield Works, Govan.

BOTH the North and the South Staffordshire Institutes of Mining Engineers have for some years past been seeking to establish a course of mining engineering instruction at the Mason's Science College, Birmingham. Within the last few weeks such a department has been opened, intended to meet the needs of candidates for the positions of mining engineers, mine managers, colliery proprietors, and kindred posts. The chief lecturer is the ex-president of the North Staffordshire Institute, Mr. Jno. Brown, M. Inst. C.E. Mr. Craig, M.P., is expected to open the department on the 15th October.

SOME of the streets in Stockholm are now being lighted very successfully, the installation consisting of twelve Pilsen lamps, fed from a Schuckert 12-light dynamo machine, driven by a 10-horse power nominal portable engine of Swedish make. Great satisfaction is expressed at the lights, and one of the newspapers says, "We have noticed that the working both of the machinery and of the lamps has been more even and made better effect than the systems of electric lighting formerly tried at Stockholm—Brush, Siemens, Jungursen, Jablockoff. Very few fluctuations in the lamps could be seen. The light was bright and so strong that a reader who had placed himself in the middle between two lamps could see to read pencil writings and small print. The effect of the light on the grass plots and shrubberies was enchanting."

A QUESTION of interest as to iron brands is involved in a case which has this week come before the Birmingham Courts, and was thence handed over to the quarter sessions. The defendant, Thomas Williams, who is a chain, rivet, and nail manufacturer, was summoned for using the word "Lowmoor" as a trade mark. It was urged that that mark was the exclusive property of Messrs. Hird, Dawson, and Hardy, trading at Lowmoor, Yorkshire. It seems that although the firm do not allow a "Lowmoor" stamp outside their premises, yet that such a stamp was in current use in the Shropshire rivet districts, since the defendant "borrowed one from a friend." For the defence it was contended that the rivets were made from iron sold by a Shropshire firm at £12 10s. a ton, which was not itself marked "Lowmoor," but had been rolled from tires marked thus.

IN our annual article for the present year we noticed at some length the Guion steamer Oregon. This vessel has been tried on the Clyde on the 21st and previous days with remarkable results. She has already been fully described in our pages. On Wednesday week she steamed for seven hours continuously, and in a run from Ailsa Craig to Cumbrae Heads, a distance of 29½ knots, with a remnant of the tide against her, she steamed the distance in 1 hour and 27 minutes. This gives a speed of over 20 knots, or more than 23 ordinary miles per hour. The indicated horse-power was upwards of 12,000. The Oregon was built by Messrs. J. Elder and Co. She is 520ft. long, 54ft. wide, and 40ft. 9in. deep. Her gross tonnage is 7500. She has three cylinder engines, the high-pressure in the middle, the two low-pressure standing one at each side of it. The high-pressure is 70in., the two low-pressure 104in. diameter, with a stroke of 6ft. The crank shaft is built of crucible steel. Steam is supplied by nine steel boilers, double-ended, 16ft. 9in. long, and 16ft. 6in. diameter, with four Fox's furnaces at each end. The working pressure is 100 lb. She will burn at full speed at least 10 tons of coal per hour.

THE two handsome three-branch candelabra now being put at the entrance to the Northumberland-avenue by the Metropolitan Board of Works are now completed. The candelabra are from the designs of Mr. G. Vulliamy, the architect of the Metropolitan Board of Works. The castings are from the foundry of Messrs. Young and Co., statue founders and engineers, Pimlico, and are from the models made by Messrs. Mabey and Co., Princes-street, Westminster, sculptors and modellers. The lamps, of globular form, are Mr. William Sugg's patent, fitted with his patent combination flat flame burners, each lamp having a group of four burners, three of the burners burning 10ft. each and one in the centre 5ft. per hour. The centre one is intended to be burned after midnight, and there is an arrangement by which the lamplighter may extinguish the outer three of the group, leaving only the centre to burn till daylight. Each lamp is provided with a white glass reflecting top, first introduced by Mr. William Sugg in the experimental street lighting by gas in Waterloo-road and Waterloo-place, in January, 1879, and which has since been almost universally adopted. The effective illuminating power from each of the six lamps—measured by a photometer on the ground—is 175 candles, making for each candelabra a total equal to 525 candles. This is the highest result yet obtained by common coal gas burned in street lamps of the flat flame type. The whole of the gas arrangements and the erection of the columns have been under the supervision of Mr. Mills, the gas engineer to the Metropolitan Board of Works.

RAILWAY MATTERS.

THE Pontypridd, Newport, and Caerphilly line is expected to be opened on the 1st of November.

ON the Hudson River Railroad, some years ago, whistles having a very low tone were used, when it was found that they could not be readily heard amid the noise of the train. The bells were consequently partly filled up with wood, which made their sound more shrill, and remedied the evil.

IT is said that the Philadelphia and Reading Railroad Company proposes hereafter to use rails 60ft. long instead of 30ft., and will begin their manufacture at once. The rails will also be increased in weight from 68 lb. to 70 lb. per yard. The decreased number of joints to care for will lessen expenses, it is thought, but there are difficulties in the way of handling and transporting the 60ft. rails, which trackmen will understand.

THE Union Pacific, the Central Pacific, the Northern Pacific, and the Atchison, Topeka, and Santa Fa railway companies have contracted for the Westinghouse automatic freight brake for their entire freight equipment. The cost of this brake, as furnished by the Westinghouse Air Brake Company, is 50 dols. per freight car, the engine fixtures costing 300 dols. per engine and 60 dols per tender. The Westinghouse Company, however, offers to give a discount of 20 per cent. on the car fixtures to companies contracting for their entire equipment before June 30th, 1884, and a discount of 10 per cent. on contracts made for that date until the close of the year.

IN 1871 General Duane made a series of experiments at Portland, Me., on locomotive engine whistles. In his report of them he says:—"The experimental whistles were of the following dimensions, viz., 2½in., 3in., 4in., 5in., 6in., 10in., 12in., and 18in. diameter. Those of 2½in., 3in., 5in., and 10in. were fitted, instead of the ordinary bell with long cylinders, provided with movable pistons, so that the effective length of the bell could be altered at pleasure. The pitch of the blast was found to vary with the length of the bell, and the power of the whistle with its diameter. The ratio of the power to the diameter was not accurately obtained, but it is probable that the extreme range of sound of a whistle is proportional to the square root of its diameter."

A LIST has recently been compiled by Mr. Pfarsk of the length of the principal railway viaducts in the world, the figures of which are as follows:—Parkesburg, U.S., 2150 yards; St. Louis, over the Missouri, 1993; Louisville, over the Ohio, 1635; across the Fast River, 1520; and the same for the Delaware at Philadelphia and for the Victoria Bridge over the St. Lawrence; the Volga Bridge, near Syssran, 1495; the Moersdyk Bridge, Holland, 1490; Pongabuda (India), 1148; the Dneister Bridge, near Kiew, 1090; over the Rhine at Mayence, 1038; the Dneiper at Pultawa, 980; the Mississippi, at Quincy, 980; the Missouri, at Omaha, 860; across the Weichsel, near Dirschau, 845; the Danube, near Stadlau, 775; the Po, near Mezzana-Corti, 765; the Tamar, at Saltash, 673; the Mississippi at Dubugue, 542; the Gorai (India), 535; the Britannia Bridge, 480; over the Saone at Friburg, 392; across the Theiss at Szegedin, 365.

THE making of the Arlberg Railway is proceeding with great rapidity. The tunnel is now within 1180 metres of completion; the boring will probably be finished by the end of October, and the line opened for traffic in the course of 1884. The total length of the great tunnel will be 10,270 metres—nearly 6⅓ miles—and no similar work of equal magnitude was ever before so rapidly accomplished. The Arlberg Railway will form an important outlet for Austrian and Hungarian produce, and cannot fail to increase the trade of the empire with Switzerland and France. But in making a new international railway, and maintaining an irrational and restrictive tariff, Austria is virtually blowing hot and cold with the same breath. The Swiss commercial papers express a fear that for this reason the Arlberg Railway may, after all, not realise the expectations of its promoters, and they are urging the Federal Council to propose to the Austro-Hungarian Government a revision, in a liberal sense, of the existing commercial relations between the two countries. The tunnel has already been described and illustrated in our columns.

A SMOKE consumer, invented by R. L. Walker, is being applied to locomotives of the Illinois Central R.R. A vertical water bridge divides the fire-box or furnace into two compartments, one of which is charged with fresh coal, while the other contains freely burning coal. The compartment containing the fresh coal is closed at the top by a damper which confines the gases and is regulated by the fireman in the engine cab. The smoke and gases arising from the fresh coal as it becomes heated pass through a small opening over the water tables and above the fire into the next compartment, where they are entirely consumed. The operation is then reversed by the other compartment of the fire-box being charged with fresh coal, in consequence of which the smoke and gases pass into the compartment opposite, where the fire has reached a high temperature. There is in the fire-box a firebrick arch, which becomes highly heated and preserves a uniform temperature in the furnace and assists in consuming the gases from the fresh coal. There may be something new in the details of this invention, but the same idea has often been worked out in other ways. It is a curious fact that very high temperatures prevent the complete combustion of carbonic oxide.

WEATHER forecasts are distributed by rail in Ohio. Signals are placed on the sides of the baggage cars. The signals are three in number as to form and two as to colour—red and blue. The shapes are sun, moon, and star. The signal is made as large as possible, and the disc can be seen at a long distance. The red sun and blue moon mean higher temperature and general rain. The crescent means lower temperature; the full disc of blue means general rain; the star represents local rains. The road goes through an agricultural region of considerable importance. It is the line connecting the cities of Columbus and Cleveland. Two trains start out in the morning at the middle point between those cities. The signals are put on the cars at five o'clock in the morning, and as they run through the morning hours the farmers along the line can have an opportunity of seeing them and predicting the weather for the day. The railway company circulated through the whole line little cards having these signals displayed in colours, with their meaning in every combination, which enable everybody to understand what is meant. A recent communication from General Hazen indicates a disposition on the part of the general Government to take hold of the matter and bring it into general operation as far as possible.

ACCORDING to statistics issued by the German Railway Department there were 4123 instances of broken tires amongst forty-two railway companies running over 21,000 miles during the winter of 1880-81. During the same period thirteen companies, representing 300 miles of railway, were free from such accidents. The greatest proportion occurred during the month of January—37·89 per cent. The temperature at the time of breaking was only ascertained in two-thirds of the cases, and of these 1080 were at or above freezing point, while 1553 were at a lower temperature, the latter being specially recorded in connection with steel tires. Crucible cast steel seems to have been the substance most liable to fracture, and fine-grained iron the least subject to it. The facts recorded are considered by the *Wochenblatt für Architekten und Ingenieure* to indicate that longitudinal sleepers are more favourable than other systems to the avoiding of the accidents referred to. About one-half of the defects in question were discovered during the examination at railway stations, and the remainder, in about equal proportions, were found out while the train was going on, or during examination in the workshops. It is further stated that a sudden and forcible action of the brake is specially apt to cause the breaking of tires. The instances on goods trains were the most numerous, and on express trains the least frequent. In this country broken tires are almost unknown. The mischief is done abroad by the way in which the tires are put on.

NOTES AND MEMORANDA.

M. TOMMASI has devised an arrangement to make the luminous point of the Jablochkoff candle practically stationary. A selenium regulator acts as an automatic elevator of the point as the candle burns down.

ACCORDING to the *Sanitary Engineer* the Gramme Electrical Company, together with its members, the Brush, Edison, Fuller, Jablochkoff, Thomson-Houston, United States and Weston companies, own or control nearly 500 patents.

THE best quality of charcoal is made from oak, maple, beech, and chestnut. Wood will furnish, when properly charged, about 20 per cent. of coal. A bushel of coal from pine weighs 29 lb.; a bushel of coal from hardwood weighs 30 lb.; 100 parts of oak make nearly 23 of charcoal; red pine, 22·10; white pine, 23.

ON Tuesday the electrical launch, which forms the most novel and attractive feature of the Electrical Exhibition at Vienna, conveyed a distinguished party on the longest trip yet made in such a vessel. The launch started from Vienna and followed the course of the Danube to Pressburg, a distance of about fifty miles, accomplishing the journey in four hours, or at the rate of about 12½ miles an hour, with the stream. The launch is the joint production of the Electrical Power Storage Company, Messrs. Siemens Brothers and Co., and Messrs. Yarrow and Co.

AN arrangement for producing brilliant light by the combination of gas and electricity has been brought out by M. Somzee, which consists of an ordinary gas flame, through which passes a curved metallic rod provided with means for preventing overheating under the action of the electric current, which is derived from a secondary battery. The light is said to be white, and much cooler than a corresponding light from gas alone. The platinum does not require a great intensity of current, and that "one or two small elements will suffice to supply an ordinary light, and make it give four or five time more light at a cost three times less than gas."

M. FRIEDEL, having contested the announcement of M. Spring that a pressure of 5000 atmospheres exerted upon amorphous pulverulent matters causes them to become aggregated into crystalline masses, MM. E. Jannettaz, Neel, and Clermont determined to repeat his experiments, using pressures of from 6000 to 8000 atmospheres. They operated upon pulverised antimony, bismuth, zinc, iron, tin, copper, and lead, Darcet's alloy and brass, lead, and zinc sulphides, sodium lead and mercurous chlorides, mercuric iodide, magnesia, alumina, silica, chalk, and copper sulphate. All these powders were agglutinated into solid masses, but even those which acquired some degree of transparency were not crystallised. Many of the substances, however, such as steatite, graphite, clays, and metals, acquired a schistous structure, and assumed the thermic properties characteristic of such structure.

AN interesting example of the originality which American ironmakers bring to bear upon the solution of exceptional problems is furnished by the manner in which the managers of the Lucy furnace, at Pittsburg, got over the difficulty of handling their cinder. There was no room for dumping in the vicinity of the works; and after many and expensive experiments, cars were designed which allow the cinder to be carried over long distances in a liquid condition. It is related that the cinder was thus in one winter carried a distance of forty miles, to help to break up an ice-gorge, or rather melt it away—a feat which was successfully accomplished. In this country we have no ice-gorges, so we cannot follow the Yankee example; but we build breakwaters of slag, and utilise it now and then to even more advantage than in melting ice.

A HEAD, says the *Panama Star and Herald*, taken from a monolith at Tiahuanaco has been erected in La Paz, Bolivia. Some time ago General Ballivian attempted to transport the monolith intact, but, after removing it some distance, the work was found to be difficult and the effort was given up. This stone is eight metres in length. The head which has now been taken to La Paz weighs 2700 lb. It must be remembered that the ruined city at Tiahuanaco is celebrated for the massive nature of the stones employed in the erection of its temples, fortresses, and houses. In one of the walls there is a gigantic mass of rock which has been carefully measured and proved to weigh 250,000 lb., or 125 short tons. Who were the builders and how they contrived to handle these enormous masses of rock remain enigmas to the present day, although fancy and tradition have been busily employed endeavouring to solve them. Tiahuanaco is situate in Bolivia on the south shore of Lake Titicaca.

COMMENTING on the behaviour of arsenic in contact with putrefying animal substances, the *British Medical Journal* says that the existence of volatile arsines formed when arsenic is in contact with decaying animal matter, may serve to throw light upon the anomalies attending the use of arsenical wall papers. It is well known—and has hitherto not received any satisfactory explanation—that some highly arsenical wall papers have been used without manifest injury to health; whilst others, on the other hand, though containing much less arsenic, have produced distressing results. It may be that in the one case volatile arsenical bases have been formed, and not in the other. The fact that the frequenters of dissecting-rooms, where bodies are injected with preparations of arsenic, do not suffer from arsine poisoning is, however, adverse to the theory of the formation of these bodies under the influence of putrefaction, unless in very exceptional cases.

IN order to ascertain to what extent aniline colours might be injurious to health, notice was, for some years, taken of the health of the employés of the aniline colour works at Höchst-on-the-Main, where 672 persons are employed. Reporting the result, the *Journal of Gas Lighting* says that it is known that nitro-benzol is poisonous, yet among the twenty-four men employed at Höchst, in the nitro-benzol house, during the last four years, symptoms of "nitro-benzolismus" appeared in only five cases. Aniline, also, is admittedly poisonous; and of the twenty-nine men employed in the aniline house at Höchst there were eighteen cases of specific aniline poisoning, none of which proved fatal. The workmen in the magenta house were always reddened with dye, even to the inside of the mouth, and some of the material must therefore have been swallowed; yet not a single case of specific ailment has occurred among them for eighteen years. Neither magenta nor its derivatives, when made without arsenic, can be considered in the least degree harmful. Naphthaline is observed to be deleterious only when in the form of hot vapour. On the whole, Dr. Grandhomme finds that the average mortality of the workpeople was 4·2 per cent., which is a distinctly favourable result, and should go far to dispel any lingering dread of coal tar colours, on the ground of their supposed possession of poisonous qualities.

MESSRS. COCKSHOTT AND JOWETT, of Thornton-road, Bradford, well-known makers of phosphor tin, inform us that they have produced an entirely new alloy. They have, after a long series of experiments, succeeded in alloying manganese with phosphorus and tin and copper, producing a metal which, for tensile strength and durability, they think will be found superior to any alloy in the market. This phosphor manganese tin may be used exactly in the same manner, and in similar proportions, as phosphor tin—though it is better to cast at a little higher temperature—but the result will be found much superior both as regards hardness and tensile strength. Phosphor manganese tin will be found a very convenient form in which to have the combination of manganese and phosphorus, as it will enable the brassfounder to produce the bronze of a quality exactly suitable to the purpose for which it is required by adding a greater or lesser proportion of copper, &c., accordingly as the bronze is required to be tougher or harder. This phosphor manganese bronze is made in two qualities, No. 1 and No. 2, both the same price. The former is very tough and suitable for purposes where the castings are required to withstand a great strain. Mr. Kirkaldy, of London, has found this alloy to withstand the enormous strain of 34,754 lb. per square inch. The latter is for bearings and wearing parts of machinery, and is exceedingly hard, but at the same time very tough, the tensile strength being, according to Mr. Kirkaldy, 29,979 lb. per square inch.

MISCELLANEA.

THE Franklin Institute, of Philadelphia, proposes to arrange for the holding of an international electric exhibition, to open on the 3rd of September, 1884.

THE authorities of Wednesbury, together with those of Willenhall, are each preparing sewerage schemes of considerable magnitude, the water council of the Birmingham Corporation having increased their vigilance as to the pollution of the river Tame.

MR. C. R. BOWLING, the senior inspector of factories and workshops in Birmingham, who has administered the Factory Acts in that city for thirteen years, has accepted the charge of one of the Metropolitan districts, and will shortly remove to London.

THE French Ministry of Commerce is engaged in drawing up particulars of the patents for inventions granted in France since the foundation of the present Republic. The work so far is complete up to the end of 1878. During the eight years from the end of 1870 there were 55,000 applications for patent rights, or an annual average of nearly 7000. In the succeeding years the applications have considerably increased.

THE Philadelphia City Councils have passed an ordinance which, if faithfully observed, will go far toward keeping the street pavements in good order. All openings in the streets made for any purpose and by any person must be, when the object of the opening is accomplished, filled in with earth and rammed in layers and immediately repaved. If any settlement occurs within sixty days thereafter the pavements must be renewed at once.

ON the 17th instant the Pilsen Company was requested to light up the western and foreign wing of the Fisheries Exhibition, and on the evening of Wednesday, the 19th inst., fourteen Pilsen arc lamps of 2000-candle power were running successfully, fourteen other lamps of the same kind being added on the 20th inst. Considering that this installation involved the running of nearly a mile of leads, besides the fixing of dynamo machines and other apparatus, this was good work.

MESSRS. PIGOU, WILKES, AND LAWRENCE, Limited, gunpowder manufacturers of Dartford, wish to erect an extensive magazine capable of containing 20,000 lbs. of blasting powder on Wren's Nest Hill, Sedgely. The consent of the Home Secretary has been obtained to an application being made to the local justices, and this will be considered appropriately enough on the 5th November. Other applications to erect dynamite and gun-cotton magazines in the same locality have been abandoned through the opposition of local authorities.

WE are informed that Messrs. W. H. Allen and Co., of York-street Works, Lambeth, S.E., are manufacturing the circulating engines for the new steamers being built on the Clyde for the Cunard line. These pumping engines will demonstrate the enormous size of the ships, the pumps being capable of circulating 16,000 gallons per minute, and discharging 4200 tons per hour from the bilge. The main engines will indicate 13,000-horse power, and these together with the ships are being constructed by Messrs. John Elder and Co., of Fairfield Works, Govan.

BOTH the North and the South Staffordshire Institutes of Mining Engineers have for some years past been seeking to establish a course of mining engineering instruction at the Mason's Science College, Birmingham. Within the last few weeks such a department has been opened, intended to meet the needs of candidates for the positions of mining engineers, mine managers, colliery proprietors, and kindred posts. The chief lecturer is the ex-president of the North Staffordshire Institute, Mr. Jno. Brown, M. Inst. C.E. Mr. Craig, M.P., is expected to open the department on the 15th October.

SOME of the streets in Stockholm are now being lighted very successfully, the installation consisting of twelve Pilsen lamps, fed from a Schuckert 12-light dynamo machine, driven by a 10-horse power nominal portable engine of Swedish make. Great satisfaction is expressed at the lights, and one of the newspapers says, "We have noticed that the working both of the machinery and of the lamps has been more even and made better effect than the systems of electric lighting formerly tried at Stockholm—Brush, Siemens, Jungursen, Jablockoff. Very few fluctuations in the lamps could be seen. The light was bright and so strong that a reader who had placed himself in the middle between two lamps could see to read pencil writings and small print. The effect of the light on the grass plots and shrubberies was enchanting."

A QUESTION of interest as to iron brands is involved in a case which has this week come before the Birmingham Courts, and was thence handed over to the quarter sessions. The defendant, Thomas Williams, who is a chain, rivet, and nail manufacturer, was summoned for using the word "Lowmoor" as a trade mark. It was urged that that mark was the exclusive property of Messrs. Hird, Dawson, and Hardy, trading at Lowmoor, Yorkshire. It seems that although the firm do not allow a "Lowmoor" stamp outside their premises, yet that such a stamp was in current use in the Shropshire rivet districts, since the defendant "borrowed one from a friend." For the defence it was contended that the rivets were made from iron sold by a Shropshire firm at £12 10s. a ton, which was not itself marked "Lowmoor," but had been rolled from tires marked thus.

IN our annual article for the present year we noticed at some length the Guion steamer Oregon. This vessel has been tried on the Clyde on the 21st and previous days with remarkable results. She has already been fully described in our pages. On Wednesday week she steamed for seven hours continuously, and in a run from Ailsa Craig to Cumbrae Heads, a distance of 29½ knots, with a remnant of the tide against her, she steamed the distance in 1 hour and 27 minutes. This gives a speed of over 20 knots, or more than 23 ordinary miles per hour. The indicated horse-power was upwards of 12,000. The Oregon was built by Messrs. J. Elder and Co. She is 520ft. long, 54ft. wide, and 40ft. 9in. deep. Her gross tonnage is 7500. She has three cylinder engines, the high-pressure in the middle, the two low-pressure standing one at each side of it. The high-pressure is 70in., the two low-pressure 104in. diameter, with a stroke of 6ft. The crank shaft is built of crucible steel. Steam is supplied by nine steel boilers, double-ended, 16ft. 9in. long, and 16ft. 6in. diameter, with four Fox's furnaces at each end. The working pressure is 100 lb. She will burn at full speed at least 10 tons of coal per hour.

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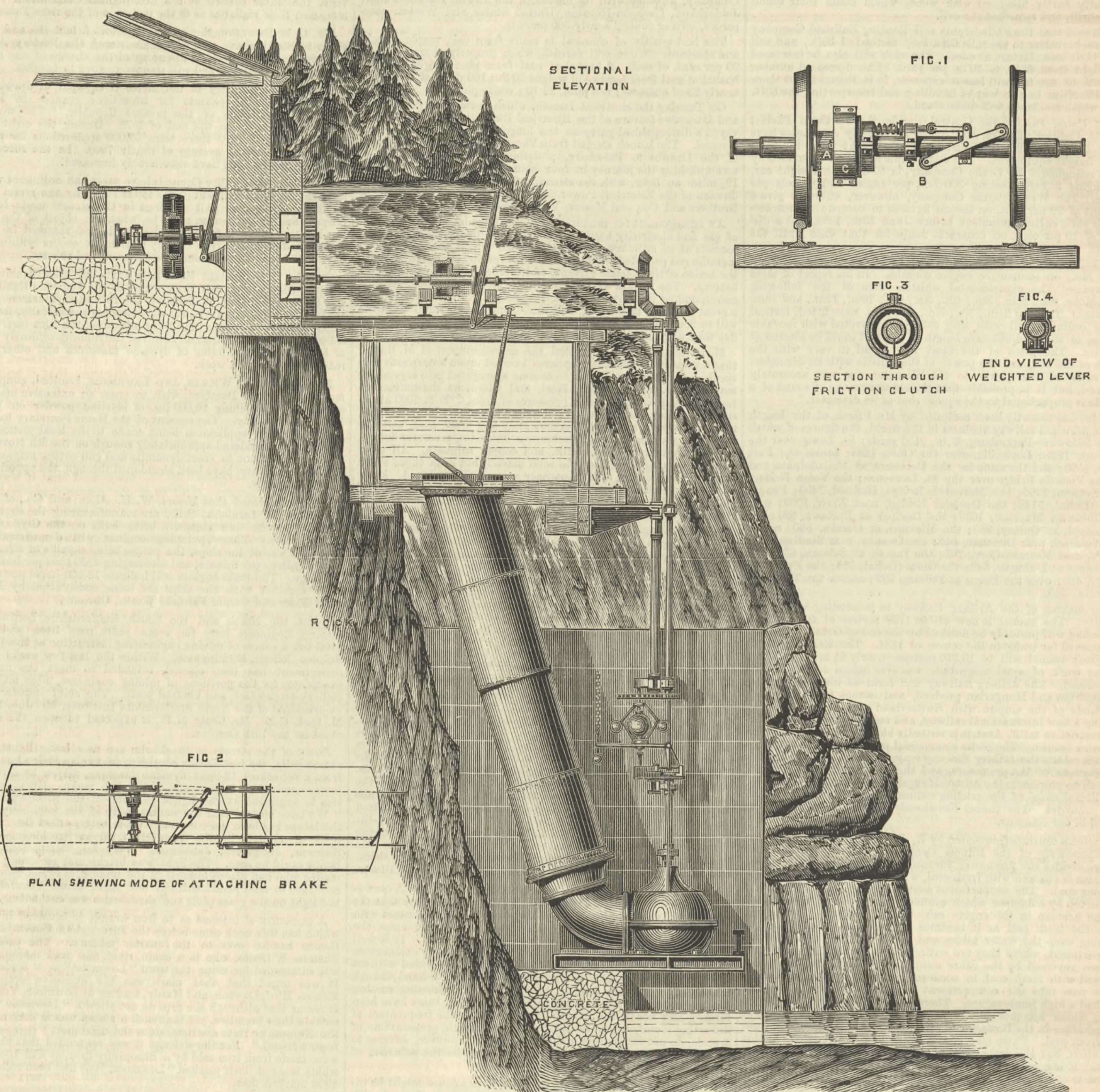
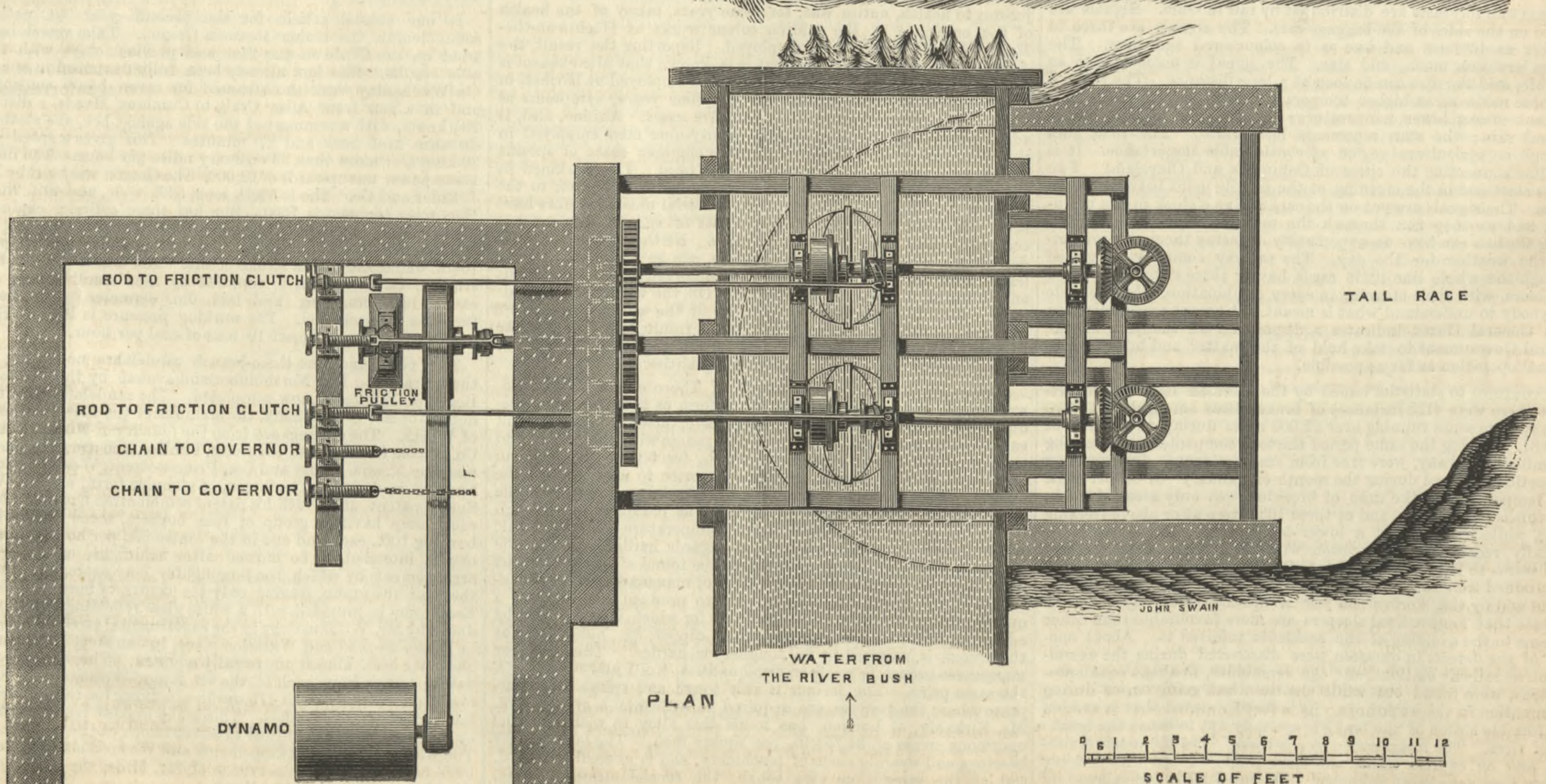
TURBINES, PORTRUSH AND BUSH VALLEY TRAMWAY.

MESSRS. BAGSHAW AND SONS, ENGINEERS, BATLEY.

(*For description see page 239.*)





PLAN

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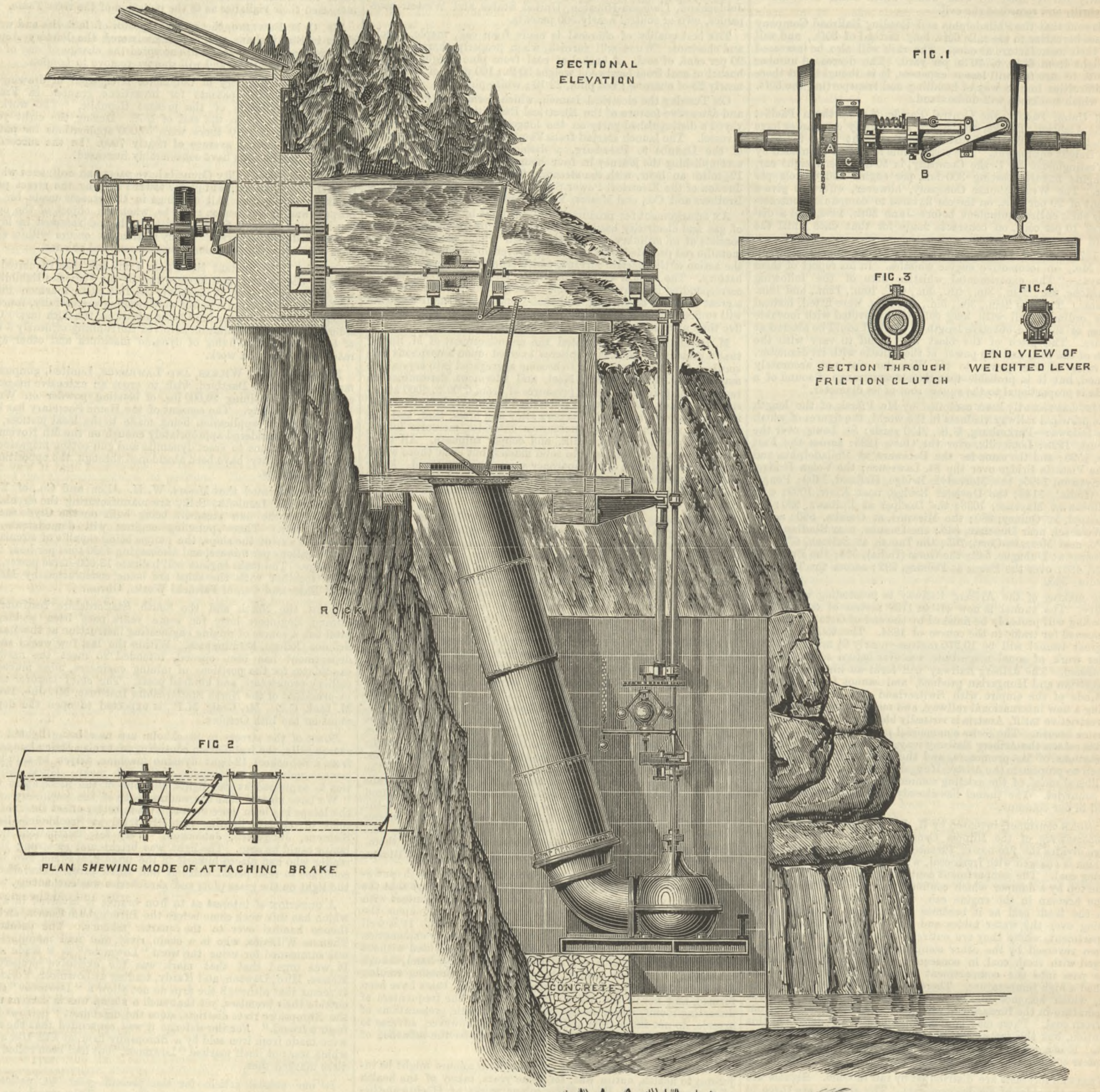

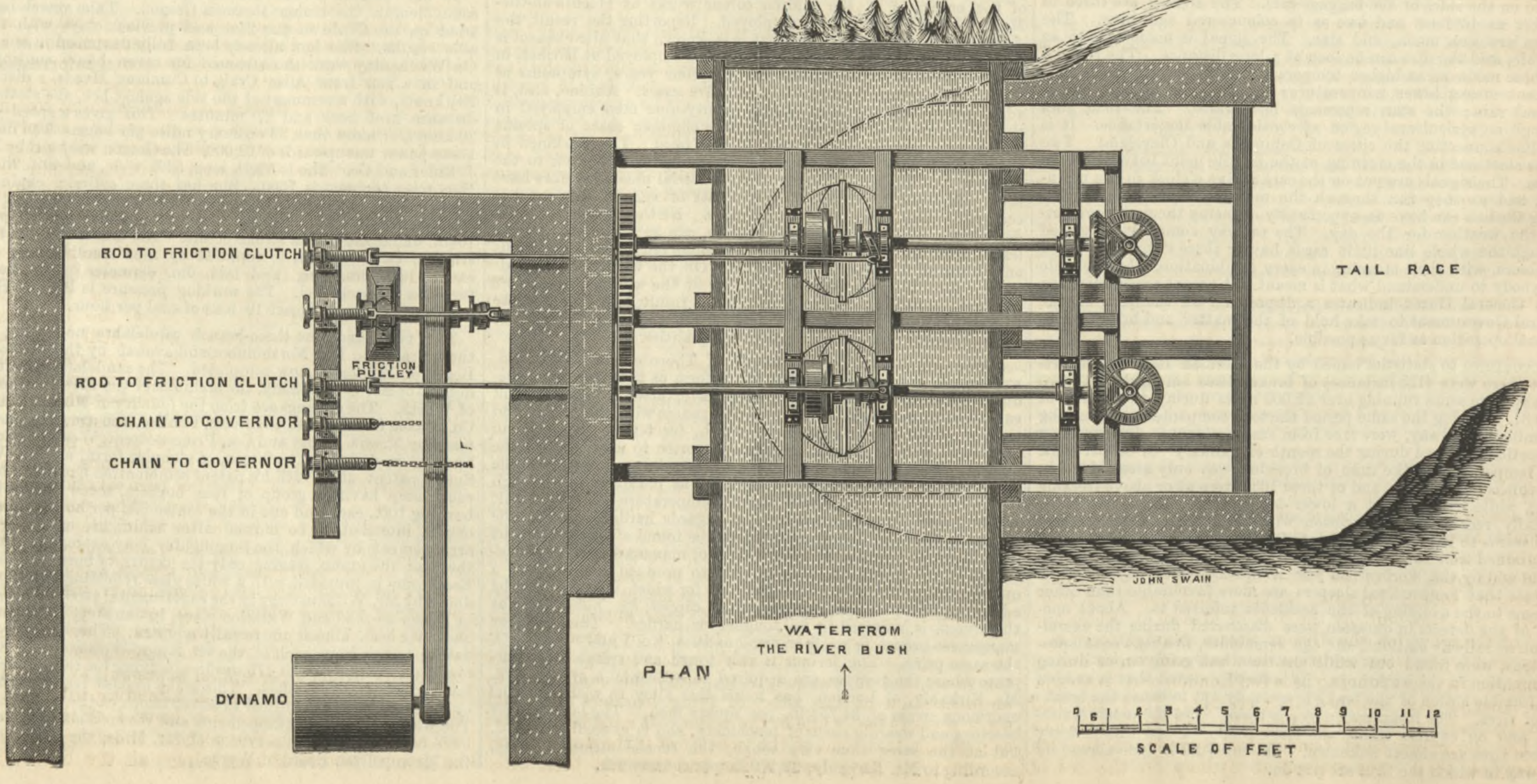

PLAN

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TO CORRESPONDENTS.

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

J. R. G.—*You can get the treatise on the indicator which you want from Messrs. Elliott Bros., West Strand, London.*

STEAM HAMMER TUPS.—*G. P., Staleybridge, is requested to communicate with Mr. Claridge, Holwell Ironworks, Melton Mowbray.*

H. H. C.—*There is no book on constants and factors of safety. A knowledge of such things is acquired during an engineer's education, and no hard-and-fast rule is laid down. It is necessary that a roof, or shaft, or boiler should be strong enough to bear a given strain, and the margin of safety allowed varies. Engineering is not all made up of rules and figures.*

POWER REQUIRED TO DRILL HOLES.

(*To the Editor of The Engineer.*)

SIR,—Would any reader kindly inform me what indicated horse-power is required to drill a ¾in. and 1in. hole through iron or Bessemer steel? I have looked through all our books and cannot find it. S. H.

September 26th.

BERGEN'S ROTARY SQUEEZER.

(*To the Editor of The Engineer.*)

SIR,—In THE ENGINEER of Sept. 14th, to correspondent *re* Bergen's rotating squeezer, you say you do not believe any squeezer is to be found in England other than the ordinary crocodile. I believe you will find a rotary one at work at Chillington Ironworks, Wolverhampton; if not now, it was until lately, and had been for about thirty-five years to my recollection. The sketch in your last impression will give an idea of its construction. The old and well-known firm of G. B. Thorneycroft also had one in use for many years, but the axis of the drum was horizontal, and the drum was about 9ft. diameter; but it has been obsolete for many years. WITNESS.

Leicestershire, September 22nd.

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MEETING NEXT WEEK.

SOCIETY OF ENGINEERS.—Monday, October 1st, at 7.30 p.m., a paper will be read "On Designs, Specifications, and Inspection of Ironwork," by Mr. Hamilton W. Pendred, the leading features of which are as follows:—The relations existing between engineers and contractors; a more perfect knowledge of each other's line of business desirable. Defects in specifications. Good and complete drawings expedite work. The necessity of designs being completed at the outset. Details and their design. Evils of bending angle irons. Joint covers and their use. Specifications. Methods of work in different yards. Securing cross girders to main ones. Joints of floor plates. Water-tight floors. Drifting: its use and abuse. Rimmers. Mode of fastening main girders to abutments. Hand and machine rivetting. Camber of girders. Designing cast ironwork. The use of fillets. Evils of casting lugs on columns. The shifting of cores in casting. Inspecting cast ironwork. Cement used to fill up flaws. Painting. Weighing and delivery of materials at the site. The legal value of dispute clauses in specifications.

THE ENGINEER.

SEPTEMBER 28, 1883.

THE AUSTRAL INQUIRY.

ON Monday, the 24th inst., an inquiry was commenced at Westminster by the Wreck Commissioner, assisted by four assessors, into the cause of the sinking of the screw steamer Austral in Sydney Harbour on the 11th of November last. The Austral was a new steel steamer of 5588 tons gross, and of the following registered dimensions:—Length, 456ft.; breadth, 48·2ft.; and depth of hold, 33·9ft. She was built by the firm of Messrs. J. Elder and Co., of Glasgow, for the Orient Steam Navigation Company, and is the latest addition to that company's line of passenger steamers running between London and Australia. The Austral was launched in December, 1881, and had already made one voyage to Australia and back previous to her departure from London for Sydney on the 7th September, 1882. She arrived at Sydney on the 3rd of November following, and after discharging the greater part of her cargo she heeled over and sank during the process of coaling while lying moored in smooth water in Neutral Bay. The Austral is provided with a double bottom extending throughout 256ft. of her length, on what is known as the cellular system of construction, for the purpose of carrying water ballast to ensure a sufficiency of stability when she is flying light without cargo. This double bottom, which is divided into two parts by a watertight longitudinal middle line girder, and further subdivided by several transverse divisional bulkheads, is capable of holding about 605 tons of water, 111 tons of which is contained in a tank specially fitted as a reserve fresh water tank to supplement the 70 tons carried separately for the purpose of providing the ordinary supply. In addition to the water ballast described above, the Austral has a fore peak tank capable of holding 44 tons, an after tank holding 64 tons, and in the after hold a deep tank, constructed so as to be able to carry coals, general cargo, or 295 tons of water, as circumstances may require.

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We do not now propose to enter upon a discussion of the causes of the disaster, as the matter is still *sub judice*, but as the general question of the effect of double bottoms upon the stability of vessels constructed for the purpose of carrying water ballast is one on which many erroneous opinions prevail, it can with propriety be touched upon. It was only too evident during the cross examination of one of the witnesses by the counsel engaged in this case, that, notwithstanding the fact that much has been written by scientific men upon the subject of double bottoms, popular fallacies still exist as to the effect of empty water ballast tanks in causing vessels to capsize Water ballast tanks are not the creation of the last few years. For twenty years or more it has been the practice to employ water ballast in steam colliers so as to enable them to return speedily to the coaling port and re-coal without incurring the delay and expense incidental to the use of dry ballast. Water ballast was not, however, adopted generally in cargo-carrying steamers until a few years later, and as this change was soon followed by the loss of a number of vessels, a large proportion of which were so fitted, the opinion began to be held that the water ballast was the cause of loss. All kinds of theories were formulated as to the causes of loss among the unscientific. It was contended that the imprisoned air in the empty tanks is continually endeavouring to capsize the vessel, and it was sought to justify this contention by an illustration of the effect of tying bladders filled with air to a man's feet while in the water. It must be admitted as probable that some of the vessels lost at the time referred to would not have been so lost had they not been fitted with water ballast tanks, but this was due to the fact that as designed their proportions were not suited for water ballast, and not through any inherent capsizing tendencies in the ballast tank itself. These vessels were, as a rule, made very narrow in proportion to their depth; and the lifting of the cargo caused by the fitting of the tanks was in many cases sufficient to compromise the already narrow margin of stability. This defect in design is now being remedied. Vessels are being built much broader in proportion to their depth, with the result that they are enabled to carry their water ballast in safety.

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TO CORRESPONDENTS.

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

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

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

J. R. G.—*You can get the treatise on the indicator which you want from Messrs. Elliott Bros., West Strand, London.*

STEAM HAMMER TUPS.—*G. P., Staleybridge, is requested to communicate with Mr. Claridge, Holwell Ironworks, Melton Mowbray.*

H. H. C.—*There is no book on constants and factors of safety. A knowledge of such things is acquired during an engineer's education, and no hard-and-fast rule is laid down. It is necessary that a roof, or shaft, or boiler should be strong enough to bear a given strain, and the margin of safety allowed varies. Engineering is not all made up of rules and figures.*

POWER REQUIRED TO DRILL HOLES.

(*To the Editor of The Engineer.*)

SIR,—Would any reader kindly inform me what indicated horse-power is required to drill a $\frac{3}{4}$in. and 1in. hole through iron or Bessemer steel? I have looked through all our books and cannot find it. S. H.

September 26th.

BERGEN'S ROTARY SQUEEZER.

(*To the Editor of The Engineer.*)

SIR,—In THE ENGINEER of Sept. 14th, to correspondent *re* Bergen's rotating squeezer, you say you do not believe any squeezer is to be found in England other than the ordinary crocodile. I believe you will find a rotary one at work at Chillington Ironworks, Wolverhampton; if not now, it was until lately, and had been for about thirty-five years to my recollection. The sketch in your last impression will give an idea of its construction. The old and well-known firm of G. B. Thorneycroft also had one in use for many years, but the axis of the drum was horizontal, and the drum was about 9ft. diameter; but it has been obsolete for many years. WITNESS.

Leicestershire, September 22nd.

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MEETING NEXT WEEK.

SOCIETY OF ENGINEERS.—Monday, October 1st, at 7.30 p.m., a paper will be read "On Designs, Specifications, and Inspection of Ironwork," by Mr. Hamilton W. Pendred, the leading features of which are as follows:—The relations existing between engineers and contractors; a more perfect knowledge of each other's line of business desirable. Defects in specifications. Good and complete drawings expedite work. The necessity of designs being completed at the outset. Details and their design. Evils of bending angle irons. Joint covers and their use. Specifications. Methods of work in different yards. Securing cross girders to main ones. Joints of floor plates. Water-tight floors. Drifting: its use and abuse. Rimmers. Mode of fastening main girders to abutments. Hand and machine rivetting. Camber of girders. Designing cast ironwork. The use of fillets. Evils of casting lugs on columns. The shifting of cores in casting. Inspecting cast ironwork. Cement used to fill up flaws. Painting. Weighing and delivery of materials at the site. The legal value of dispute clauses in specifications.

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CERTAIN accusations have been brought against the British Association. It has been said that it was becoming too "popular," and that its proceedings lacked that stern devotion to pure science which scorns to be popular; or to speak in language which must of necessity be understood. So this year Professor Cayley was made president; and his address is supposed to have restored the balance, and to have brought back the reputation of the Association to its proper place. Professor Cayley dealt with science in its very purest form, and it is, we think, worth while to consider how far and in what way such an address as that which he delivered as president of the British Association is likely to be useful. Scientific teaching is now, and has been for some time past, in a peculiar and unusual position. It is only within a comparatively recent period that science has been widely taught at all. The first students were well content to take such fare as was offered them, and to ask no questions, or but very few. The world does not stand still, however; and it has somewhat recently become evident, first, that the student is not what he was; and secondly, that the spirit of scepticism and inquiry is extending its influence into regions hitherto almost untouched by it. The man of science began some thirty years ago, let us say, to unsettle the mind of the world on many points, and for a long period he had it all his own way. But those who choose to look below the surface of things are aware that unless he is very careful indeed he will be hoist with his own petard. The word of a scientific man was at one time law; but that was a little while ago, and very few thoughtful men now accept what is told them concerning new discoveries and old theories without much cogitation and hesitation. Any student who is a little above the average knows that he can put questions to learned professors charged with the task of instructing him which they cannot answer; and these questions are not unimportant; on the contrary, they lie at the root of the phenomena of nature. As such a student goes on learning and thinking, he will find that much that passes for science is but a knowledge of words and not of things; and he will further find that even about the meanings of these words opinions differ. If this line of thought is pursued for a few years the student will at last arrive, not unnaturally, at the conclusion that no one knows anything about anything.

Now Professor Cayley's address may be taken, on the one hand, as proving that in certain departments of scientific investigation we do really acquire sound information; and, on the other hand, it is almost impossible for the student to whom we have referred to read it without coming to the conclusion that some science, at all events, is simply chaos. It has been said that mathematics are the only exact science; but however true this may be within certain limits, we find two such master minds as those of John Stuart Mill and Professor Cayley at issue about the fundamental bases of one branch at least of mathematics. Mill contends that the truths of mathematics, in particular those of geometry, rest on experience. Professor Cayley discussed this point at length, and we quote a few lines both from Mill and Cayley, to show the lines taken by each:—"It is customary," says Mill, "to say that the points, lines, circles, and squares, which are the subjects of geometry, exist in our conceptions merely, and are parts of our minds; which minds, by working on their own materials, construct an *à priori* science, the evidence of which is purely mental, and has nothing to do with outward experience. By howsoever high authority this doctrine has been sanctioned, it appears to me psychologically incorrect. The points, lines, and squares which anyone has in his mind are, as I apprehend, simply copies of the points, lines, and squares which he has known in his experience. Our idea of a point I apprehend to be simply our idea of the minimum visible, the small portion of surface which we can see. We can reason about a line as if it had no breadth, because we have a power which we can exercise over the operations of our minds; the power, when a perception is present to our senses or a conception to our intellects, of attending to a part only of that perception or conception instead of the whole. But we cannot conceive a line without breadth; we can form no mental picture of such a line; all the lines which we have in our mind are lines possessing breadth. If anyone doubt this, we may refer him to his own experience. I much question if anyone who fancies that he can conceive of a mathematical line thinks so from the evidence of his own consciousness. I suspect it is rather because he supposes that unless such a perception be possible, mathematics could not exist as a science, a supposition which there will be no difficulty in showing to be groundless." To this Professor Cayley replies:—"I think it may be at once conceded that the truths of geometry are truths precisely because they relate to and express the properties of what Mill calls 'purely imaginary objects;' that these objects do not exist in Mill's sense, that they do not exist in nature, may also be granted; that they are 'not even possible,' if this means not possible in an existing nature, may also be granted. That we cannot 'conceive' them depends on the meaning which we attach to the word conceive. I would myself say that the purely imaginary objects are the only realities, the ὄντως ὄντα, in regard to which the corresponding physical objects are as the shadows in the cave; and it is only by means of them that we are able to deny the existence of a corresponding physical object; if there is no conception of straightness, then it is meaningless to deny the existence of a perfectly straight line." We quote this passage purposely, because the last lines contain a proposition which attracted a great deal of attention, and excited some applause. It is a very neat and ingenious proposition. We shall not attempt, however, to say whether Mill or Cayley has the best of it. The two statements as they stand suffice to show that even in mathematics there is no sure footing for the student. It must, however, be understood that in saying this we reserve particular points. Thus it is certain that two and two make four, and that any three angles of a triangle are equal to two right angles, and so on. But the mathematician has long since left such school-boy lore as this, and mathematics, at one time the most certain, now promises to become the most misty of the sciences.

As an example of pure science, Professor Cayley's address is extremely satisfying. He passed in review certain mathematical theories which are more or less based on what is known as the negative dimension in algebra. To those who are not familiar with what has been termed transcendental algebra, it would be impossible within a brief space to make the nature of the negative dimension clear. However, we may say that it is really less than nothing. By its aid it becomes possible to deal with space of more than three dimensions, and to consider the phenomena which may be manifested by a single rope with more than two ends. The late Professor Clifford was much given to this line of investigation, and showed, among other things, that in space of four dimensions a knot could not be tied, while a bag could be turned inside out without flexure. We quote again from Professor Cayley:—"I have just come to speak of four-dimensional space. What meaning do we attach to it? or can we attach to it any meaning? It may be at once admitted that we cannot conceive of a fourth dimension of space; that space, as we conceive of it, and the physical space of our experience, are alike three-dimensional; but we can, I think, conceive of space as being two or even one-dimensional. We can imagine rational beings living in a one-dimensional space—a line—or in a two-dimensional space—a surface—and conceiving of space accordingly, and to whom, therefore, a two-dimensional space, or, as the case may be, a three-dimensional space, would be as inconceivable as a four-dimensional space is to us; and very curious speculative questions arise. Suppose the one-dimensional space a right line, and that it afterwards becomes a curved line; would there be any indication of the change? Or, if originally a curved line, would there be anything to suggest to them that it was not a right line? Probably not, for a one-dimensional geometry hardly exists. But let the space be two-dimensional, and imagine it originally a plane, and afterwards bent—converted, that is, into some form of developable surface—or converted into a curved surface; or imagine it originally a developable or curved surface. In the former case there should be an indication of the change, for the geometry originally applicable to the space of their experience—our own Euclidian geometry—would cease to be applicable; but the change could not be apprehended by them as a bending or deformation of the plane, for this would imply the notion of a three-dimensional space in which this bending or deformation could take place. In the latter case their geometry would be that appropriate to the developable or curved surface which is their space: viz., this would be their Euclidian geometry: would they ever have arrived at our own more simple system? But take the case where the two-dimensional space is a plane, and imagine the beings of such a space familiar with our own Euclidian plane geometry; if, a third dimension being still inconceivable by them, they were by their geometry or otherwise led to the notion of it, there would be nothing to prevent them from forming a science such as our own science of three-dimensional geometry." Now we may venture to ask, What is the use of all this? We have here the very purest of pure science. It is refined gold. There is no alloy of the "popular" in it. We are not disposed to assert that it is without utility, but this appears to us to be a utility of a very remote kind. Beyond question it is akin to poetry, and we suspect that there is a nearer relationship between the poetical faculty and transcendental mathematics than appears at first sight, but as to practical use it possesses simply none at all. Yet there can be no doubt that in the near future no one will have a chance of taking high mathematical honours at Cambridge who cannot successfully handle four-dimensional geometry. The time, talent, and brain labour which may thus be wasted are immense in amount. Similar work will find its way into every competitive examination, and Indian civil servants, and engineer and artillery officers must follow as they best can in the footsteps of Cayley or Clifford.

On the other hand, if we were asked would we eliminate all such speculations from the human mind if we had the power, we would reply certainly not. For men like Professor Cayley they possess an infinite charm not to be gauged by ordinary minds, and the drift of his thought leads him on to roads of inquiry which bring him to stores of useful knowledge. For example, it has been said that the knowledge which mathematicians now possess of the structure of algebraic forms is as different from what it was before Cayley's time as the knowledge of the human body possessed by one who has dissected it and knows its internal structure is different from that of one who has only seen it from the outside. The danger to be feared from the progress of pure science appears to us to be that it will be invested with undue prominence in our universities, and that to a knowledge of it will be given rewards which might be better bestowed. Mathematics represent but one of many branches. It will always be difficult to draw a line not only between pure and applied science, but between what it is and is not worth while to teach. We freely admit this; but it must be possible to fix a limit. In several of our technical colleges this is very well done, and we may especially cite the engineering instruction given now in most of our great towns. But there is always a risk that the transcendental may take the place of the practical; and we have seen some evidence of it lately in the treatment of strains, and investigations of the performance of the steam engine. We have already pointed out that what passes for scientific truth is no longer invariably regarded as true; and the time is not far distant, we hope, when the student will hear more of "working hypotheses" and less of dogmatic assertion. Thus to teach a class that the pressure of a gas is due to a species of molecular bombardment, is very pretty and convenient; but it would be better to add that no one knows whether there really is a bombardment of the kind going on; that no one really *knows* at all to what the pressure of a gas is due. It will be seen that to pursue this system would revolutionise the practice of teaching physical science; and in this way we think some good would be gained. Honesty on the part of teachers is greatly valued by advanced pupils. There would remain, however, a great array of simple facts, a knowledge of which is quite indispensable and of immense value to the engineer. Thus, without knowing anything of the cause of gravity, he may be certain that in the latitude of London a stone will fall at the rate of 16ft. 1in., very nearly, in one second; and while he may regard the undulatory theory as a not very satisfactory working hypothesis to explain the phenomena of light, there is nothing to prevent him from mastering the principles by which the usual errors of a dumpy level are to be corrected. It was once said of a judge that his decisions were invariably right, but that his reasons for deciding were always wrong. Much the same thing may be said of the science teacher of the present day. Nearly all that he has to tell the student concerning phenomena at all events, is true, and can be proved to be true; but as a rule, the theories put forward to explain phenomena are incapable of demonstration, and ought not to be put forward as true, but only as convenient. The whole subject is too large to be handled in the space now at our disposal. We have left much unsaid that may, we think, be said with advantage—though not now, at another time.

ENGINEERING ABSURDITIES.

From time to time proposals are brought before the world in, we may take it for granted, good faith, which contemplate the carrying out of enormous works by engineers. Some of these are absurd, and as the engineer is supposed to play an important part in connection with them, they may be termed engineering absurdities. Although such schemes as those concerning which we are writing are absurd, they are not necessarily ludicrous. Indeed, should the attempt ever be made to put them into practice, the results might be extremely disastrous. A notable example of the absurd in engineering is supplied by the Jordan Valley canal scheme, which would entail cuttings hundreds of feet deep and many miles long through solid rock; while allowance being made for evaporation, nearly a century would be required to fill the Jordan Valley with sea water to the requisite level. When such schemes are seriously discussed by the British Association it is, perhaps, worth while to say here a few words concerning what the engineer can and cannot do—a point on which very vague notions seem to exist in the minds of the general public. The theory is that the civil engineer can do anything. He can dig canals to outrageous depths; take away a mass of earth equal to half an English county in wheelbarrows; alter a coast line if he thinks proper; convert a desert into a fertile plain; or make an inland sea where water is now worth a guinea a quart; and so on. It will be seen that, from this point of view, the engineer is neither more nor less than a necromancer. In old times those who wished to build palaces in a night, or turn the course of rivers, or take away a neighbour's landmark, usually applied to a magician for help. Rich or powerful men kept private necromancers for themselves, while poorer people had to take their turn with others for the wise man's services. In the present day no one believes in art magic, but the engineer has been dragged in head and shoulders to fill the vacancy. It is, we think, about time that the public learned that the engineer is not a magician, nor is he endowed with any extraordinary powers. His education has taught him how to do certain things, and also that certain things cannot be done at all. This latter kind of information is of immense value. It is to be regretted that it is not more plentiful.

We have heard it argued that nothing is impossible to the engineer who has money and time at his control in limitless abundance. This, however, is a complete mistake. There are certain things which could not be accomplished no matter how much time and money were available. We may cite, for example, the putting in of foundations in great depths of water. Among the various engineering absurdities which have turned up recently, is a scheme originated in France for building a bridge across the Channel from Dover to Calais. The superstructure is to be carried on columns, the lower ends of which are to be sunk in the bed of the sea. A bridge of this kind could not possibly be erected. Without divers the foundations could not be got in, and divers could not work under the pressure due to the depth. Whether a bridge could be made on a different system we shall not stop to inquire. The bridge as proposed is an absurdity. Again, schemes are brought forward not infrequently which are absurd because they involve an enormous expenditure of time or capital, or both; albeit, they are practicable. We remember many years ago a scheme being discussed for making a ship canal right across Ireland—the same idea in a different form has been revived recently—It was coolly assumed that fifty years would be required to construct this canal. We venture to doubt that any man, Government, or nation, would embark on the carrying out of an enterprise which would bring in no return and be of no value for half a century; and this consideration leads us to another point. What is supposed to be the end had in view by those who undertake such works as the engineer carries out? The reply is obvious—a return is expected, either directly or indirectly, in money. The only exceptions are works constructed by a Government for the good of a community at large; such, for example, as breakwaters and lighthouses. All schemes for works which cannot pay, and that pretty promptly, are engineering absurdities. A point very well worth discussion, but never properly discussed yet, is the limit of time within which a given undertaking must pay, in order to justify the capitalist in investing in it. Thus, for example, while it would not be difficult to get shares taken up in a company proposing to pay a dividend in three years, it would be hard to place shares making no returns for ten years, and next to impossible to dispose of shares the profit on which would be postponed for a quarter of a century. The engineer, it may be conceded, can do a great deal; but there are some schemes which could not be made to pay in any shape or way for many many years, and he would be quite powerless to hurry the progress of events. This time limit renders many proposals absurd that are not otherwise ridiculous; and it must not be forgotten that when the major forces of nature have to be dealt with haste cannot be made. No less than thirty years were spent in making the breakwater at Holyhead, and various other national works of much importance might be cited, even now not finished, although begun dozens of years ago.

Some men appear to be endowed with minds which are incapable of dealing with particulars, and who, the moment they get an idea, determine that it must be carried out at once. Great bridges, ship canals, embankments, and tunnels have an immense charm for these gentlemen. They need only take up a good atlas to find a score of places where "something might be done," with, it is assumed, advantage. If they look at the map of Scotland they see that a great ship canal ought to be cut right across from the Firth of Forth to the Firth of Clyde. Not a thing like the Crinan Canal, but a waterway which would save steamers bound for America, from Sunderland, Hull, Newcastle, and such like ports, from going "North about" all the way round by the Pentland Firth or north of the Orkneys. Again, from Port Patrick on the Scotch to Donaghadee on the Irish coast is but eighteen or twenty miles, and the depth of water is not very great—120 fathoms or so at the most, we believe. It has been proposed more than twice to our certain knowledge that an embankment should be constructed between the towns named and lines of railway laid on it. This is a good example of an engineering absurdity. Engineers could not make such an embankment, because the stuff of which it must be composed would be washed away by the sea quicker than it would be possible to tip it, supposing even that the enormous mass of material needed were available. Again, the construction of a great ship canal between Hamburgh and the Gulf of Lubeck will suggest itself. By this the Baltic would be put hundreds of miles nearer England than it is now, and the open season would be considerably prolonged, as steamers would not have to contend with ice on the North of Denmark in the Skager Rack. As for bridges, places too numerous to mention suggest themselves, as, for example, the Straits of Messina. It is related that the Emperor Nicholas of Russia, when asked how certain railways in his dominion should run, took a pencil, a map, and a ruler, and drawing a line from St. Petersburg to Moscow, gave that as the route. In this case the Emperor was not so far wrong, because he wanted the railway for military purposes; and the country being flat, little was to be gained by going right or left of the straight line. Such enthusiasts as the author of the Jordan Canal scheme follow the Emperor of Russia's example—at a distance. They are entirely unable to understand that the engineer is only discharging his proper functions when he is spending his employer's money on remunerative undertakings. To admit that a certain scheme cannot be carried out save at an enormous outlay of time and money—especially the former—is sufficient at once to condemn it, unless it can be shown that extremely important advantages would arise from it; but it is just on this point that the authors of magnificent schemes usually break down. They build castles in the air, and they fail not only to see what can and cannot be done, but what will and will not pay for the doing. Thus a ship canal will not necessarily be used if it only saves steamers a voyage of a few hundred miles. A cargo steamer, for example, will carry 2500 tons of grain at, say, ten miles an hour with a consumption of about one ton of coal, costing 10s. per hour; thus the coal bill will be £12 for every 240 miles, or £24 for running, in round numbers, 500 miles. The whole of the expenses for two days would not amount to £100. A ship of this kind going through the Suez Canal will pay at least £1250. Such a tariff could not be kept up for a moment if the route to India by the Cape were not immensely longer than the route by the Red Sea. The making of a costly ship canal to save a few hundred miles of steaming must prove wholly unremunerative.

Before taking leave of engineering absurdities we would add a word of warning on the subject of harbours of refuge. A movement has for some time been going on to promote the construction of such harbours, especially on our east and south coasts. A good deal of sentiment is mixed up with this, and sentiment is sometimes a dangerous thing to indulge in. We strongly advocate the construchave in our mind are lines possessing breadth. If anyone doubt this, we may refer him to his own experience. I much question if anyone who fancies that he can conceive of a mathematical line thinks so from the evidence of his own consciousness. I suspect it is rather because he supposes that unless such a perception be possible, mathematics could not exist as a science, a supposition which there will be no difficulty in showing to be groundless." To this Professor Cayley replies:—"I think it may be at once conceded that the truths of geometry are truths precisely because they relate to and express the properties of what Mill calls 'purely imaginary objects;' that these objects do not exist in Mill's sense, that they do not exist in nature, may also be granted; that they are 'not even possible,' if this means not possible in an existing nature, may also be granted. That we cannot 'conceive' them depends on the meaning which we attach to the word conceive. I would myself say that the purely imaginary objects are the only realities, the ὄντως ὄντα, in regard to which the corresponding physical objects are as the shadows in the cave; and it is only by means of them that we are able to deny the existence of a corresponding physical object; if there is no conception of straightness, then it is meaningless to deny the existence of a perfectly straight line." We quote this passage purposely, because the last lines contain a proposition which attracted a great deal of attention, and excited some applause. It is a very neat and ingenious proposition. We shall not attempt, however, to say whether Mill or Cayley has the best of it. The two statements as they stand suffice to show that even in mathematics there is no sure footing for the student. It must, however, be understood that in saying this we reserve particular points. Thus it is certain that two and two make four, and that any three angles of a triangle are equal to two right angles, and so on. But the mathematician has long since left such school-boy lore as this, and mathematics, at one time the most certain, now promises to become the most misty of the sciences.

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ENGINEERING ABSURDITIES.

From time to time proposals are brought before the world in, we may take it for granted, good faith, which contemplate the carrying out of enormous works by engineers. Some of these are absurd, and as the engineer is supposed to play an important part in connection with them, they may be termed engineering absurdities. Although such schemes as those concerning which we are writing are absurd, they are not necesarily ludicrous. Indeed, should the attempt ever be made to put them into practice, the results might be extremely disastrous. A notable example of the absurd in engineering is supplied by the Jordan Valley canal scheme, which would entail cuttings hnndreds of feet deep and many miles long through solid rock; while allowance being made for evaporation, nearly a century would be required to fill the Jordan Valley with sea water to the requisite level. When such schemes are seriously discussed by the British Association it is, perhaps, worth while to say here a few words concerning what the engineer can and cannot do—a point on which very vague notions seem to exist in the minds of the general public. The theory is that the civil engineer can do anything. He can dig canals to outrageous depths; take away a mass of earth equal to half an English county in wheelbarrows; alter a coast line if he thinks proper; convert a desert into a fertile plain; or make an inland sea where water is now worth a guinea a quart; and so on. It will be seen that, from this point of view, the engineer is neither more nor less than a necromancer. In old times those who wished to build palaces in a night, or turn the course of rivers, or take away a neighbour's landmark, usually applied to a magician for help. Rich or powerful men kept private necromancers for themselves, while poorer people had to take their turn with others for the wise man's services. In the present day no one believes in art magic, but the engineer has been dragged in head and shoulders to fill the vacancy. It is, we think, about time that the public learned that the engineer is not a magician, nor is he endowed with any extraordinary powers. His education has taught him how to do certain things, and also that certain things cannot be done at all. This latter kind of information is of immense value. It is to be regretted that it is not more plentiful.

We have heard it argued that nothing is impossible to the engineer who has money and time at his control in limitless abundance. This, however, is a complete mistake. There are certain things which could not be accomplished no matter how much time and money were available. We may cite, for example, the putting in of foundations in great depths of water. Among the various engineering absurdities which have turned up recently, is a scheme originated in France for building a bridge across the Channel from Dover to Calais. The superstructure is to be carried on columns, the lower ends of which are to be sunk in the bed of the sea. A bridge of this kind could not possibly be erected. Without divers the foundations could not be got in, and divers could not work under the pressure due to the depth. Whether a bridge could be made on a different system we shall not stop to inquire. The bridge as proposed is an absurdity. Again, schemes are brought forward not infrequently which are absurd because they involve an enormous expenditure of time or capital, or both; albeit, they are practicable. We remember many years ago a scheme being discussed for making a ship canal right across Ireland—the same idea in a different form has been revived recently—It was coolly assumed that fifty years would be required to construct this canal. We venture to doubt that any man, Government, or nation, would embark on the carrying out of an enterprise which would bring in no return and be of no value for half a century; and this consideration leads us to another point. What is supposed to be the end had in view by those who undertake such works as the engineer carries out? The reply is obvious—a return is expected, either directly or indirectly, in money. The only exceptions are works constructed by a Government for the good of a community at large; such, for example, as breakwaters and lighthouses. All schemes for works which cannot pay, and that pretty promptly, are engineering absurdities. A point very well worth discussion, but never properly discussed yet, is the limit of time within which a given undertaking must pay, in order to justify the capitalist in investing in it. Thus, for example, while it would not be difficult to get shares taken up in a company proposing to pay a dividend in three years, it would be hard to place shares making no returns for ten years, and next to impossible to dispose of shares the profit on which would be postponed for a quarter of a century. The engineer, it may be conceded, can do a great deal; but there are some schemes which could not be made to pay in any shape or way for many many years, and he would be quite powerless to hurry the progress of events. This time limit renders many proposals absurd that are not otherwise ridiculous; and it must not be forgotten that when the major forces of nature have to be dealt with haste cannot be made. No less than thirty years were spent in making the breakwater at Holyhead, and various other national works of much importance might be cited, even now not finished, although begun dozens of years ago.

Some men appear to be endowed with minds which are incapable of dealing with particulars, and who, the moment they get an idea, determine that it must be carried out at once. Great bridges, ship canals, embankments, and tunnels have an immense charm for these gentlemen. They need only take up a good atlas to find a score of places where "something might be done," with, it is assumed, advantage. If they look at the map of Scotland they see that a great ship canal ought to be cut right across from the Firth of Forth to the Firth of Clyde. Not a thing like the Crinan Canal, but a waterway which would save steamers bound for America, from Sunderland, Hull, Newcastle, and such like ports, from going "North about" all the way round by the Pentland Firth or north of the Orkneys. Again, from Port Patrick on the Scotch to Donaghadee on the Irish coast is but eighteen or twenty miles, and the depth of water is not very great—120 fathoms or so at the most, we believe. It has been proposed more than twice to our certain knowledge that an embankment should be constructed between the towns named and lines of railway laid on it. This is a good example of an engineering absurdity. Engineers could not make such an embankment, because the stuff of which it must be composed would be washed away by the sea quicker than it would be possible to tip it, supposing even that the enormous mass of material needed were available. Again, the construction of a great ship canal between Hamburgh and the Gulf of Lubeck will suggest itself. By this the Baltic would be put hundreds of miles nearer England than it is now, and the open season would be considerably prolonged, as steamers would not have to contend with ice on the North of Denmark in the Skager Rack. As for bridges, places too numerous to mention suggest themselves, as, for example, the Straits of Messina. It is related that the Emperor Nicholas of Russia, when asked how certain railways in his dominion should run, took a pencil, a map, and a ruler, and drawing a line from St. Petersburg to Moscow, gave that as the route. In this case the Emperor was not so far wrong, because he wanted the railway for military purposes; and the country being flat, little was to be gained by going right or left of the straight line. Such enthusiasts as the author of the Jordan Canal scheme follow the Emperor of Russia's example—at a distance. They are entirely unable to understand that the engineer is only discharging his proper functions when he is spending his employer's money on remunerative undertakings. To admit that a certain scheme cannot be carried out save at an enormous outlay of time and money—especially the former—is sufficient at once to condemn it, unless it can be shown that extremely important advantages would arise from it; but it is just on this point that the authors of magnificent schemes usually break down. They build castles in the air, and they fail not only to see what can and cannot be done, but what will and will not pay for the doing. Thus a ship canal will not necessarily be used if it only saves steamers a voyage of a few hundred miles. A cargo steamer, for example, will carry 2500 tons of grain at, say, ten miles an hour with a consumption of about one ton of coal, costing 10s. per hour; thus the coal bill will be £12 for every 240 miles, or £24 for running, in round numbers, 500 miles. The whole of the expenses for two days would not amount to £100. A ship of this kind going through the Suez Canal will pay at least £1250. Such a tariff could not be kept up for a moment if the route to India by the Cape were not immensely longer than the route by the Red Sea. The making of a costly ship canal to save a few hundred miles of steaming must prove wholly unremunerative.

Before taking leave of engineering absurdities we would add a word of warning on the subject of harbours of refuge. A movement has for some time been going on to promote the construction of such harbours, especially on our east and south coasts. A good deal of sentiment is mixed up with this, and sentiment is sometimes a dangerous thing to indulge in. We strongly advocate the construction of harbours of refuge; but work of this kind will have to be carried out very judiciously. It will never do to take a map, put down one's finger, and say "we must have a harbour of refuge here." Harbours must be made where they can be made, not where they ought to be. It is quite possible to commit great mistakes on this point; and we may say that some of the refuge harbour schemes which have been brought before us are in the fullest sense of the word engineering absurdities. The engineer can do a great deal, but he cannot do everything; and no one is more willing to admit this than he himself.

THE NEW IRON SLIDING SCALE.

THE commencement of the new sliding scale in the manufactured iron trade of the North of England has taken place under circumstances that are not favourable to the workmen, for it began with a fall of 7½ per cent. in wages. The return of the accountant to the Board of Arbitration shows that during the last two months a reduced range of prices has ruled, and this to a considerable extent. The "time bargain" entered on in March last expires this month, and the sliding scale fixed on then comes into force. Under it there is the reduction that has just been named. The details of the report of the accountant show that there is still a large volume of trade, the associated manufacturers in the North producing at the rate of 650,000 tons of finished iron yearly. Not less than 86 per cent. of this is in the shape of plates and angles, mainly for shipbuilding use. The quantity of the bar iron made by the associated firms is rather less than it was. These are the main features of the report of the accountant, which is the first that has been issued for a two months' period. It has been hoped when that time bargain was entered on that it would have caused the prices of manufactured iron to advance; but it has not only failed to do so—it has been unable to prevent the slight fall that has taken place. It remains to be seen whether it will be adhered to; but the fact that it has been a failure is patent. Three of the plate mills of Durham have been laid idle for many months, and for nearly six months the others have ceased work on Mondays, without prices being affected in the market. But the cost of the manufactured iron has been increased to the maker, and whilst his profits have been restricted, the workmen cannot have got much if any benefit; for though the tonnage rate of work has been kept up artificially, this has not been the case with the rate of wages of the day-pay men. A six months' trial of "restriction" in the manufactured iron trade has been sufficient to prove that it has failed to benefit the trade, and that at the same time it has power to hurt it to some extent. The manufactured iron trade will find the level that will tempt customers if the price and the extent of the production are allowed to be regulated by the laws of demand rather than by artificial regulations that must be local in their application.

STAFFORDSHIRE MINES DRAINAGE.

THE engineering operations of the South Staffordshire Mines Drainage Commissioners have reached a stage at which they have more claim upon the attention of engineering circles than per haps at any other time since the Commission was appointed A few years ago there seemed to be good reason to conclude that the unwatering of the chief parts of the South Staffordshire submerged mining district was an engineering problem of so great magnitude that it had better be left alone. As the latest of several praiseworthy endeavours to pull the scheme through, the powers of the Commission were vested in a triumvirate. This has now been in force about long enough to warrant an opinion whether a brighter prospect is possible. An answer to the inquiry, probably the first answer upon which conclusions could reasonably be based, is forthcoming in the reports just issued of the operations for the year ending the 30th of June last. These show that the bold policy of incurring heavy expenditure in face of decreasing capital was not unwise, since a return will evidently be realised soon enough to prevent serious inconvenience. In the Tipton and Bilston district, where the work for the engines is perhaps heavier than in any other, the annual cost of pumping, which was last year £18,300, will, it is anticipated, be brought down to nearly, if not quite one-half that amount on the completion of the driving of a new network of levels. These will hardly be finished within the current financial year, but their progress will enable mines to be unwatered, that should at once yield a revenue. Yet the average twenty-four hours' work of the seven engines for the past twelve months, which was 15,000,000 gallons, was nearly 2,000,000 gallons above that of the year preceding. Of these engines three, or perhaps four, will be unnecessary when the levels are finished. Again, in the Old Hill district, works are in progress which will soon effect a yearly economy of £3000. As to surface drainage, an expenditure during the year of more than £18,000 has brought this department very nearly to the state of efficiency required by the arbitrators under the Mines Drainage Acts, and they are now in far more advanced condition than ever before. It is true that to make the progress here indicated, considerable pressure has had to be put upon the owners of mining property; and that the accounts of the Commission show by no means a heavy balance on the right side; but it is evident that the difficulty is now being overcome, and that a little more patience will bring a successful termination to engineering operations as arduous and unique as any which, for very many years, the Government has had to aid in furtherance of this country's industrial wellbeing.

LITERATURE.

Memorial Edition of the Life of Richard Trevithick. E. and F. N. Spon, London. 1883.

SOME time ago a preliminary committee was formed of a few gentlemen, admirers of genius, for the purpose of providing a memorial of some kind to Richard Trevithick. It is not quite clear with whom the idea originated, but Mr. Tangye has played an important part in the movement, and Major John Davis, F.S.A., of Westminster, gave it shape and coherence. At length a working committee was formed, and the importance of the movement may be gathered from the fact that on this committee are the Prince of Wales, the Archbishop of Canterbury, the Duke of Sutherland, the Earl of Mount Edgcumbe, and Lord Robartes. Besides these there are on the committee sixty-five engineers and scientific men, such as Mr. Bateman, Sir F. Bramwell, and Sir John Lubbock. In Cornwall, the birthplace of Trevithick, a sub-committee has been appointed, with Mr. W. Husband as secretary, and Mr. Bolitho as president. It was essential to the operations of the committee that they should posess in a handy and readable form such a memoir of Richard Trevithick as would explain to the world what manner of man he was. The objects of the committee are best set forth in the words of a resolution passed at a meeting of the committee, which took place at the Institution of Civil Engineers, Great George-street, on the 10th of April last, "Resolved, to raise a fund for the erection of a statue to the memory of Richard Trevithick, and further to provide a fund for the establishment of scholarships bearing his name, such scholarships to aid in the technical education of young men to qualify them for the profession of mining and other engineers," and also "that employers of labour be requested to allow penny subscriptions from their workmen." This last resolution would, we think, be peculiarly gratifying to Trevithick could he be made aware of it; and that it was passed shows, we think, a delicate appreciation on the part of the committee of Trevithick's character.

The little pamphlet before us is the result of the want to which we have referred above. Although the name of Trevithick is familiar enough to most engineers, little has hitherto been known accurately concerning him. A life of him, by Francis Trevithick, was published in two volumes in 1872. It contains an enormous mass of information so badly put together that it is impossible to read the book with either pleasure or profit. Although it is not stated in the pamphlet before us by whom it is written, we fancy that Major Davis is the author; and he has succeeded in bringing within the compass of twenty-four pages all that busy people will need to know concerning Trevithick. This has been done by selecting not only facts but words in the most judicious fashion, so that no space has been wasted. The labour involved in the preparation of such a memoir as this from the material available must have been very great. As an example of Major Davis's style, we may cull the following passage:—"Trevithick's early education was very rudimentary, but what was wanting in his education was supplied by natural talent. Soon after he left school, his precocious engineering ability was practically shown by his solving a question respecting the correctness of certain underground levels which had puzzled several experts. There is nothing to show at what age he commenced the battle of life, but at the comparatively early age of twenty-four, in spite of an inferior education, he stood prominently forward as the leading competitor of the celebrated Watt." As a specimen of condensed narrative this passage is we think perfect.

All Trevithick's inventions of importance are briefly but sufficiently described in this pamphlet, which is profusely illustrated by admirable engravings. Trevithick was the apostle of high-pressure steam. He cared nothing about a vacuum; and greatly daring, he adventured on what even now are considered very high pressures. No wonder that James Watt looked on him with horror. The temperaments of the two men again were different—Watt was a philosopher, in many respects an invalid, a man really of small energy, and requiring at all times the co-operation of active men, such as Boulton and Murdock, to keep him going on. Trevithick, on the contrary, was like his own high-pressure steam—fierce, audacious, energetic to a degree, entirely unsparing of himself, a man to conquer worlds, a man to be held back, not urged forward. His fiery zeal made him a nuisance to Watt. To Trevithick, Watt was a slow-going, scarcely honest, tardy, elderly man. The following extract from the last letter Trevithick wrote to his friend, Davis Gilbert, puts the relations of the two men in a strong light:—"I have been branded with folly and madness for attempting what the world calls impossibilities, and even by the great engineer, the late Mr. James Watt, who said to an eminent scientific character still living that I deserved hanging for bringing into use the high-pressure engine. This so far has been my reward from the public; but should this be all, I shall be satisfied by the great secret pleasure and laudable pride that I feel in my own breast from having been the instrument of bringing forward and maturing new principles and new arrangements of boundless value to my country. However much I may be straitened in pecuniary circumstances, the great honour of being a useful subject can never be taken from me, which to me far exceeds riches."

We shall not attempt to set forth here what it was that Trevithick did for the world. He effected enough to entitle his memory to be kept for ever before engineers. The story of the man's life, as set forth in his works, is well told by Major Davis. It is an astounding record of inventions.

The objects had in view by the committee are in every way meritorious. A statue is due to Trevithick, but the establishment of scholarships represents a really remunerative outlay. A statue is a work of art, not of utility; the foundation of a scholarship is a paying investment. Although subscriptions have come in fairly well up to the present, not nearly as much money has been got as ought to be got. Mr. Tangye's munificent example ought to be followed. He has given £100, a sum which worthily heads the list of subscriptions at present. May we express the hope that it will not long be suffered to stand alone, and that those who cannot follow Mr. Tangye's example as far as the amount of their subscriptions are concerned, will recognise the fact that the desire to do as he has done may be displayed in smaller subscriptions, yet representing as much as a man can spare. We have no hesitation in saying that the movement has our warmest sympathies, or in urging our readers to subscribe little or much; better a little than none at all.

THE DRAINAGE OF MALACCA.—We are given to understand that the Municipal Commissioners of Malacca have approved the scheme for the drainage of that town prepared by Mr. Cargill, our municipal engineer. Some short time ago, at the request of the Government, Mr. Cargill inspected the sister settlement, and reported fully upon the present defective condition of its drainage. In his report—which is of an able and exhaustive character—he lays down a system of drainage adapted to place the sanitary state of Malacca upon a satisfactory basis. The Municipal Commissioners have expressed a wish to retain Mr. Cargill's services for the further carrying out of the work, as the Government, it is said, are willing to find the necessary funds.—*Straits Times.*

LEGAL INTELLIGENCE.

WRECK COMMISSIONER'S COURT.

(*Before* Mr. H. C. ROTHERY, *Wreck Commissioner, with Assessors.*)

THE AUSTRAL.

CAPTAIN METHVEN, Captain Parish, Mr. Eames, engineer, and Mr. Robertson, late Chief Constructor for Portsmouth Dockyard, were the Assessors.

This was the official inquiry ordered by the Board of Trade into the capsizing of the Austral, one of the largest steamers of the Orient Line, in Sydney Harbour, on the 11th of November, 1882. Owing to recent investigations into the stability of vessels referred to in the Daphne report, and the number of lives put in jeopardy by the event, the case excited more than ordinary interest. Proceedings began on Monday.

Mr. Mansel Jones and Mr. Howard Smith were for the Solicitor to the Board of Trade—Mr. W. Murton, Mr. Bucknill and Mr. Baden Powell for the owners; Mr. T. H. Nelson for the master.

Mr. MANSEL JONES said the Austral was built at Govan in 1882, and registered at Glasgow. She was 456ft. long, 48·25ft. broad, and 33·95ft. deep. Her engine-room was 102ft. long. She had three compound engines, made by John Elder and Co.—one 62in., the other 86in. in diameter, 5ft. stroke, and 1000 nominal horse-power. Her gross tonnage was 5588, and net tonnage 3289 tons. Her hull was of steel. She was classed 100 A1 for three-decked vessels. She had fifteen coaling ports, eight on the starboard and seven on the port side, 2ft. 6in. high, and 3ft. 3in. wide. The lower edge of these was 25ft. 6in. from the bottom of the keel. She had ballast tanks capable of taking 670 tons of water. She had also fresh-water tanks. She left London on the 7th of September, 1882, with a crew of 195 and over 500 passengers. She arrived in Sydney on November 3rd. She made fast alongside the circular quay, and discharged her cargo except about 200 tons of iron, which was in the main hold. While at the quay she took in coal, and on the 6th of November the vessel took a list to starboard; but the list was speedily corrected by trimming the coal over to the port side. On the 7th of November she was moved, the water ballast tanks, which had been full, were pumped out, and she was moved from the circular quay to moorings in Neutral Bay belonging to the company, about 200 yards from the shore, in fourteen fathoms of water. No water was in the boilers. She had then in her about 1700 tons of coal, about 200 tons of iron, about 110 tons of fresh water in one of the ballast tanks, and about 70 tons of fresh water in the fresh water tank. In consequence of various matters, Sunday and a holiday intervening, and a strike among the coal porters, no more coal was taken in until the 10th. On the evening of that day about 10.45 p.m., a steam collier called the Woonoona, with 500 to 600 tons of coal, came alongside. All the coal ports were opened on both sides. The master of the collier came to the chief officer of the Austral for instructions, and was ordered to the starboard side of the Austral, where she made fast, and commenced coaling through four of the ports. They so commenced about 11.15 p.m. It appeared to have been the practice on board this vessel not to keep an anchor watch beyond one hand on deck. No officer was on deck, and from the depositions of the chief engineer it appeared that he had no intimation that the steam collier had come alongside. These vessels were coaled by contract. He turned in early that night. The captain was on deck at midnight, and also at 1 a.m., because his slumbers were disturbed by the coaling going on. He stated in his depositions that at 1 a.m. there was no list, but the vessel was on a perfectly even keel. When the Woonoona came alongside the coal ports were 4ft. out of the water. At 3.30 a.m. there was a slight list to starboard. He had made statements from depositions taken by the coroner at Sydney, in which there were some discrepancies. The coaling went on at the rate of about 40 tons an hour, so that, having began at 11.15, there was at 3.15 about 160 tons put in on the starboard side. About 3.30 a light list to starboard was noticed, but not enough to cause any of the officers to be called; but at 3.50 a very sudden list, amounting to a jerk, was felt and awakened the chief officer, who called the captain. The vessel was so far heeled over that the starboard ports were under water, and it was difficult to stand on deck. All hands were roused, the lashings of the Woonoona were cut, and all the crew except five escaped on board that vessel and a lighter which was alongside forward. The water rushed in so fast that at 4.20 a.m. she sank with the five men. In answer to a question from the learned Commissioner, counsel said that the donkey engine was not being used; steam was up; the donkey man was asleep. She sank nearly upright. He proposed entering into the construction of the vessel, the bunkers, and the position of the coal when she sank. He would call the chief engineer.

Mr. NELSON submitted to the Court whether the proceedings should go on. An inquiry under the Act was commenced at Sydney on the 27th of November, 1882. He was not referring to the inquest. Under the Merchant Shipping Act of 1854, sec. 433, there was power given, now vested in the Wreck Commissioner, to hold an inquiry if after preliminary investigation it should appear necessary or the Board of Trade should direct. The preliminary inquiry was held at Sydney, and in consequence John Murdoch, for whom he appeared, was served with a notice that the Marine Board had ordered an investigation, and he was cited to appear. The captain did attend. After a short opening of the inquiry it was adjourned to December 5th. When the Court met again on that date it was intimated that they were not going to proceed with the inquiry, but that they abandoned it. Thereupon the solicitor for Captain Murdoch applied to the Government at Sydney to proceed with the inquiry. The Minister of Justice thereupon informed him that the depositions taken before the coroner would be forwarded to the Imperial Government for the consideration of the Board of Trade in England. There had been a misunderstanding between the Imperial and the Colonial Governments on the subject. The master, having been summoned before a competent court, ought not to be put in jeopardy again; not that he admitted he was in jeopardy. Otherwise this inquiry might be abandoned and another begun in Sydney, and so on *ad infinitum*. The captain had been practically kept ashore all the time—a serious matter. Then as to the depositions spoken of by his learned friend, how could they be evidence before this Court? He had witnesses to call who were in Australia; but this Court had no power to issue a commission to examine them in Australia. He would thus be prejudiced by the inquiry not being proceeded with in Australia.

Mr. BUCKNILL would not endorse the objection. The owners were anxious the inquiry should be exhaustive, and that the problem how it was the vessel sank should be solved.

The COMMISSIONER overruled the objection. There was a mere intention to hold the inquiry which was not carried out. The objection as to witnesses would apply with greater force to an inquiry in Australia, from which the builders would necessarily have been absent.

Mr. John Macdougall said he was chief engineer of the Austral, and held a first engineer's certificate. He served on the previous voyages out and home of the Austral, as well as on this. The Austral had eight coaling-ports on the starboard and seven on the port side. They were 3ft. by 2ft. 6in. each, and all opened upwards, with hinges on the upper edge. They were fastened by dogs, inside—no flap. The after-bunker was between the engine-room and the after-boilers; it extended across the vessel, with a passage through. There were pocket-bunkers on each side of the engine-room; there was another bunker forward. Next forward were pocket-bunkers alongside of the forward boilers on each side. The forward main bunker was forward of the forward boilers, and extended across the ship. He entered into other particulars of the bunkers, which are summarised in his statement of their contents. The forward main bunker would hold 930 tons from the main deck to the hold. About 265 tons were above and 665 below the steel deck. Going sternwards, the side bunkers on each side of the forward boilers held tion of harbours of refuge; but work of this kind will have to be carried out very judiciously. It will never do to take a map, put down one's finger, and say "we must have a harbour of refuge here." Harbours must be made where they can be made, not where they ought to be. It is quite possible to commit great mistakes on this point; and we may say that some of the refuge harbour schemes which have been brought before us are in the fullest sense of the word engineering absurdities. The engineer can do a great deal, but he cannot do everything; and no one is more willing to admit this than he himself.

THE NEW IRON SLIDING SCALE.

THE commencement of the new sliding scale in the manufactured iron trade of the North of England has taken place under circumstances that are not favourable to the workmen, for it began with a fall of 7½ per cent. in wages. The return of the accountant to the Board of Arbitration shows that during the last two months a reduced range of prices has ruled, and this to a considerable extent. The "time bargain" entered on in March last expires this month, and the sliding scale fixed on then comes into force. Under it there is the reduction that has just been named. The details of the report of the accountant show that there is still a large volume of trade, the associated manufacturers in the North producing at the rate of 650,000 tons of finished iron yearly. Not less than 86 per cent. of this is in the shape of plates and angles, mainly for shipbuilding use. The quantity of the bar iron made by the associated firms is rather less than it was. These are the main features of the report of the accountant, which is the first that has been issued for a two months' period. It has been hoped when that time bargain was entered on that it would have caused the prices of manufactured iron to advance; but it has not only failed to do so—it has been unable to prevent the slight fall that has taken place. It remains to be seen whether it will be adhered to; but the fact that it has been a failure is patent. Three of the plate mills of Durham have been laid idle for many months, and for nearly six months the others have ceased work on Mondays, without prices being affected in the market. But the cost of the manufactured iron has been increased to the maker, and whilst his profits have been restricted, the workmen cannot have got much if any benefit; for though the tonnage rate of work has been kept up artificially, this has not been the case with the rate of wages of the day-pay men. A six months' trial of "restriction" in the manufactured iron trade has been sufficient to prove that it has failed to benefit the trade, and that at the same time it has power to hurt it to some extent. The manufactured iron trade will find the level that will tempt customers if the price and the extent of the production are allowed to be regulated by the laws of demand rather than by artificial regulations that must be local in their application.

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LITERATURE.

Memorial Edition of the Life of Richard Trevithick. E. and F. N. Spon, London. 1883.

SOME time ago a preliminary committee was formed of a few gentlemen, admirers of genius, for the purpose of providing a memorial of some kind to Richard Trevithick. It is not quite clear with whom the idea originated, but Mr. Tangye has played an important part in the movement, and Major John Davis, F.S.A., of Westminster, gave it shape and coherence. At length a working committee was formed, and the importance of the movement may be gathered from the fact that on this committee are the Prince of Wales, the Archbishop of Canterbury, the Duke of Sutherland, the Earl of Mount Edgcumbe, and Lord Robartes. Besides these there are on the committee sixty-five engineers and scientific men, such as Mr. Bateman, Sir F. Bramwell, and Sir John Lubbock. In Cornwall, the birthplace of Trevithick, a sub-committee has been appointed, with Mr. W. Husband as secretary, and Mr. Bolitho as president. It was essential to the operations of the committee that they should posess in a handy and readable form such a memoir of Richard Trevithick as would explain to the world what manner of man he was. The objects of the committee are best set forth in the words of a resolution passed at a meeting of the committee, which took place at the Institution of Civil Engineers, Great George-street, on the 10th of April last, "Resolved, to raise a fund for the erection of a statue to the memory of Richard Trevithick, and further to provide a fund for the establishment of scholarships bearing his name, such scholarships to aid in the technical education of young men to qualify them for the profession of mining and other engineers," and also "that employers of labour be requested to allow penny subscriptions from their workmen." This last resolution would, we think, be peculiarly gratifying to Trevithick could he be made aware of it; and that it was passed shows, we think, a delicate appreciation on the part of the committee of Trevithick's character.

The little pamphlet before us is the result of the want to which we have referred above. Although the name of Trevithick is familiar enough to most engineers, little has hitherto been known accurately concerning him. A life of him, by Francis Trevithick, was published in two volumes in 1872. It contains an enormous mass of information so badly put together that it is impossible to read the book with either pleasure or profit. Although it is not stated in the pamphlet before us by whom it is written, we fancy that Major Davis is the author; and he has succeeded in bringing within the compass of twenty-four pages all that busy people will need to know concerning Trevithick. This has been done by selecting not only facts but words in the most judicious fashion, so that no space has been wasted. The labour involved in the preparation of such a memoir as this from the material available must have been very great. As an example of Major Davis's style, we may cull the following passage: —"Trevithick's early education was very rudimentary, but what was wanting in his education was supplied by natural talent. Soon after he left school, his precocious engineering ability was practically shown by his solving a question respecting the correctness of certain underground levels which had puzzled several experts. There is nothing to show at what age he commenced the battle of life, but at the comparatively early age of twenty-four, in spite of an inferior education, he stood prominently forward as the leading competitor of the celebrated Watt." As a specimen of condensed narrative this passage is we think perfect.

All Trevithick's inventions of importance are briefly but sufficiently described in this pamphlet, which is profusely illustrated by admirable engravings. Trevithick was the apostle of high-pressure steam. He cared nothing about a vacuum; and greatly daring, he adventured on what even now are considered very high pressures. No wonder that James Watt looked on him with horror. The temperaments of the two men again were different—Watt was a philosopher, in many respects an invalid, a man really of small energy, and requiring at all times the co-operation of active men, such as Boulton and Murdock, to keep him going on. Trevithick, on the contrary, was like his own high-pressure steam—fierce, audacious, energetic to a degree, entirely unsparing of himself, a man to conquer worlds, a man to be held back, not urged forward. His fiery zeal made him a nuisance to Watt. To Trevithick, Watt was a slow-going, scarcely honest, tardy, elderly man. The following extract from the last letter Trevithick wrote to his friend, Davis Gilbert, puts the relations of the two men in a strong light:—"I have been branded with folly and madness for attempting what the world calls impossibilities, and even by the great engineer, the late Mr. James Watt, who said to an eminent scientific character still living that I deserved hanging for bringing into use the high-pressure engine. This so far has been my reward from the public; but should this be all, I shall be satisfied by the great secret pleasure and laudable pride that I feel in my own breast from having been the instrument of bringing forward and maturing new principles and new arrangements of boundless value to my country. However much I may be straitened in pecuniary circumstances, the great honour of being a useful subject can never be taken from me, which to me far exceeds riches."

We shall not attempt to set forth here what it was that Trevithick did for the world. He effected enough to entitle his memory to be kept for ever before engineers. The story of the man's life, as set forth in his works, is well told by Major Davis. It is an astounding record of inventions.

The objects had in view by the committee are in every way meritorious. A statue is due to Trevithick, but the establishment of scholarships represents a really remunerative outlay. A statue is a work of art, not of utility; the foundation of a scholarship is a paying investment. Although subscriptions have come in fairly well up to the present, not nearly as much money has been got as ought to be got. Mr. Tangye's munificent example ought to be followed. He has given £100, a sum which worthily heads the list of subscriptions at present. May we express the hope that it will not long be suffered to stand alone, and that those who cannot follow Mr. Tangye's example as far as the amount of their subscriptions are concerned, will recognise the fact that the desire to do as he has done may be displayed in smaller subscriptions, yet representing as much as a man can spare. We have no hesitation in saying that the movement has our warmest sympathies, or in urging our readers to subscribe little or much; better a little than none at all.

THE DRAINAGE OF MALACCA.—We are given to understand that the Municipal Commissioners of Malacca have approved the scheme for the drainage of that town prepared by Mr. Cargill, our municipal engineer. Some short time ago, at the request of the Government, Mr. Cargill inspected the sister settlement, and reported fully upon the present defective condition of its drainage. In his report—which is of an able and exhaustive character—he lays down a system of drainage adapted to place the sanitary state of Malacca upon a satisfactory basis. The Municipal Commissioners have expressed a wish to retain Mr. Cargill's services for the further carrying out of the work, as the Government, it is said, are willing to find the necessary funds.—*Straits Times.*

LEGAL INTELLIGENCE.

WRECK COMMISSIONER'S COURT.

(*Before* MR. H. C. ROTHERY, *Wreck Commissioner, with Assessors.*)

THE AUSTRAL.

CAPTAIN METHVEN, Captain Parish, Mr. Eames, engineer, and Mr. Robertson, late Chief Constructor for Portsmouth Dockyard, were the Assessors.

This was the official inquiry ordered by the Board of Trade into the capsizing of the Austral, one of the largest steamers of the Orient Line, in Sydney Harbour, on the 11th of November, 1882. Owing to recent investigations into the stability of vessels referred to in the Daphne report, and the number of lives put in jeopardy by the event, the case excited more than ordinary interest. Proceedings began on Monday.

Mr. Mansel Jones and Mr. Howard Smith were for the Solicitor to the Board of Trade—Mr. W. Murton, Mr. Bucknill and Mr. Baden Powell for the owners; Mr. T. H. Nelson for the master.

Mr. MANSEL JONES said the Austral was built at Govan in 1882, and registered at Glasgow. She was 456ft. long, 48·25ft. broad, and 33·95ft. deep. Her engine-room was 102ft. long. She had three compound engines, made by John Elder and Co.—one 62in., the other 86in. in diameter, 5ft. stroke, and 1000 nominal horse-power. Her gross tonnage was 5588, and net tonnage 3289 tons. Her hull was of steel. She was classed 100 A1 for three-decked vessels. She had fifteen coaling ports, eight on the starboard and seven on the port side, 2ft. 6in. high, and 3ft. 3in. wide. The lower edge of these was 25ft. 6in. from the bottom of the keel. She had ballast tanks capable of taking 670 tons of water. She had also fresh-water tanks. She left London on the 7th of September, 1882, with a crew of 195 and over 500 passengers. She arrived in Sydney on November 3rd. She made fast alongside the circular quay, and discharged her cargo except about 200 tons of iron, which was in the main hold. While at the quay she took in coal, and on the 6th of November the vessel took a list to starboard; but the list was speedily corrected by trimming the coal over to the port side. On the 7th of November she was moved, the water ballast tanks, which had been full, were pumped out, and she was moved from the circular quay to moorings in Neutral Bay belonging to the company, about 200 yards from the shore, in fourteen fathoms of water. No water was in the boilers. She had then in her about 1700 tons of coal, about 200 tons of iron, about 110 tons of fresh water in one of the ballast tanks, and about 70 tons of fresh water in the fresh water tank. In consequence of various matters, Sunday and a holiday intervening, and a strike among the coal porters, no more coal was taken in until the 10th. On the evening of that day about 10.45 p.m., a steam collier called the Woonoona, with 500 to 600 tons of coal, came alongside. All the coal ports were opened on both sides. The master of the collier came to the chief officer of the Austral for instructions, and was ordered to the starboard side of the Austral, where she made fast, and commenced coaling through four of the ports. They so commenced about 11.15 p.m. It appeared to have been the practice on board this vessel not to keep an anchor watch beyond one hand on deck. No officer was on deck, and from the depositions of the chief engineer it appeared that he had no intimation that the steam collier had come alongside. These vessels were coaled by contract. He turned in early that night. The captain was on deck at midnight, and also at 1 a.m., because his slumbers were disturbed by the coaling going on. He stated in his depositions that at 1 a.m. there was no list, but the vessel was on a perfectly even keel. When the Woonoona came alongside the coal ports were 4ft. out of the water. At 3.30 a.m. there was a slight list to starboard. He had made statements from depositions taken by the coroner at Sydney, in which there were some discrepancies. The coaling went on at the rate of about 40 tons an hour, so that, having began at 11.15, there was at 3.15 about 160 tons put in on the starboard side. About 3.30 a light list to starboard was noticed, but not enough to cause any of the officers to be called; but at 3.50 a very sudden list, amounting to a jerk, was felt and awakened the chief officer, who called the captain. The vessel was so far heeled over that the starboard ports were under water, and it was difficult to stand on deck. All hands were roused, the lashings of the Woonoona were cut, and all the crew except five escaped on board that vessel and a lighter which was alongside forward. The water rushed in so fast that at 4.20 a.m. she sank with the five men. In answer to a question from the learned Commissioner, counsel said that the donkey engine was not being used; steam was up; the donkey man was asleep. She sank nearly upright. He proposed entering into the construction of the vessel, the bunkers, and the position of the coal when she sank. He would call the chief engineer.

Mr. NELSON submitted to the Court whether the proceedings should go on. An inquiry under the Act was commenced at Sydney on the 27th of November, 1882. He was not referring to the inquest. Under the Merchant Shipping Act of 1854, sec. 433, there was power given, now vested in the Wreck Commissioner, to hold an inquiry if after preliminary investigation it should appear necessary or the Board of Trade should direct. The preliminary inquiry was held at Sydney, and in consequence John Murdoch, for whom he appeared, was served with a notice that the Marine Board had ordered an investigation, and he was cited to appear. The captain did attend. After a short opening of the inquiry it was adjourned to December 5th. When the Court met again on that date it was intimated that they were not going to proceed with the inquiry, but that they abandoned it. Thereupon the solicitor for Captain Murdoch applied to the Government at Sydney to proceed with the inquiry. The Minister of Justice thereupon informed him that the depositions taken before the coroner would be forwarded to the Imperial Government for the consideration of the Board of Trade in England. There had been a misunderstanding between the Imperial and the Colonial Governments on the subject. The master, having been summoned before a competent court, ought not to be put in jeopardy again; not that he admitted he was in jeopardy. Otherwise this inquiry might be abandoned and another begun in Sydney, and so on *ad infinitum.* The captain had been practically kept ashore all the time—a serious matter. Then as to the depositions spoken of by his learned friend, how could they be evidence before this Court? He had witnesses to call who were in Australia; but this Court had no power to issue a commission to examine them in Australia. He would thus be prejudiced by the inquiry not being proceeded with in Australia.

Mr. BUCKNILL would not endorse the objection. The owners were anxious the inquiry should be exhaustive, and that the problem how it was the vessel sank should be solved.

The COMMISSIONER overruled the objection. There was a mere intention to hold the inquiry which was not carried out. The objection as to witnesses would apply with greater force to an inquiry in Australia, from which the builders would necessarily have been absent.

Mr. John Macdougall said he was chief engineer of the Austral, and held a first engineer's certificate. He served on the previous voyages out and home of the Austral, as well as on this. The Austral had eight coaling-ports on the starboard and seven on the port side. They were 3ft. by 2ft. 6in. each, and all opened upwards, with hinges on the upper edge. They were fastened by dogs, inside—no flap. The after-bunker was between the engine-room and the after-boilers; it extended across the vessel, with a passage through. There were pocket-bunkers on each side of the engine-room; there was another bunker forward. Next forward were pocket-bunkers alongside of the forward boilers on each side. The forward main bunker was forward of the forward boilers, and extended across the ship. He entered into other particulars of the bunkers, which are summarised in his statement of their contents. The forward main bunker would hold 930 tons from the main deck to the hold. About 265 tons were above and 665 below the steel deck. Going sternwards, the side bunkers on each side of the forward boilers held about 76 tons below and about 72 tons above the steel deck. The bunker between the forward and after boilers, a thwart-ship bunker, contained about 250 tons, of which about 70 tons were above and 180 below the steel floor. The next were pocket-bunkers on each side of the after boilers, which contained 76 tons below and 72 above the steel floor. The thwart-ship bunker, between the engine-room and stoke-hole, contained about 425 tons, of which 136 were above and 289 below the steel deck. The side bunkers on each side of the engine-room contained on the starboard side 32 tons below and 51 tons above the steel deck, 83 in all. On the port side there were 32 tons below and 76 tons above, 108 in all. He reckoned 40ft. to the ton. When the vessel was capsized there were wanting about 70 tons on the starboard side to fill it, and 10 on the port side in the first boiler mentioned, the thwart-ship boiler. It was filling from the ports and sliding down into the bottom of the ship. The lower part was quite full, the 70 tons and 10 tons wanting referred to the part above the steel deck. The next bunker had 54 tons on the starboard side before they started putting in. At the time of the casualty it was filled below the deck, and wanted 49 tons of being filled above also—on the starboard side. On the port side it was filled all except 10 tons above the steel deck. The next bunker aft, a thwart-ship bunker, had 48 tons on the port side below the steel deck, and on the starboard side about 58. Still going aft, to the pocket bunkers on the starboard side, the lower or starboard side was quite full, and there were about 30 tons in the after. On the port side it was full below; there were 25 tons above. The next, a thwart-ship bunker, had 130 tons below, 6 above, on the starboard side. On the port side there were 75 tons below and nothing above. Last of all the pocket bunkers had 32 tons under deck on the starboard side, and 42 tons above. On the port side there were 13 below and 10 above. The coal was bulli coal, an anthracite, which occupies about 40ft. to the ton.

By Mr. BUCKNILL.—He had been speaking from recollection, and would bring his notes next day. After the Austral was raised, Mr. Miller, chief engineer of the Cephalonia, and Mr. Cruickshank, chief engineer of the South Wales Government, inspected the bunkers. Witness was present, and was satisfied that the calculations then made were approximately correct. No coals had been taken out. There was an excess in weight of coals on the starboard side, whether it was 160 tons or not he could not say. He had duplicates of the tickets of coals received. They weighed some bulli coal at Glasgow. It was 41·25ft., not 40ft. to the ton weight; but that was after the coal had lain on board the ship some time and had dried up.

By the COMMISSIONER.—The estimates he had given were from what he saw when the vessel was raised. He was asleep when she coaled. There were shoots with covers in the steel deck by which the coal passed from the upper to the lower bunkers.

Mr. John William Shepherd said he was manager to Messrs. John Elder and Co., by whom the Austral was built and engined according to a specification prepared by him and delivered to them. She was built of steel, in compliance with Lloyd's rules, under special survey, classed 100 A1. The coal fell from the ports on the steel deck and was shovelled down through the shoots. He did not agree with the engineer's figures as to the capacity of the bunkers. He calculated 43 cubic feet to the ton. The witness then gave slightly different figures; but could not say at short notice whether the discrepancy was explained by the difference in the unit. The total coal capacity was 2730 tons; but he believed that the two after-pocket bunkers never carried coal. The water ballast was 785 tons, including fresh water tanks. No steps were taken to test her stability before she went her first voyage. Some calculations were made by him. The engines and boilers—full—were 1400 or 1500 tons in weight, about 50 tons each boiler being allowed for the water in the boilers. When launched in October, 1881, she was a hull only, with 60 tons of shafting, and some water in the tanks forward. She drew 14ft. 8in. aft, 11ft. 9in. forward, mean 13ft. 2½in; 150 tons of water forward, 20 tons elsewhere.

Formal proof was given through this witness of the specifications and the displacement scale.

After the adjournment Mr. Shepherd's evidence was continued. He said he had previously designed the Orient, and she was considered one of the finest ships in the world. The Austral was designed as an improvement on the Orient. The Austral had 2ft. more beam than the Orient. He came round with the Austral on her trial trip from Glasgow to London, and was perfectly satisfied with the vessel's behaviour. The bulkheads were thoroughly tested. He went on the first voyage of the Austral as far as Naples. His opinion that the vessel possessed good stability was not at all shaken on that voyage, although they encountered bad weather. On her trial trip 300 tons of pig iron were put into the Austral until those in charge of her knew how to properly manage the water ballast tanks.

By Mr. NELSON.—When he left the vessel at Naples he did not know whether the water ballast tanks were full or not. Without water in her ballast tanks and with her spars aloft the Austral would not float on an even keel; she would incline to starboard. If the water ballast tanks were pumped out the vessel would rise about 1ft. 10in. The water ballast tanks being empty would tend to raise the centre of gravity. Before the vessel was launched be found the centre of gravity was 21·92ft. above the top of the keel. At Gravesend she drew 25ft. 10in. on an even keel. The Plimsoll disc was placed so as to give a freeboard of 11ft. 6in. The bottom of the coal ports was 1ft. 3in. above the Plimsoll mark. In his opinion, the reason of the Austral going over was that all the coal was put in on one side of the vessel. On an even keel, with a draught of 21ft. 3in., 120 tons of coal put in her on the starboard side would cause an inclination or list of about 15 deg. The Austral did not sink in consequence of a sudden heel or lurch, that was impossible.

The examination of Mr. Shepherd, the manager of the builders' firm, Messrs. John Elder and Co., was continued by the Court on Tuesday. He said, in answer to the Court, that the centre of gravity of the ship was determined by him without water in the boilers. Every water-tight compartment was tested and passed by him. It was not formerly the practice to incline vessels. The builders could not be asked to do it. Now they were taking more precautions.

The COMMISSIONER.—This Court has often expressed its astonishment that vessels are sent to sea worth £150,000 or more, and the owners will not spend £40 or £50 to ascertain their stability.

Mr. BUCKNILL.—It was said in a report issued some time ago that that opinion had not been expressed. I have often heard it expressed by this Court.

Mr. John MacDougall, recalled, said when they arrived at Sydney they went to the circular quay. They had 185 tons of coal on arrival. It was distributed over the bunkers; he could not say how much in each, having lost his notes. They commenced coaling at 1 a.m. on November 6th at the quay—port side to the quay. All the ballast tanks were then full, except one under the after bunker on the port side; that was quite empty. (The Court referred to the plan. It contained 60·2 tons.) It was full at the quay before they commenced coaling, and was pumped out by Captain Murdoch's orders. It was witness's duty to see the coal properly stowed. The crew had printed regulations. (These were produced.) The captain gave him the order to pump out the tank. Carlson was the stevedore employed to coal. They coaled from the starboard side, through the forward ports into the forward main bunkers, and into the side pockets and thwartship bunkers. His log was lost in the vessel. It was kept in his room. On the 6th they took in 220 tons of coal, all on the starboard side. Asked who was attending to the storing of the bunkers, he said no attention was required, as it went at once to the bottom of the ship. It was brought in in baskets. The 118th rule of his regulations said that the chief engineer must personally superintend the coaling and measure each tenth bag, and see that the third or fourth engineer attended to stowing. He was also to make certain entries. The ship took a list suddenly to starboard on the 6th, at about 5.30 a.m., before the full 220 tons had been taken in. They were not then, nor had they been during the night, discharging the cargo. He could not say how much cargo was in her. The list was about 7 deg. He accounted for it by the rope by which she was made fast slipping off from the post. They trimmed the coal over and she righted. They went to moorings in Neutral Bay on the 7th, and on the same day took in 340 tons there. He had on the 4th received orders to pump out the tanks when they were alongside the circular quay, and he pumped them out while coaling on the 6th. When the ship left the circular quay some of the tanks had been pumped out. They had pumped out one on the port side on the 4th, and on the 6th started to pump out the other on the starboard side, and then, starting with the after of all, pumped forward all out in turn. They were not all pumped out by the time she was shifted, nor were they all finished before she began coaling again. They were all empty before 3 a.m. on Wednesday, the 8th. That was according to the orders which he had got on the 4th. After great hesitation, he said little coal was taken in on Thursday, the 9th; he could not say how much. She had about 1610 tons in her on Friday night, the 10th, the eve of the day—Saturday, December 11th—on which she sank. One hundred and twenty tons were put in on Friday night on the starboard side, partly below and partly above the steel deck. On the Thursday he examined the bunkers, and the port side bunkers had more coal than the other side had. She was as nearly as possible upright on Thursday. She had then 93 tons more on the port side than on the starboard side. He arrived at that from a plan he made on board the lighter soon after the Austral went down. He got a hammock slung and remained, with others, on the lighter more than three weeks.

The COMMISSIONER.—I have added up the figures he gave us yesterday, and I find that, from the weights ascertained by him after she was raised, the Austral appears to have had 868 tons on the starboard and 840 on the port side, a difference of only twenty-eight tons, and that is in effect confirmed by his statement this morning, that she had ninety-three tons more on the port on Thursday night, and that afterwards 120 more tons were put on the starboard.

The witness produced some tickets issued by the wharfinger of the Bulli Company, which confirmed by their dates and amounts his statement that the ship took in 120 tons of coal on the last night, and that when she was raised she had 1736 tons on board. He did not know that coal was coming in on Friday night. He usually had notice that coal was carried from Morris, a fireman, who had to report to him every four hours during the coaling. Morris usually received the information from the trimmers. It was the custom for him to receive official information when consignments of coal were coming from the master. But on this Friday night he had received no notice that this consignment was coming. He was ashore on Friday night himself at some works examining the shaft. He left the ship at 4.30 p.m., and returned at 6 p.m. He did not go away from the ship again that night, turned in at 10 p.m., and was not awake till she heeled over. He was not again in the bunkers that night. The last time he was in the bunkers was on the Thursday. He did not know any coaling was going on, and was awakened at 3.45 a.m. by the chief officer shouting along the deck, "All hands on deck." He went quickly up. Her coal ports were completely immersed; she was nearly down to her rail on the starboard. He jumped on board a steamer which was lying alongside. In about a quarter of an hour she settled down—the whole of her hull under water. According to the regulations, it was his duty to superintend personally the coaling, but he did not superintend it because he did not know the coal was coming. On the earlier occasion when she coaled, the third or fourth engineer did not superintend the trimming, but witness did so himself. It was Morris's duty to see the coal was properly trimmed and stowed if any did come. Asked to show any regulation which cast this duty on Morris, who was neither the third or the fourth engineer, he was unable to point to any, but said they had a good deal of work to do, and made different arrangements. On the morning of the sinking he had no notice of any coal coming. He was turned in. Morris should have called him, but it was not Morris's duty to be on watch unless they had notice of coaling. Asked as to what watch was kept, he said it was the duty of the donkey-man, Wilson, to be on watch during the night. It would not be Wilson's duty to call witness if coal came. There was nobody there, in his department, to look after the coal coming in. The captain gave him the intimation that coal was coming in, when he got the intimation, but it sometimes happened on other occasions besides that of the sinking that coals came alongside without any notice to him. The captain might on these occasions have given orders that notice should be given to him, but he had not received the notice. He signed a receipt for the coal after the ship had gone down, taking the amount from the tickets and from the amount turned out by the steamer. The Woonoona, the collier, carried about 720 tons of coal.

By MR. NELSON.—When he turned in, he did not know that the vessel was drawing fore and aft. It was Wilson's duty to keep steam up in the donkey-boiler all night. He could not say of his own knowledge whether Wilson was on watch. Assuming no one knew that coals were coming that night, the watch on deck should have reported it to witness. Lowman was the name of the watch on deck that night. Witness could not say that Lowman "ran" from the ship in Sydney. On the Thursday Mr. Yuill, from the Orient line, was on the Austral. That was after all the coal except the last 120 tons had come in. That gentleman said nothing in his presence to witness or the captain as to when coals were coming alongside, nothing about coals at all. Witness did not know that the master, Captain Murdoch, knew, any more than witness, that coals were coming. He had not seen the Woonoona before. Witness's berth was on the port side. He did not see any of the crew walk on the broadside of the Austral when she went down; he was on the opposite side. The next morning she was lying at an angle of 30 deg. to starboard. At low water they could see the top of her bridge out of water. The coals were measured out of the Woonoona after the accident.

By Mr. BUCKNILL.—The plan which he told the Commissioner he had made on the lighter two or three days after the sinking was headed "As the coal was found when the ship was raised. Coal all seems to have run over to the starboard side when the ship listed going down." But that was a note put on the paper afterwards and was not the title of the plan. The plan was in ink, the quantities in pencil. He got those quantities from memory from an inspection of the bunkers on the Thursday, when he put them in writing, but had lost the writing. When he went into the vessel after she was raised one bunker door was open; that was the door on the port side of the forward main thwart-ship bunker. In the bulkhead abaft of the engine-room the tunnel doors, the door of the refrigerating room, and one of the connections between the refrigerating room and the electric lighting room were open. The seacocks and valves, except the one for the supply of the Downton pump and the after and forward fire-engine, were closed. They traced the pipes and found there were no means for the water to come into the vessel except through the ports. He had no doubt it was through the ports that the water came in. He was one of the first persons who went on board. He was at Govan while the ship was being built—when her machinery was being put in. There was a little more weight of the machinery on the starboard side than on the other. The list which she took on the 6th was due to coal having been taken in on the starboard side. The slipping of the rope was an effect of that cause. After that list they trimmed the coal, and also pumped out a starboard side ballast tank under the after bunker. At the quay the stevedores left the coal where it had fallen on the starboard without trimming it over to port; and he had to trim it when the Austral took the list. By proper arrangements with the water tanks he could keep her upright, even when loaded all on one side. The proper coaling is coaling on both sides, but if that course is not adopted, it would be the stevedore's duty either to trim the coal, or for the coaling steamer to go round to the other side when she has put in coal on one side. Before the Austral sank, ten tons of tunnel shafting and a piston weighing 2 tons 17 cwt. had been taken out. She had had a slight accident to her machinery in going out. When she came back to the Clyde after the disaster and was inclined, she had the flawed shafting put in again in the lower hold on the starboard. There were also three extra pistons, which weighed 3 tons 15 cwt. each. They were in the after-hold on the port side. There were rings to two pistons on the steerage deck; they weighed 15 cwt. each. There was extra gear, one and a-half ton, on the orlop deck.

Re-examined by Mr. MANSEL JONES, he said his cabin was at the after end of the engine-room, port side, main deck. He had left no instructions with any one as to his being called in case of coals coming alongside. The only watch kept in the engine-room in harbour is that of the donkey-man, who has to keep up steam in case of fire. He is also to call the chief engineer if anything is required. Three of the boilers were empty; one full—the fore port boiler—with water weighing about 40 tons. When the captain told witness to pump out the tanks, the witness said he did not see much use in it, but the captain said, "Pump them out, please." The master was rather annoyed because an order of his as to machinery going ashore had been countermanded by the assistant-manager at Sydney, Mr. Johnson. There was a strike among the trimmers. There was a delay of two days in the coaling. When he saw the Woonoona going away he did not expect her to return with coals for the Austral. They were not to leave so soon owing to repairs being necessary. If he had known coals were coming that evening he would have stayed up till they came, although he was very tired and glad to turn in, or he would have left instructions to be called. He had been sixteen years engineer, ten years chief, and in large vessels—the Orient and the Cuzco. This was the first time they had coaled in Sydney. It was not the practice to empty the tanks and coal with empty tanks and no cargo. He had never coaled before in such circumstances. It was not a course he approved.

By the Court.—The Orient has water-ballast tanks only in her after part. In coaling her, as far as he recollected, her tanks were full. So on the previous voyage of the Austral. Captain Murdoch directed witness to take the coal in through the ports. He gave the directions before he ordered the ballast tanks to be pumped out. When she took the first list, and he had to trim and pump, it did not cause him to think the vessel tender. In the forward bunker there was no longitudinal division to prevent coal from being taken from starboard to port and *vice versâ*. He could not say whether the ship would stand upright with her ballast tanks empty. There are the shoots from port to the hole in the steel deck down which the coal passed. The coals were trimmed from the side to the centre. The combings round the holes in the deck were 5in. high. The surface condensers would hold 20 tons, but were empty. They were on the starboard side. Their discharge valves were closed. After the ship was raised, the amount of coal above the steel deck on the starboard side was 242 tons, and on the port side there were 149. Below the steel deck there were 704 tons on the starboard side and 597 on the port side. In the stoke-hole there were 40 tons even right across. There were thus 200 tons more on the starboard side than on the port. The ship listed, which might have caused the coal to run over.

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By Mr. NELSON.—When he turned in at 10.30, the vessel was upright; the night fine. He was woke by the shout: "All hands turn out, ship's going over!"

By Mr. BUCKNILL.—No coal was taken in on the day of Friday, but the chief engineer told him to go into the bunkers to see that all was correct. He was doing other things, getting shoots clear, getting the dogs ready. When they put in coals all the doors were shut. Mr. Dougall said, "You go through the bunkers and see it is all right, and when there is any coal coming alongside report it to me." That was on the Friday morning. He said the coal was expected, but he did not know when it was coming. After getting to the Woonoona he saw the Austral take a lurch to the Woonoona before she went down. He thought she would right herself. After the lurch the whole of the ports were under water. He had not looked for them before.

Mr. Shepherd, recalled by Mr. BADEN-POWELL, said there were 80 tons weight of machinery in excess on the starboard side of the vessel. The only set-off was a small turning engine, which might weigh a ton.

On the 26th Captain John Murdoch was examined. He said he held a certificate of competency as an extra master. He had held it since 1866—17 years. During that period he had commanded the Viceroy, 2400 tons, steamer, for R. and H. Green—three years—the Cuzco, 2700, chartered by the Orient Company—four years. The Viceroy had a tank containing 60 tons only; the Cuzco had water ballast to the amount of 130 or 140 tons. The Austral was the first vessel he had commanded having water ballast tanks on the cellular system. On the first voyage he took out in the Austral a general London cargo, with dead weight and passengers. The load-line was the same in each voyage, 26ft. They were loaded down to the load-line. He proceeded to describe the first voyage. On leaving London the water-ballast tanks were all full. He was furnished with a book of regulations by the owners. There were no specific regulations as to his loading and ballasting; the coaling and ballasting was all done by the marine superintendent of the company in London, and in Australia the captain was entirely under the control of the manager there. His own control over the ship ceased when he came alongside the quay. Any suggestion of his which was not agreeable to the manager there was put on one side. He did not give the orders to fill the tanks when in the docks in London, but ascertained when in the river that they were full. Never having sailed in a cellular-bottom ship before, he requested the managers previously to sailing to permit him to have some dead weight in the ship. He had been at Glasgow in order that he might acquire a knowledge of the ship before the vessel was finished. He was not aware of any experiments as to her stability. She was not rigged under his supervision. The water-ballast tanks were entirely emptied between Naples and Port Said on the first voyage by his orders. Up to that time she had behaved very well, fine weather, sail set. He emptied the tanks then to enable him to take in as much coal as possible at Port Said, and not to exceed the draught laid down by the Suez Canal Company, 24ft. 7in. Directly after leaving Suez, in the Red Sea, the tanks were refilled, and so remained to Australia. They had fine weather to Aden, a burst of monsoon to Socotra, afterwards the trades. The vessel behaved remarkably well; he was perfectly satisfied with her. They coaled at Sydney. They about 76 tons below and about 72 tons above the steel deck. The bunker between the forward and after boilers, a thwart-ship bunker, contained about 250 tons, of which about 70 tons were above and 180 below the steel floor. The next were pocket-bunkers on each side of the after boilers, which contained 76 tons below and 72 above the steel floor. The thwart-ship bunker, between the engine-room and stoke-hole, contained about 425 tons, of which 136 were above and 289 below the steel deck. The side bunkers on each side of the engine-room contained on the starboard side 32 tons below and 51 tons above the steel deck, 83 in all. On the port side there were 32 tons below and 76 tons above, 108 in all. He reckoned 40ft. to the ton. When the vessel was capsized there were wanting about 70 tons on the starboard side to fill it, and 10 on the port side in the first boiler mentioned, the thwart-ship boiler. It was filling from the ports and sliding down into the bottom of the ship. The lower part was quite full, the 70 tons and 10 tons wanting referred to the part above the steel deck. The next bunker had 54 tons on the starboard side before they started putting in. At the time of the casualty it was filled below the deck, and wanted 49 tons of being filled above also—on the starboard side. On the port side it was filled all except 10 tons above the steel deck. The next bunker aft, a thwart-ship bunker, had 48 tons on the port side below the steel deck, and on the starboard side about 58. Still going aft, to the pocket bunkers on the starboard side, the lower or starboard side was quite full, and there were about 30 tons in the after. On the port side it was full below; there were 25 tons above. The next, a thwart-ship bunker, had 130 tons below, 6 above, on the starboard side. On the port side there were 75 tons below and nothing above. Last of all the pocket bunkers had 32 tons under deck on the starboard side, and 42 tons above. On the port side there were 13 below and 10 above. The coal was bulli coal, an anthracite, which occupies about 40ft. to the ton.

By Mr. BUCKNILL.—He had been speaking from recollection, and would bring his notes next day. After the Austral was raised, Mr. Miller, chief engineer of the Cephalonia, and Mr. Cruickshank, chief engineer of the South Wales Government, inspected the bunkers. Witness was present, and was satisfied that the calculations then made were approximately correct. No coals had been taken out. There was an excess in weight of coals on the starboard side, whether it was 160 tons or not he could not say. He had duplicates of the tickets of coals received. They weighed some bulli coal at Glasgow. It was 41·25ft., not 40ft. to the ton weight; but that was after the coal had lain on board the ship some time and had dried up.

By the COMMISSIONER.—The estimates he had given were from what he saw when the vessel was raised. He was asleep when she coaled. There were shoots with covers in the steel deck by which the coal passed from the upper to the lower bunkers.

Mr. John William Shepherd said he was manager to Messrs. John Elder and Co., by whom the Austral was built and engined according to a specification prepared by him and delivered to them. She was built of steel, in compliance with Lloyd's rules, under special survey, classed 100 A1. The coal fell from the ports on the steel deck and was shovelled down through the shoots. He did not agree with the engineer's figures as to the capacity of the bunkers. He calculated 43 cubic feet to the ton. The witness then gave slightly different figures; but could not say at short notice whether the discrepancy was explained by the difference in the unit. The total coal capacity was 2730 tons; but he believed that the two after-pocket bunkers never carried coal. The water ballast was 785 tons, including fresh water tanks. No steps were taken to test her stability before she went her first voyage. Some calculations were made by him. The engines and boilers—full—were 1400 or 1500 tons in weight, about 50 tons each boiler being allowed for the water in the boilers. When launched in October, 1881, she was a hull only, with 60 tons of shafting, and some water in the tanks forward. She drew 14ft. 8in. aft, 11ft. 9in. forward, mean 13ft. 2¾in; 150 tons of water forward, 20 tons elsewhere.

Formal proof was given through this witness of the specifications and the displacement scale.

After the adjournment Mr. Shepherd's evidence was continued. He said he had previously designed the Orient, and she was considered one of the finest ships in the world. The Austral was designed as an improvement on the Orient. The Austral had 2ft. more beam than the Orient. He came round with the Austral on her trial trip from Glasgow to London, and was perfectly satisfied with the vessel's behaviour. The bulkheads were thoroughly tested. He went on the first voyage of the Austral as far as Naples. His opinion that the vessel possessed good stability was not at all shaken on that voyage, although they encountered bad weather. On her trial trip 300 tons of pig iron were put into the Austral until those in charge of her knew how to properly manage the water ballast tanks.

By Mr. NELSON.—When he left the vessel at Naples he did not know whether the water ballast tanks were full or not. Without water in her ballast tanks and with her spars aloft the Austral would not float on an even keel; she would incline to starboard. If the water ballast tanks were pumped out the vessel would rise about 1ft. 10in. The water ballast tanks being empty would tend to raise the centre of gravity. Before the vessel was launched he found the centre of gravity of the ship was 21·92ft. above the top of the keel. At Gravesend she drew 25ft. 10in. on an even keel. The Plimsoll disc was placed so as to give a freeboard of 11ft. 6in. The bottom of the coal ports was 1ft. 3in. above the Plimsoll mark. In his opinion, the reason of the Austral going over was that all the coal was put in on one side of the vessel. On an even keel, with a draught of 21ft. 3in., 120 tons of coal put in her on the starboard side would cause an inclination or list of about 15 deg. The Austral did not sink in consequence of a sudden heel or lurch, that was impossible.

The examination of Mr. Shepherd, the manager of the builders' firm, Messrs. John Elder and Co., was continued by the Court on Tuesday. He said, in answer to the Court, that the centre of gravity of the ship was determined by him without water in the boilers. Every water-tight compartment was tested and passed by him. It was not formerly the practice to incline vessels. The builders could not be asked to do it. Now they were taking more precautions.

The COMMISSIONER.—This Court has often expressed its astonishment that vessels are sent to sea worth £150,000 or more, and the owners will not spend £40 or £50 to ascertain their stability.

Mr. BUCKNILL.—It was said in a report issued some time ago that that opinion had not been expressed. I have often heard it expressed by this Court.

Mr. John MacDougall, recalled, said when they arrived at Sydney they went to the circular quay. They had 185 tons of coal on arrival. It was distributed over the bunkers; he could not say how much in each, having lost his notes. They commenced coaling at 1 a.m. on November 6th at the quay—port side to the quay. All the ballast tanks were then full, except one under the after bunker on the port side; that was quite empty. (The Court referred to the plan. It contained 60·2 tons.) It was full at the quay before they commenced coaling, and was pumped out by Captain Murdoch's orders. It was witness's duty to see the coal properly stowed. The crew had printed regulations. (These were produced.) The captain gave him the order to pump out the tank. Carlson was the stevedore employed to coal. They coaled from the starboard side, through the forward ports into the forward main bunkers, and into the side pockets and thwartship bunkers. His log was lost in the vessel. It was kept in his room. On the 6th they took in 220 tons of coal, all on the starboard side. Asked who was attending to the storing of the bunkers, he said no attention was required, as it went at once to the bottom of the ship. It was brought in in baskets. The 118th rule of his regulations said that the chief engineer must personally superintend the coaling and measure each tenth bag, and see that the third or fourth engineer attended to stowing. He was also to make certain entries. The ship took a list suddenly to starboard on the 6th, at about 5.30 a.m., before the full 220 tons had been taken in. They were not then, nor had they been during the night, discharging the cargo. He could not say how much cargo was in her. The list was about 7 deg. He accounted for it by the rope by which she was made fast slipping off from the post. They trimmed the coal over and she righted. They went to moorings in Neutral Bay on the 7th, and on the same day took in 340 tons there. He had on the 4th received orders to pump out the tanks when they were alongside the circular quay, and he pumped them out while coaling on the 6th. When the ship left the circular quay some of the tanks had been pumped out. They had pumped out one on the port side on the 4th, and on the 6th started to pump out the other on the starboard side, and then, starting with the after of all, pumped forward all out in turn. They were not all pumped out by the time she was shifted, nor were they all finished before she began coaling again. They were all empty before 3 a.m. on Wednesday, the 8th. That was according to the orders which he had got on the 4th. After great hesitation, he said little coal was taken in on Thursday, the 9th; he could not say how much. She had about 1610 tons in her on Friday night, the 10th, the eve of the day—Saturday, December 11th—on which she sank. One hundred and twenty tons were put in on Friday night on the starboard side, partly below and partly above the steel deck. On the Thursday he examined the bunkers, and the port side bunkers had more coal than the other side had. She was as nearly as possible upright on Thursday. She had then 93 tons more on the port side than on the starboard side. He arrived at that from a plan he made on board the lighter soon after the Austral went down. He got a hammock slung and remained, with others, on the lighter more than three weeks.

The COMMISSIONER.—I have added up the figures he gave us yesterday, and I find that, from the weights ascertained by him after she was raised, the Austral appears to have had 868 tons on the starboard and 840 on the port side, a difference of only twenty-eight tons, and that is in effect confirmed by his statement this morning, that she had ninety-three tons more on the port on Thursday night, and that afterwards 120 more tons were put on the starboard.

The witness produced some tickets issued by the wharfinger of the Bulli Company, which confirmed by their dates and amounts his statement that the ship took in 120 tons of coal on the last night, and that when she was raised she had 1736 tons on board. He did not know that coal was coming in on Friday night. He usually had notice that coal was carried from Morris, a fireman, who had to report to him every four hours during the coaling. Morris usually received the information from the trimmers. It was the custom for him to receive official information when consignments of coal were coming from the master. But on this Friday night he had received no notice that this consignment was coming. He was ashore on Friday night himself at some works examining the shaft. He left the ship at 4.30 p.m., and returned at 6 p.m. He did not go away from the ship again that night, turned in at 10 p.m., and was not awake till she heeled over. He was not again in the bunkers that night. The last time he was in the bunkers was on the Thursday. He did not know any coaling was going on, and was awakened at 3.45 a.m. by the chief officer shouting along the deck, "All hands on deck." He went quickly up. Her coal ports were completely immersed; she was nearly down to her rail on the starboard. He jumped on board a steamer which was lying alongside. In about a quarter of an hour she settled down—the whole of her hull under water. According to the regulations, it was his duty to superintend personally the coaling, but he did not superintend it because he did not know the coal was coming. On the earlier occasion when she coaled, the third or fourth engineer did not superintend the trimming, but witness did so himself. It was Morris's duty to see the coal was properly trimmed and stowed if any did come. Asked to show any regulation which cast this duty on Morris, who was neither the third or the fourth engineer, he was unable to point to any, but said they had a good deal of work to do, and made different arrangements. On the morning of the sinking he had no notice of any coal coming. He was turned in. Morris should have called him, but it was not Morris's duty to be on watch unless they had notice of coaling. Asked as to what watch was kept, he said it was the duty of the donkey-man, Wilson, to be on watch during the night. It would not be Wilson's duty to call witness if coal came. There was nobody there, in his department, to look after the coal coming in. The captain gave him the intimation that coal was coming in, when he got the intimation, but it sometimes happened on other occasions besides that of the sinking that coals came alongside without any notice to him. The captain might on these occasions have given orders that notice should be given to him, but he had not received the notice. He signed a receipt for the coal after the ship had gone down, taking the amount from the tickets and from the amount turned out by the steamer. The Woonoona, the collier, carried about 720 tons of coal.

By MR. NELSON.—When he turned in, he did not know that the vessel was drawing fore and aft. It was Wilson's duty to keep steam up in the donkey-boiler all night. He could not say of his own knowledge whether Wilson was on watch. Assuming no one knew that coals were coming that night, the watch on deck should have reported it to witness. Lowman was the name of the watch on deck that night. Witness could not say that Lowman "ran" from the ship in Sydney. On the Thursday Mr. Yuill, from the Orient line, was on the Austral. That was after all the coal except the last 120 tons had come in. That gentleman said nothing in his presence to witness or the captain as to when coals were coming alongside, nothing about coals at all. Witness did not know that the master, Captain Murdoch, knew, any more than witness, that coals were coming. He had not seen the Woonoona before. Witness's berth was on the port side. He did not see any of the crew walk on the broadside of the Austral when she went down; he was on the opposite side. The next morning she was lying at an angle of 30 deg. to starboard. At low water they could see the top of her bridge out of water. The coals were measured out of the Woonoona after the accident.

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By Mr. NELSON.—When he turned in at 10.30, the vessel was upright; the night fine. He was woke by the shout: "All hands turn out, ship's going over!"

By Mr. BUCKNILL.—No coal was taken in on the day of Friday, but the chief engineer told him to go into the bunkers to see that all was correct. He was doing other things, getting shoots clear, getting the dogs ready. When they put in coals all the doors were shut. Mr. Dougall said, "You go through the bunkers and see it is all right, and when there is any coal coming alongside report it to me." That was on the Friday morning. He said the coal was expected, but he did not know when it was coming. After getting to the Woonoona he saw the Austral take a lurch to the Woonoona before she went down. He thought she would right herself. After the lurch the whole of the ports were under water. He had not looked for them before.

Mr. Shepherd, recalled by Mr. BADEN-POWELL, said there were 80 tons weight of machinery in excess on the starboard side of the vessel. The only set-off was a small turning engine, which might weigh a ton.

On the 26th Captain John Murdoch was examined. He said he held a certificate of competency as an extra master. He had held it since 1866—17 years. During that period he had commanded the Viceroy, 2400 tons, steamer, for R. and H. Green—three years—the Cuzco, 2700, chartered by the Orient Company—four years. The Viceroy had a tank containing 60 tons only; the Cuzco had water ballast to the amount of 130 or 140 tons. The Austral was the first vessel he had commanded having water ballast tanks on the cellular system. On the first voyage he took out in the Austral a general London cargo, with dead weight and passengers. The load-line was the same in each voyage, 26ft. They were loaded down to the load-line. He proceeded to describe the first voyage. On leaving London the water-ballast tanks were all full. He was furnished with a book of regulations by the owners. There were no specific regulations as to his loading and ballasting; the coaling and ballasting was all done by the marine superintendent of the company in London, and in Australia the captain was entirely under the control of the manager there. His own control over the ship ceased when he came alongside the quay. Any suggestion of his which was not agreeable to the manager there was put on one side. He did not give the orders to fill the tanks when in the docks in London, but ascertained when in the river that they were full. Never having sailed in a cellular-bottom ship before, he requested the managers previously to sailing to permit him to have some dead weight in the ship. He had been at Glasgow in order that he might acquire a knowledge of the ship before the vessel was finished. He was not aware of any experiments as to her stability. She was not rigged under his supervision. The water-ballast tanks were entirely emptied between Naples and Port Said on the first voyage by his orders. Up to that time she had behaved very well, fine weather, sail set. He emptied the tanks then to enable him to take in as much coal as possible at Port Said, and not to exceed the draught laid down by the Suez Canal Company, 24ft. 7in. Directly after leaving Suez, in the Red Sea, the tanks were refilled, and so remained to Australia. They had fine weather to Aden, a burst of monsoon to Socotra, afterwards the trades. The vessel behaved remarkably well; he was perfectly satisfied with her. They coaled at Sydney. They arrived with tanks filled, and took all coal, except about 100 tons, at the circular quay. The coal was taken at the quay to save time, because the ship was only five days in Sydney, and commenced coaling as soon as she was fast alongside the wharf. The tanks were emptied when he hauled out into the stream before sailing. That was because, it not being the wool season in Australia, the company's agent had engaged a large quantity of weight—copper and tin, with wheat, leather, tallow, hides, the general winter cargo from the colony. He remembered the ship being put down with this weight to 27ft. 7in., and no heed being paid of his remonstrance to the agent (Mr. Yuill). She was standing at that with her tanks empty, and that was why he had pumped her out. The disc was under water to the best of his recollection. He first sent up to the office to request that they would stop sending more dead weight, as the ship was too deep. The answer he received was that they could not break the shipments. He sent up before she sank to 27ft. 7in.; how low she was he did not remember, but the Plimsoll disc was well down. They persisted in putting the weight on board. In his opinion 27ft. 7in. was such a draught that to protect himself he told the agent that he would not take the ship to sea until he took 100 tons out of the ship. Over 100 tons of coal, he thought 120, were then taken out. There were very few passengers on board, the majority joining at Melbourne. He put to sea when the 120 tons were taken out, went 600 miles in two and a-half days' quietly steaming, and called at Melbourne. The coal consumption being 120 to 130 tons a day there would be about 260 tons consumed. At Melbourne they took in 4000 to 5000 carcases of frozen mutton, which takes about 80ft. to the ton; also about 100 tons of coal either in Melbourne or Adelaide. On leaving Melbourne the Plimsoll mark was in sight, and he did not think she was too deeply laden. Between Melbourne and Adelaide, 400 or 500 miles, there was a fearful sea; he had to reduce her speed enough to keep steerage way; slight structures on the deck carried away, but nothing of consequence. On the second voyage he left London on September 7th, the tanks were empty on getting into the river. There were between 300 and 400 tons of dead weight, part rails and bar iron, and a general cargo. They drew about 25ft. 10in. on an even keel. They were neaped for water and missed one tide; that was why the tanks were pumped out, and, as it was, she scraped the whole way over the sill of the dock. The tanks were filled again in the river. The tanks were kept filled to the Cape, where they coaled 1000 to 1100 tons. On leaving Simon's Bay—Cape—he filled up all the tanks but the forward one. Directly he got under the Australian land, a few days before reaching Melbourne, he had that one filled, so that all were full on arriving at Melbourne. They remained full till he arrived at Sydney on November 3rd. He made fast alongside the circular quay, very much against his wish, a wish expressed to Mr. Yuill, the agent whom he met at Melbourne. Previously to leaving London he got imperative orders verbally from Mr. William Anderson, one of the co-managers of the Orient Line, "If you allow a pound of coal to go over the deck of the ship such conduct will be strictly scrutinised when you return to London." On the previous voyage the whole coaling had been done over the deck at Sydney; the ports were not opened. Consequently there was a very great mess made of the ship. He had a long conversation with Mr. Anderson about the ship, and the subject was generally alluded to in all the public papers out there. Before leaving London, witness requested that the managers or surveyor should write to the agent at Sydney to arrange for coaling the ship through the ports. The only good and proper way to coal the ship at Sydney was to coal on both sides, and that was why he objected to go alongside the circular quay. But if they had made the proper arrangements he could have coaled on both sides alongside the quay. The ship was supplied in London on the second voyage with a large number of coaling baskets, which were supplied for the purpose of coaling through the ports, and were not in her on the first voyage. The coal should have been transported from the colliers into lighters. It would have been possible to discharge cargo with a lighter between the ship and the quay. When he got to the quay, arrangements had not been made to enable him to coal in that manner. He saw Mr. Yuill at Melbourne. On his arrival at Sydney, a clerk of Mr. Yuill's represented the company. They arrived on Friday evening, November 3rd, at Sydney, and went under steam with a tug in attendance on Saturday morning alongside the quay, where they discharged passengers. The coal was sent alongside by the agents in a steamboat, and there was no alternative to taking it on the starboard side. No communication was made to him by the captain of the steam collier. Witness ordered the engineer to open the ports on both sides. They were opened on both sides, he thought. He did not remonstrate after his remonstrance to Mr. Yuill at Melbourne. There he said to Mr. Yuill: "I suppose, sir, you have received the instructions sent by the managers that no coal is to go over the deck of this ship." Mr. Yuill said the only arrangement he had made was, that he had instructed the owners of the colliers not to allow the men to pass any coal over the deck of the ship, but that it must go in through the ports. Witness said: "Well, I must request that you allow the ship to remain out in the stream." Mr. Yuill asked why. Witness said because if those were the only arrangements he had made it would be impossible to coal the ship on both sides. Witness now explained, on the suggestion of the Court, that a steamer could not come between the ship and the quay without stopping the discharge of the cargo. He added that Mr. Yuill in reply merely said that he must go alongside the wharf. There was not, that he recollected, any further conversation about coaling at that time. The engines had all gone to pieces on the voyage out, as everyone knew, and there were heavy repairs to be done in Sydney, and so they were in no hurry to leave Sydney. The forward length of the shafting had a heavy flaw in it. This was discovered before arriving at Simon's Bay. The high-pressure and the two low-pressure pistons were cracked. The fault in the two latter pistons was discovered at Sydney. The high-pressure valve gear was completely useless. They were trying a little patent with regard to the rings inside the valves, and the low-pressure valve gear was in very bad order. When the high-pressure valve gear gave out before arriving at Simon's Bay, it broke the crosshead. He reported this damage to Mr. Yuill at Melbourne. Previously to arriving at Melbourne there would have been a day fixed for the return voyage. Witness had a conversation with Mr. Yuill about it. On arriving at Sydney he found that the Garonne, the next ship on the berth, had taken their date, and the Austral's advertised departure was postponed. The necessity for getting coals on board immediately on getting to the quay was because the manager was anxious that the ship should be thrown open to the public, and should be cleaned up first. The manager followed witness round by land, and arrived at Sydney, he thought, on Monday, the 6th. No coaling commenced till after midnight on the Sunday. Witness had received no orders from the manager at Melbourne as to coaling. Witness immediately after arriving in Sydney, the morning after, gave his orders to the chief engineer to get his ports open and all ready for coaling. The first order about the tanks he gave to the chief engineer was about 6 a.m. on the Monday morning:—"Mr. MacDougall, you will pump out one tank on the starboard side to help in bringing the ship to an even keel again, that the discharging of the cargo may not be interfered with." At that time some coal had been taken on board at the starboard side; none on the port. They had not shoved off from the quay to enable the lighters to come between them and the quay. There were no lighters to come. Asked why, not having any orders from Mr. Yuill to coal, he had allowed coaling on one side only, he said that when the steamer came alongside if he refuse coal her master complained to the office, and the office asks him why he does not take it. He could refuse to take in coal, but it would be at his own peril. Before leaving the quay, he thought on the Saturday, before anything was pumped out and any coal came, he gave the engineer to understand that he—witness—was not allowed to take any coal over the deck, that the coal would come from the colliers in the usual way, and as the coal came in they would pump the water ballast out. The engineer did not say, to his recollection, that it would be of little use, and witness did not say, "Never mind; pump the tanks out." He had no recollection of the conversation which the engineer had detailed. He had never said a sharp word to Mr. MacDougall. The countermanding of his own orders by the officer on shore was, it was true, a constant source of irritation. The coal steamer came alongside on Sunday afternoon, and the ports were then open. Witness knew coaling would commence shortly after midnight. The chief engineer knew it. They did not allow Sunday work. The deck-bridge was the roof of his cabin. Sometimes by a fluke they heard coal was coming alongside; he had no regular notice. No intimation was made to him by the master of the collier on the Sunday that he bore coal for the Austral. The practice was that the officer on shore sent coal; it came at 4, 5, and 6 a.m. to the ship, and they on the ship knew nothing about it. Finding the collier alongside, and knowing she was going to begin coaling after midnight, he did not think it necessary to give the engineer any orders as to trimming. A book of the company's regulations is supplied to the engineer. (Mr. Jones read Article 118, which directed that the chief engineer must personally superintend the stowing.) To the best of witness's belief, and according to the impression he was always under, the article was always observed. On Monday, the 6th, or before leaving the circular quay, he had no further conversation with the engineer. Witness heard the engineer say in Court the previous day that another tank was pumped out. Witness was not aware of it. Witness did not order the tanks to be pumped out. Asked when he became aware that all the tanks were pumped out, witness said that on the 10th—Friday—he said to the chief engineer, in presence of the agent, "Are the coals all trimmed down? Are the salt-water ballast tanks cleaned down and dried?" The chief engineer's answer was, "All the ballast tanks are pumped out and perfectly dry." On the Tuesday witness had given the order to pump out the rest of the tanks. Witness's reason was that in discharging the coal from the steam colliers into the ship, the colliers were so high in the hoist of the coal above the coal ports that when they tipped them down there was a great waste of coal. They rig a plank from the rail of the ship, slung clear of the collier's bulwarks, they have friction winches on the colliers, they heave up with the friction winch, and a man runs along the plank and tips the coal in. The colliers keep rising as they discharge coal, and the ship goes down. Going back to the 6th, and asked as to the list which the vessel took on that day, he said he came immediately to the conclusion that they had put the coal in on the starboard side and had not trimmed it. The foreman coalman requested him to allow some coal to be brought across the deck to be put on the port side. Witness refused permission, ordered the coalman to get his men down into the bunkers to trim the coal, and ordered the engineer to pump out a tank. The chief engineer's report to him was, "Coal taken in alongside quay 150 tons." That was all on the starboard. Nearly all the cargo which had been brought on to Sydney—some had been delivered at Melbourne—was then in her. It was quite reasonable that she should take a list; it was 5 deg. or 6 deg. only—what you might see daily in the Albert Dock. The rising tide helped to break the rope; he was not disquieted. On the Monday when he got the ship upright, he went to the office and stated to the clerk, Mr. Johnston, that he would not take in any more coal, and asked for a permit to take the ship to Neutral Bay, so that he might coal on both sides. He got verbal permission, and steamers were sent to assist him to Neutral Bay. In Neutral Bay he discharged cargo on Tuesday and Wednesday. There was a threatened strike of the labourers. Every expedition was used to get the best of the cargo out before the Thursday, the day fixed by them for leaving work—itself a holiday, as being the Prince of Wales's birthday. The round cargo—measurement goods—as opposed to the dead weight was out by Thursday. No machinery was taken out till they got to Neutral Bay. The moorings were about half a mile from the quay. When she sank her head was north-east. The coal ports were kept open, triced up to the sides of the ship, all the time they were at the moorings. No coal was taken in on Friday. Witness left the ship at 6 p.m., and returned at 10.45 p.m. The ship was perfectly upright. The steam collier was alongside and had just commenced discharging coal into the ship. The main-yard was braced up to allow the masts of the collier to go clear. Witness came on board at the port gangway. His cabin was on the midship line of the promenade deck. It was a lovely night; bright stars, perfectly cloudless, dead calm. Witness looked over the starboard side. They were coaling the second port from forward out of the forward part of the collier. To the best of his recollection, they were coaling in the after-end into the after cross-bunker. The coal ports used would be the third from forward and the second from aft. The boats were all swung in and berthed. There was no need to alter them. Witness went to his cabin, and the coaling continued. The night-watchman, Lowman, was on watch when witness came on deck. It was not the practice to have an officer keeping the anchor-watch at Sydney. When there were passengers on board, an officer kept watch in port, as they were considered *en voyage*, but not at Sydney when there were no passengers. The only regulation was that the chief officer should see that a proper watch was kept. Lowman had sailed with the chief officer several voyages, and was, without exception, the steadiest man in the ship. The mate appointed him—after consulting witness—to be night watchman. The post secures no extra pay, but is considered light, as the watchman does no work by day. He is supposed to come on duty at 6 p.m., and remains till 5 a.m. He has to report anything unusual to the mate. The port is exposed to sudden gales, known as "southerly busters," but their arrival is telegraphed for hours before along the coast. Asked now if he thought it safe and proper to have a watch without officers, he said, No, if you had enough officers to keep a proper watch; but his officers were in the holds all day. Each had a hold, was answerable for bad stowage and pillage, and would not be fit to keep watch also at night. On the previous voyage, when the ship was five days at Sydney, the officers did not have their clothes off all the time. A watch on deck was not necessary when coaling was going on, because if the chief engineer were doing his duty there would be some one in the bunkers. When witness arrived on board he saw nothing to call for his interference. He was aware of the regulations of the engine-room as to coaling. He had entire confidence in Mr. MacDougall, who was placed in that ship as the best man in the service. They were coaling directly beneath his cabin. He sat reading—on account of the noise—and smoking till midnight, Then he went on deck, took a turn round, and looked over the side. All were at work. He heard the chief officer's voice on the next deck ordering curtains to be put up to protect some clean work. At midnight the ship was perfectly upright. He lay down. He went on deck again at 1.30 a.m., still fine, ship still upright, and all quiet except the noise of the coaling. The last collier before the Woonoona, he was nearly certain, was on the port side. They worked up to 8 a.m. on the Thursday, the 9th. After 1.30 a.m. on the Friday night, when he remained two or three minutes on deck, he went to bed, and to sleep. The next thing was that he was awakened by the chief officer shaking him by the sleeve, and saying, "Captain Murdoch, the ship is going over." He tumbled out; the ship was at an angle of very nearly 45 deg., half a right angle. He came out on the starboard side. The starboard rail aft was down to the water, or under. He did not look over the side; there was no side to look over. She sank in eight or nine minutes at the most after he had been roused. She continued listing till she took the bottom, which prevented her from going right over. As the water came in on the port side she righted to about 13 or 14 deg. It was high water, rise and fall 4ft. or 5ft.; she was in seven fathoms at low water spring, deepening aft. He did his utmost to save life. There were 195 men in crew, there might have been two or three deserters. All were saved but five, the refrigerating engineer, the purser—whose cabin was on the starboard side, and three Lascars. There was an empty lighter on the port side, by which and by the Woonoona the rest were saved. He got to the lighter on the port side. She never went over so far as to be on her beam-ends. On each time he was on deck he took sufficient notice to be sure the ship was upright. He had no reason to expect the coal to come alongside that night; he had no information. Since 1878 he had had experience at Sydney of coaling. Colliers commonly came alongside at night, and commenced coaling immediately, and had done so with this vessel on the previous voyage. They coaled over the deck on the previous voyage, because that was the custom of the colliers at Sydney. The baskets supplied to the ship would hold about 120 lb., they were round and about 1ft. high. They were not being used. The baskets being used were those which were heaved from the collier. They held about 3 cwt., and were 3ft. or more high. They would not go through the ports. They would not use the small baskets at Sydney; he used them at St. Vincent. No homeward cargo had been taken on board the vessel when she sank; there were about 200 tons of cargo for the colony on board. He was still in the service of the company, but on half-pay.

By Mr. BUCKNILL.—He attributed the sinking of the ship to her capsizing, turning over. It was to him a mystery. His belief was that she went over from want of stability in the circumstances in which she was placed at the time. He meant that the 120 tons of coal put in on the Friday night or Saturday morning showed the vanishing point of the stability of the ship; they caused her to incline to an angle at which her stability vanished. Even if the ports had been closed she would have gone bottom up had not the bottom of the harbour brought her up. It was only his opinion; he was not an expert. He first held that opinion when he read and heard the sworn evidence that was given before the coroner. Referred to a letter of November 19th, 1882, which he wrote to the owners—the inquest began on the 13th and was finished on the 22nd, he said it was true he wrote he was unable to account for the disaster. In his own evidence, on November 14th, he said he knew of no defect in the ship which would have caused her to be unseaworthy. On the 19th, being recalled, he said at the inquest, "In the stream we continued coaling on both sides." He adhered to that, he remembered two steamers alongside at one time; and the steamer before the Woonoona was on the port side. On the Wednesday or Thursday he consulted with the engineer as to the safety of the ship if they pumped the ballast tanks to raise the Austral to avoid waste of coal in coaling. The tanks were then empty. He had given the order to empty them to the chief engineer on Tuesday. It was at 3.45 a.m. on the Saturday that he was roused. The angle of 45 degrees of which he spoke was a mere approximate guess. He knew the ship had more weight of machinery, how much he did not know, on the starboard side. He had been in severe weather with the ship, was proud of her; she was under sail for fourteen hours, and behaved very well. A letter being produced, he admitted that he wrote that on the voyage out. After the flaw was discovered, she sailed eighteen hours under sail alone, dragging her propeller after her. He stated before the coroner that he thought her a stiff ship—up to the accident he thought so—she did not roll much. Before the coroner he was asked by a juryman whether she would not have had more stability if all the tanks had been full, and he said that he conferred with the engineer on Friday, who agreed with him that she was safe as she was. That was true. When the ship was built as a cellular-bottomed ship, it was intended by the architect, builders, and owners that she should be fit to go to sea without any water ballast or dead-weight. He said that being given to understand that fact, he thought that with nearly 2000 tons of weight he was justified in pumping out the water ballast to raise the ship to take coal. She had plenty of weight in her when she took her first list, while at the quay, from 250 tons of coal being put in on the starboard side. It did not occur to him that if with her water tanks full, with all her outward cargo in her, 250 tons on the starboard gave her a list, 120 would give her a list on her cargo having been taken out and the water ballast tanks emptied. If the ship had been coaled with the baskets she brought out there would have been no occasion to empty the tanks. She went into the stream to coal on both sides. When the Woonoona came to coal her on one side only, at night, on the starboard side, he assumed that some one in the bunker was looking after the trimming. There were twenty-three trimmers in the bunkers. There was no proof she was not properly trimmed. He now assumed the coal was trimmed; they were trimming all the time. He had gathered that a saloon waiter, who was on watch that night, Ramsay, had made a deposition to the company's solicitor, in which he said that the men knocked off coaling for half an hour, from 3 to 3.30. He did not recollect having told the managers of the company that he had the ballast tanks full on the voyage out. She drew a mean of 26ft. at Gravesend on the first voyage, at Plymouth it was 25ft. forward, 25ft. 6in. aft. The Plimsoll mark was 26ft. 6in. Therefore her deck was 6in. out at Gravesend; and in sea water, and as coal was burnt, she would get higher still. He was so satisfied that he went to sea with 400 tons less stiffening dead-weight. It was from Mr. J. G. Anderson he heard that the ship was meant to go to sea with no dead-weight and no water-ballast. That was before the accident. Captain Andrews had told him so since the accident. When he pumped out the tanks between Naples and Port Said he had plenty of dead-weight in, which he now thought was very fortunate. The regulations of the line subordinated the captain to the manager in Sydney. Mr. Yuill would have no authority to have the ballast tanks pumped out. Witness would not suffer him to pump out the tanks. He was the agent to make contracts. The witness remonstrated against the weighty cargo sent in by the agent on the previous voyage; 100 tons were taken out. He could have refused to take in coal at the circular quay, but it would have been much to his disadvantage. He preferred not to say whether he and Mr. Yuill got on well together. His request that she should be taken into the stream was immediately acceded to. The list of the ship on the Monday woke him up. He called the chief officer, and ordered him to knock off the coaling at once. He knew it had not been trimmed as soon as he woke. The engineer ought to have had an officer there to superintend the trimming; but with the tunnels through the bunkers, trimming would have been difficult, as the coal would have to be heaved over the tunnels. She had taken a slight list to starboard when he was coaling on the voyage in Simon's Bay. It was blowing so heavily that he could not coal on the port side for twelve hours, and so took all on the starboard. On the first voyage she took a starboard list on coaling, for reasons which amounted to non-trimming. On the 10th she was 2ft. down by the stern. It did not occur to him that because the engineers had been working hard they would not be on duty. No one was up all night on Thursday. There were festivities in Sydney on the Prince of Wales's birthday. If Morris had kept awake, things, he supposed, might have gone on otherwise. He did not say positively that the mainyard was braced up, but that in all probability it was. Asked whether he heard Mr. Carlson, the stevedore, say at the inquest the coal-ports ought to have been fastened, he said no. There was not time to give an order to close the coal-ports when he was roused. The hinges worked very stiff; he had seen three men on the flaps to shut them. The agent, Mr. Yuill, wrote to him after the accident to resign the command of the ship. Witness refused to resign, but came home.

This brings down the evidence in this important case to Wednesday night. The inquiry was resumed on Thursday. It is not certain when it will be concluded.

MESSRS. RUSTON, PROCTOR, AND CO., Lincoln, have received a diploma of honour at the Amsterdam Exhibition.

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Before leaving London, witness requested that the managers or surveyor should write to the agent at Sydney to arrange for coaling the ship through the ports. The only good and proper way to coal the ship at Sydney was to coal on both sides, and that was why he objected to go alongside the circular quay. But if they had made the proper arrangements he could have coaled on both sides alongside the quay. The ship was supplied in London on the second voyage with a large number of coaling baskets, which were supplied for the purpose of coaling through the ports, and were not in her on the first voyage. The coal should have been transported from the colliers into lighters. It would have been possible to discharge cargo with a lighter between the ship and the quay. When he got to the quay, arrangements had not been made to enable him to coal in that manner. He saw Mr. Yuill at Melbourne. On his arrival at Sydney, a clerk of Mr. Yuill's represented the company. They arrived on Friday evening, November 3rd, at Sydney, and went under steam with a tug in attendance on Saturday morning alongside the quay, where they discharged passengers. The coal was sent alongside by the agents in a steamboat, and there was no alternative to taking it on the starboard side. No communication was made to him by the captain of the steam collier. Witness ordered the engineer to open the ports on both sides. They were opened on both sides, he thought. He did not remonstrate after his remonstrance to Mr. Yuill at Melbourne. There he said to Mr. Yuill: "I suppose, sir, you have received the instructions sent by the managers that no coal is to go over the deck of this ship." Mr. Yuill said the only arrangement he had made was, that he had instructed the owners of the colliers not to allow the men to pass any coal over the deck of the ship, but that it must go in through the ports. Witness said: "Well, I must request that you allow the ship to remain out in the stream." Mr. Yuill asked why. Witness said because if those were the only arrangements he had made it would be impossible to coal the ship on both sides. Witness now explained, on the suggestion of the Court, that a steamer could not come between the ship and the quay without stopping the discharge of the cargo. He added that Mr. Yuill in reply merely said that he must go alongside the wharf. There was not, that he recollected, any further conversation about coaling at that time. The engines had all gone to pieces on the voyage out, as everyone knew, and there were heavy repairs to be done in Sydney, and so they were in no hurry to leave Sydney. The forward length of the shafting had a heavy flaw in it. This was discovered before arriving at Simon's Bay. The high-pressure and the two low-pressure pistons were cracked. The fault in the two latter pistons was discovered at Sydney. The high-pressure valve gear was completely useless. They were trying a little patent with regard to the rings inside the valves, and the low-pressure valve gear was in very bad order. When the high-pressure valve gear gave out before arriving at Simon's Bay, it broke the crosshead. He reported this damage to Mr. Yuill at Melbourne. Previously to arriving at Melbourne there would have been a day fixed for the return voyage. Witness had a conversation with Mr. Yuill about it. On arriving at Sydney he found that the Garonne, the next ship on the berth, had taken their date, and the Austral's advertised departure was postponed. The necessity for getting coals on board immediately on getting to the quay was because the manager was anxious that the ship should be thrown open to the public, and should be cleaned up first. The manager followed witness round by land, and arrived at Sydney, he thought, on Monday, the 6th. No coaling commenced till after midnight on the Sunday. Witness had received no orders from the manager at Melbourne as to coaling. Witness immediately after arriving in Sydney, the morning after, gave his orders to the chief engineer to get his ports open and all ready for coaling. The first order about the tanks he gave to the chief engineer was about 6 a.m. on the Monday morning:—"Mr. MacDougall, you will pump out one tank on the starboard side to help in bringing the ship to an even keel again, that the discharging of the cargo may not be interfered with." At that time some coal had been taken on board at the starboard side; none on the port. They had not shoved off from the quay to enable the lighters to come between them and the quay. There were no lighters to come. Asked why, not having any orders from Mr. Yuill to coal, he had allowed coaling on one side only, he said that when the steamer came alongside if he refuse coal her master complained to the office, and the office asks him why he does not take it. He could refuse to take in coal, but it would be at his own peril. Before leaving the quay, he thought on the Saturday, before anything was pumped out and any coal came, he gave the engineer to understand that he—witness—was not allowed to take any coal over the deck, that the coal would come from the colliers in the usual way, and as the coal came in they would pump the water ballast out. The engineer did not say, to his recollection, that it would be of little use, and witness did not say, "Never mind; pump the tanks out." He had no recollection of the conversation which the engineer had detailed. He had never said a sharp word to Mr. MacDougall. The countermanding of his own orders by the officer on shore was, it was true, a constant source of irritation. The coal steamer came alongside on Sunday afternoon, and the ports were then open. Witness knew coaling would commence shortly after midnight. The chief engineer knew it. They did not allow Sunday work. The deck-bridge was the roof of his cabin. Sometimes by a fluke they heard coal was coming alongside; he had no regular notice. No intimation was made to him by the master of the collier on the Sunday that he bore coal for the Austral. The practice was that the officer on shore sent coal; it came at 4, 5, and 6 a.m. to the ship, and they on the ship knew nothing about it. Finding the collier alongside, and knowing she was going to begin coaling after midnight, he did not think it necessary to give the engineer any orders as to trimming. A book of the company's regulations is supplied to the engineer. (Mr. Jones read Article 118, which directed that the chief engineer must personally superintend the stowing.) To the best of witness's belief, and according to the impression he was always under, the article was always observed. On Monday, the 6th, or before leaving the circular quay, he had no further conversation with the engineer. Witness heard the engineer say in Court the previous day that another tank was pumped out. Witness was not aware of it. Witness did not order the tanks to be pumped out. Asked when he became aware that all the tanks were pumped out, witness said that on the 10th—Friday—he said to the chief engineer, in presence of the agent, "Are the coals all trimmed down? Are the salt-water ballast tanks cleaned down and dried?" The chief engineer's answer was, "All the ballast tanks are pumped out and perfectly dry." On the Tuesday witness had given the order to pump out the rest of the tanks. Witness's reason was that in discharging the coal from the steam colliers into the ship, the colliers were so high in the hoist of the coal above the coal ports that when they tipped them down there was a great waste of coal. They rig a plank from the rail of the ship, slung clear of the collier's bulwarks, they have friction winches on the colliers, they heave up with the friction winch, and a man runs along the plank and tips the coal in. The colliers keep rising as they discharge coal, and the ship goes down. Going back to the 6th, and asked as to the list which the vessel took on that day, he said he came immediately to the conclusion that they had put the coal in on the starboard side and had not trimmed it. The foreman coalman requested him to allow some coal to be brought across the deck to be put on the port side. Witness refused permission, ordered the coalman to get his men down into the bunkers to trim the coal, and ordered the engineer to pump out a tank. The chief engineer's report to him was, "Coal taken in alongside quay 150 tons." That was all on the starboard. Nearly all the cargo which had been brought on to Sydney—some had been delivered at Melbourne—was then in her. It was quite reasonable that she should take a list; it was 5 deg. or 6 deg. only—what you might see daily in the Albert Dock. The rising tide helped to break the rope; he was not disquieted. On the Monday when he got the ship upright, he went to the office and stated to the clerk, Mr. Johnston, that he would not take in any more coal, and asked for a permit to take the ship to Neutral Bay, so that he might coal on both sides. He got verbal permission, and steamers were sent to assist him to Neutral Bay. In Neutral Bay he discharged cargo on Tuesday and Wednesday. There was a threatened strike of the labourers. Every expedition was used to get the best of the cargo out before the Thursday, the day fixed by them for leaving work—itself a holiday, as being the Prince of Wales's birthday. The round cargo—measurement goods—as opposed to the dead weight was out by Thursday. No machinery was taken out till they got to Neutral Bay. The moorings were about half a mile from the quay. When she sank her head was north-east. The coal ports were kept open, triced up to the sides of the ship, all the time they were at the moorings. No coal was taken in on Friday. Witness left the ship at 6 p.m., and returned at 10.45 p.m. The ship was perfectly upright. The steam collier was alongside and had just commenced discharging coal into the ship. The main-yard was braced up to allow the masts of the collier to go clear. Witness came on board at the port gangway. His cabin was on the midship line of the promenade deck. It was a lovely night; bright stars, perfectly cloudless, dead calm. Witness looked over the starboard side. They were coaling the second port from forward out of the forward part of the collier. To the best of his recollection, they were coaling in the after-end into the after cross-bunker. The coal ports used would be the third from forward and the second from aft. The boats were all swung in and berthed. There was no need to alter them. Witness went to his cabin, and the coaling continued. The night-watchman, Lowman, was on watch when witness came on deck. It was not the practice to have an officer keeping the anchor-watch at Sydney. When there were passengers on board, an officer kept watch in port, as they were considered *en voyage*, but not at Sydney when there were no passengers. The only regulation was that the chief officer should see that a proper watch was kept. Lowman had sailed with the chief officer several voyages, and was, without exception, the steadiest man in the ship. The mate appointed him—after consulting witness—to be night watchman. The post secures no extra pay, but is considered light, as the watchman does no work by day. He is supposed to come on duty at 6 p.m., and remains till 5 a.m. He has to report anything unusual to the mate. The port is exposed to sudden gales, known as "southerly busters," but their arrival is telegraphed for hours before along the coast. Asked now if he thought it safe and proper to have a watch without officers, he said, No, if you had enough officers to keep a proper watch; but his officers were in the holds all day. Each had a hold, was answerable for bad stowage and pillage, and would not be fit to keep watch also at night. On the previous voyage, when the ship was five days at Sydney, the officers did not have their clothes off all the time. A watch on deck was not necessary when coaling was going on, because if the chief engineer were doing his duty there would be some one in the bunkers. When witness arrived on board he saw nothing to call for his interference. He was aware of the regulations of the engine-room as to coaling. He had entire confidence in Mr. MacDougall, who was placed in that ship as the best man in the service. They were coaling directly beneath his cabin. He sat reading—on account of the noise—and smoking till midnight, Then he went on deck, took a turn round, and looked over the side. All were at work. He heard the chief officer's voice on the next deck ordering curtains to be put up to protect some clean work. At midnight the ship was perfectly upright. He lay down. He went on deck again at 1.30 a.m., still fine, ship still upright, and all quiet except the noise of the coaling. The last collier before the Woonoona, he was nearly certain, was on the port side. They worked up to 8 a.m. on the Thursday, the 9th. After 1.30 a.m. on the Friday night, when he remained two or three minutes on deck, he went to bed, and to sleep. The next thing was that he was awakened by the chief officer shaking him by the sleeve, and saying, "Captain Murdoch, the ship is going over." He tumbled out; the ship was at an angle of very nearly 45 deg., half a right angle. He came out on the starboard side. The starboard rail aft was down to the water, or under. He did not look over the side; there was no side to look over. She sank in eight or nine minutes at the most after he had been roused. She continued listing till she took the bottom, which prevented her from going right over. As the water came in on the port side she righted to about 13 or 14 deg. It was high water, rise and fall 4ft. or 5ft.; she was in seven fathoms at low water spring, deepening aft. He did his utmost to save life. There were 195 men in crew, there might have been two or three deserters. All were saved but five, the refrigerating engineer, the purser—whose cabin was on the starboard side, and three Lascars. There was an empty lighter on the port side, by which and by the Woonoona the rest were saved. He got to the lighter on the port side. She never went over so far as to be on her beam-ends. On each time he was on deck he took sufficient notice to be sure the ship was upright. He had no reason to expect the coal to come alongside that night; he had no information. Since 1878 he had had experience at Sydney of coaling. Colliers commonly came alongside at night, and commenced coaling immediately, and had done so with this vessel on the previous voyage. They coaled over the deck on the previous voyage, because that was the custom of the colliers at Sydney. The baskets supplied to the ship would hold about 120 lb., they were round and about 1ft. high. They were not being used. The baskets being used were those which were heaved from the collier. They held about 3 cwt., and were 3ft. or more high. They would not go through the ports. They would not use the small baskets at Sydney; he used them at St. Vincent. No homeward cargo had been taken on board the vessel when she sank; there were about 200 tons of cargo for the colony on board. He was still in the service of the company, but on half-pay.

By Mr. Bucknill.—He attributed the sinking of the ship to her capsizing, turning over. It was to him a mystery. His belief was that she went over from want of stability in the circumstances in which she was placed at the time. He meant that the 120 tons of coal put in on the Friday night or Saturday morning showed the vanishing point of the stability of the ship; they caused her to incline to an angle at which her stability vanished. Even if the ports had been closed she would have gone bottom up had not the bottom of the harbour brought her up. It was only his opinion; he was not an expert. He first held that opinion when he read and heard the sworn evidence that was given before the coroner. Referred to a letter of November 19th, 1882, which he wrote to the owners—the inquest began on the 13th and was finished on the 22nd, he said it was true he wrote he was unable to account for the disaster. In his own evidence, on November 14th, he said he knew of no defect in the ship which would have caused her to be unseaworthy. On the 19th, being recalled, he said at the inquest, "In the stream we continued coaling on both sides." He adhered to that, he remembered two steamers alongside at one time; and the steamer before the Woonoona was on the port side. On the Wednesday or Thursday he consulted with the engineer as to the safety of the ship if they pumped the ballast tanks to raise the Austral to avoid waste of coal in coaling. The tanks were then empty. He had given the order to empty them to the chief engineer on Tuesday. It was at 3.45 a.m. on the Saturday that he was roused. The angle of 45 degrees of which he spoke was a mere approximate guess. He knew the ship had more weight of machinery, how much he did not know, on the starboard side. He had been in severe weather with the ship, was proud of her; she was under sail for fourteen hours, and behaved very well. A letter being produced, he admitted that he wrote that on the voyage out. After the flaw was discovered, she sailed eighteen hours under sail alone, dragging her propeller after her. He stated before the coroner that he thought her a stiff ship—up to the accident he thought so—she did not roll much. Before the coroner he was asked by a juryman whether she would not have had more stability if all the tanks had been full, and he said that he conferred with the engineer on Friday, who agreed with him that she was safe as she was. That was true. When the ship was built as a cellular-bottomed ship, it was intended by the architect, builders, and owners that she should be fit to go to sea without any water ballast or dead-weight. He said that being given to understand that fact, he thought that with nearly 2000 tons of weight he was justified in pumping out the water ballast to raise the ship to take coal. She had plenty of weight in her when she took her first list, while at the quay, from 250 tons of coal being put in on the starboard side. It did not occur to him that if with her water tanks full, with all her outward cargo in her, 250 tons on the starboard gave her a list, 120 would give her a list on her cargo having been taken out and the water ballast tanks emptied. If the ship had been coaled with the baskets she brought out there would have been no occasion to empty the tanks. She went into the stream to coal on both sides. When the Woonoona came to coal her on one side only, at night, on the starboard side, he assumed that some one in the bunker was looking after the trimming. There were twenty-three trimmers in the bunkers. There was no proof she was not properly trimmed. He now assumed the coal was trimmed; they were trimming all the time. He had gathered that a saloon waiter, who was on watch that night, Ramsay, had made a deposition to the company's solicitor, in which he said that the men knocked off coaling for half an hour, from 3 to 3.30. He did not recollect having told the managers of the company that he had the ballast tanks full on the voyage out. She drew a mean of 26ft. at Gravesend on the first voyage, at Plymouth it was 25ft. forward, 25ft. 6in. aft. The Plimsoll mark was 26ft. 6in. Therefore her deck was 6in. out at Gravesend; and in sea water, and as coal was burnt, she would get higher still. He was so satisfied that he went to sea with 400 tons less stiffening dead-weight. It was from Mr. J. G. Anderson he heard that the ship was meant to go to sea with no dead-weight and no water-ballast. That was before the accident. Captain Andrews had told him so since the accident. When he pumped out the tanks between Naples and Port Said he had plenty of dead-weight in, which he now thought was very fortunate. The regulations of the line subordinated the captain to the manager in Sydney. Mr. Yuill would have no authority to have the ballast tanks pumped out. Witness would not suffer him to pump out the tanks. He was the agent to make contracts. The witness remonstrated against the weighty cargo sent in by the agent on the previous voyage; 100 tons were taken out. He could have refused to take in coal at the circular quay, but it would have been much to his disadvantage. He preferred not to say whether he and Mr. Yuill got on well together. His request that she should be taken into the stream was immediately acceded to. The list of the ship on the Monday woke him up. He called the chief officer, and ordered him to knock off the coaling at once. He knew it had not been trimmed as soon as he woke. The engineer ought to have had an officer there to superintend the trimming; but with the tunnels through the bunkers, trimming would have been difficult, as the coal would have to be heaved over the tunnels. She had taken a slight list to starboard when he was coaling on the voyage in Simon's Bay. It was blowing so heavily that he could not coal on the port side for twelve hours, and so took all on the starboard. On the first voyage she took a starboard list on coaling, for reasons which amounted to non-trimming. On the 10th she was 2ft. down by the stern. It did not occur to him that because the engineers had been working hard they would not be on duty. No one was up all night on Thursday. There were festivities in Sydney on the Prince of Wales's birthday. If Morris had kept awake, things, he supposed, might have gone on otherwise. He did not say positively that the mainyard was braced up, but that in all probability it was. Asked whether he heard Mr. Carlson, the stevedore, say at the inquest the coal-ports ought to have been fastened, he said no. There was not time to give an order to close the coal-ports when he was roused. The hinges worked very stiff; he had seen three men on the flaps to shut them. The agent, Mr. Yuill, wrote to him after the accident to resign the command of the ship. Witness refused to resign, but came home.

This brings down the evidence in this important case to Wednesday night. The inquiry was resumed on Thursday. It is not certain when it will be concluded.

Messrs. Ruston, Proctor, and Co., Lincoln, have received a diploma of honour at the Amsterdam Exhibition.

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

(*From our own Correspondent.*)

MARKED bars and some other classes of good smithy iron were in somewhat improved request upon the week yesterday in Wolverhampton and also to-day—Thursday—in Birmingham. But the aggregate demand was hardly so conspicuous as a week ago.

The chief mails of the week have been less valuable. Iron is being shipped from Adelaide, and the Cuban trade has drooped.

While best iron is stronger, common iron has here and there shown signs of weakness; so that though £7 10s. is still the official quotation for marked bars, common bars are nearer £6 5s. as a minimum than they were last week.

The strip mills keep fairly active at prices which are mostly from 5s. to 10s. in advance of common bars.

In angles and girder plates the competition of the North of England was felt somewhat severely. That angles should be lower in the North of England than bars was to-day spoken of as very different to the custom of the trade in Staffordshire.

Black sheets of the "Woodford" brand, all subject to the usual 2½ per cent. discount, were quoted £9 up to 20 g., £10 10s. from 21 to 24 g., £12 from 25 to 26 g., and £12 10s. for 28 w.g. "Woodford best" close-annealed sheets were £13, £14 10s., £16, and £16 10s. respectively; ditto, "best best," £14, £15 10s., £17, and £17 10s.; ditto, "best best best" £15, £16 10s., £18, and £18 10s.; whilst Woodford charcoal were quoted, £15, £16 10s. £18, and £18 10s., according to gauge.

Of close-annealed mild steel sheets, by Siemens-Martin process, there were sold a few good lots without much concession upon list prices. About £15 was realised for 20 g., and £18 10s. for 28 w.g.

Good makes of corrugated sheets of 6ft. by 8ft. were quoted £12 10s. to £13 for 18 and 20 g., with the usual £1 extra for 24 g., another £2 for 26 g., and a further £2 for 28 g.

Galvanised tinned flat sheets of well-known quality, close annealed and cold rolled of 72ft. by 24ft. or 30ft., were £20 to £26, according to gauge, whilst a less high-class but still a serviceable sort was quoted £18 10s. to £24. Yet there were complaints that some galvanised singles are this week reaching the ports at prices which cannot yield profit.

On Saturday the accountants to the South Staffordshire Mill and Forge Wages Board—Messrs. B. Smith and Sons, Wolverhampton—issued their quarterly certificate of the selling price of bar iron, ascertained by an examination of the books of twelve selected bar firms. The period comprised June, July, and August. The declared average was £6 15s. 7·03d., or 3·68d. per ton more than in the quarter preceding. This advance is too small to carry any change in wages under the existing sliding scale, but had it been larger no alteration could have occurred, since the scale is under notice by the operatives for revision—a notice upon which the arbitrator, Mr. Alderman Avery, gives his award in Birmingham to-day, thus fixing the rate of wages to be paid from October 1st. The reduction of 7½ per cent. in Northern wages which comes into force on that date will not be likely to improve the case of the Staffordshire men, although it will have to be taken into consideration that, whereas this is the first reduction in the North this year, wages in Staffordshire have already suffered two reductions—5 per cent. at the beginning of April and 2½ per cent. in July. The wages for the two districts are now about level, for in the North the rate for puddling is 7s., with the usual extras, which amount to about 1s., and in Staffordshire the puddler gets 7s. 6d. per ton, with 6d. in lieu of extras.

The averages since the institution of the scale are as here, the dates indicating the termination of the respective quarters:—1880: May 31st, £7 17s. 10d.; August 31st, £6 19s. 8d.; November 30th, £6 15s. 6d. 1881: February 28th, £6 12s. 11d.; May 31st, £6 9s. 6d.; August 31st, £6 7s.; November 30th, £6 11s. 1d. 1882: Scale suspended; no average taken. 1883: February 28th, £6 19s. 6d.; May 31st, £6 15s. 3d.; August 31st—the one just issued—£6 15s. 7d.

The weight of opinion as to the basis on which the forthcoming revision should leave the scale is in favour of all classes of iron being included in the ascertaining of the selling price instead of bars only as now, and the concession also of a premium of 1s. in excess of equal shillings to pounds. There is, however, a suggestion that bars only should be retained, but with an alteration of the present restrictions as to sizes. At present the prices are collected on from ½in. up to 4in. rounds and squares, and from 1in. up to 6in. flats. It is asked that the sizes of rounds and squares shall be from ½in. up to 7in., or from 4in. down to 7/16in., flats remaining unaltered.

The extension of Messrs. Hatton's tin-plate works at Bilston has so far proceeded that a portion of the "new side" has been already started. It consists of two pairs of sheet rolls out of the two trains, or five pairs, designed. These will be worked by a pair of condensing engines having automatic cut-off gear. The fly-wheel is of 40 tons, and the wheels which drive the train are 18in. across the teeth. The employment of steel in the production of stamping sheets and of tin-plates has called for the erection of a powerful steam hammer for the breaking-down of the ingots. The removal of broken or the replacing of new rolls will be facilitated by an overhead travelling crane, which has a 45ft. span, and is capable of lifting 25 tons, and travels on girders 138ft. long. The roof over the new mill will be 183ft. by 125ft., and 34ft. in height. Alike as to design and execution, the firm are their own engineers.

Pig iron was in plentiful supply both in Birmingham and Wolverhampton, and there were larger lots of foreign pigs of good quality upon offer than usual. All-mine iron was easy to buy at from 65s. down to 62s. 6d., medium qualities were 55s. down to 45s., and common sorts from that figure down to nearer 40s. Derbyshire pigs were from 50s. down to 47s. 6d.; and while there were some excellent Northampton brands which realised the last-named figure, there were others which were not difficult to buy at 45s. At this last figure some excellent orders have been booked by makers here, who are using the Northampton ore to produce a pig which competes with the Northampton iron; and their success has made them determine to prepare a second furnace for the production of that commodity.

NOTES FROM LANCASHIRE.

(*From our own Correspondents.*)

Manchester.—The continued absence of any real weight of new business coming into the market is causing a somewhat anxious feeling with regard to the future. For the present the leading branches of the iron trade, it is true, are kept as a rule actively employed. Pig iron makers have still contracts on their books, which afford them pretty near full employment; but their present sales are extremely small. Finished iron makers are in many cases so pressed with work for prompt specification that they can scarcely entertain new orders for quick delivery, but the amount of forward buying going on is very limited, and in the engineering branches of trade, although there is still a large amount of work in hand, orders in many departments are running out much faster than they are being replaced by new work. The general tendency all through the trade is in the direction of lessening activity, and in many quarters anything but a hopeful view is taken with regard to the prospects for the ensuing winter.

There was again only a very quiet market at Manchester on Tuesday. For pig iron the inquiry was extremely small, and one difficulty in the way of sales which I frequently hear referred to is the large quantity of scrap iron offering in the market at exceedingly low prices. Lancashire makers of pig iron, who are tolerably well sold for the remainder of the year, hold on firmly to late rates and are not disposed to book orders at anything under their list price of 45s. for forge and 45s. 6d. for foundry less 2½ delivered equal to Manchester. They are, however, undersold by district brands, and the new business at present being done in local iron is of a very trifling character. For good Lancashire brands 44s. 10d. to 45s. 10d. less 2½ for forge and foundry qualities delivered here is still quoted, but 6d. under these figures is being taken, and to secure any orders of weight concessions are necessary.

In hematites the business doing continues very small; nominally prices are unchanged, the few small sales that are made being on the basis of 59s. to 59s. 6d. less 2½ for good foundry brands delivered here.

Forge proprietors throughout this district are all very busy, but it is largely due to the usual pressure for the completion of orders with the approaching close of the season for shipments. The work in hand is chiefly for early delivery, but it is for the present so plentiful that prices are very firm. For delivery into the Manchester district £6 2s. 6d. to £6 5s. are the minimum quotations for bars; £6 12s. 6d. for hoops, and £8 5s. to £8 7s. 6d. per ton for sheets.

Messrs. Wm. Collier and Co., of Salford, have just completed for the Russian Government a specially-designed radial drilling machine, which is fitted with a drill headstock arrangement that enables the spindle to be worked at an angle up to 45 deg. in any direction. The machine consists of a strong box foundation plate, fitted with an upright carrying a radial arm, which, in addition to the special arrangement of the drill headstock, is constructed to raise and lower, thus obviating the necessity of a rising-and-falling table. The arm has a 7ft. radius, and the spindle has a 15in. variable self-acting down-feed, with quick hand motion to wind up, and is constructed to drill holes up to 4in. diameter. Messrs. Collier are also constructing drills on a similar principle, with the arm arranged to radiate 45 deg. from the horizontal line.

On Saturday arrangements were made for a visit by the members of the Manchester Association of Employers, Foremen, and Draughtsmen to the Oldham Industrial Exhibition, but, unfortunately, greater attractions at Southport, where Sir F. Bramwell delivered an address on the telephone to probably one of the most crowded audiences of workmen ever brought together from the principal Lancashire centres of industry, drew away a large number of the members. I have on a previous occasion given an outline of the Oldham Exhibition, and there is not much I need add now. There are, however, one or two special features worth brief notice. In the first place, the Exhibition has proved one of the most successful ever held in the provinces, upwards of 100,000 visitors having been already admitted during the couple of months it has been open, and the daily average of visitors is increasing as the Exhibition continues. In the second place, it indicates the line which might be followed out with advantage in future industrial exhibitions. Already complaints are being made that exhibitions are being overdone, and this, no doubt, is the case where attempts are made to give a universal character to the collections of exhibits, which are brought together in so many towns possessing no features of their own to render the exhibitions specially interesting. Really universal exhibitions can only be got together with advantage after long intervening periods, and if we are to have frequent periodical industrial exhibitions, they can only be made successful by devoting them in turn to special branches of industry, and selecting the foremost centre of the particular industry to be illustrated as the locality for the exhibition. It is the following out of this line that has contributed largely to the success of the Oldham Exhibition. There is no place in the world where the enormous progress made in all departments of cotton machinery could be so well illustrated as in Oldham, and to this object the Exhibition has in great measure been specially devoted, with the result that no such display of all descriptions of machines connected with the manipulation and manufacture of cotton fabrics has ever before been brought together, and it has attracted visitors from nearly all parts of the globe. One great advantage of a thoroughly practical exhibition of this description in the very midst of the special branch of industry it illustrates is that the users of machinery are brought into close contact with the producers, with the fullest opportunity of comparing personally all the best methods that have been introduced. Followed out on similar lines, there is no doubt that exhibitions devoted specially to particular branches of industry in the best known centres of such industry might be found to serve a useful purpose, which is more than can be said of many of the heterogeneous collections which have sprung up in such numbers of late.

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THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THE miners' delegates have at length made up their minds. They are to ask for an advance of 15 per cent. This decision was arrived at by a conference of delegates held at Rotherham on Monday, when there were present 149 delegates, representing 38,745 men, or about 10,000 more than at the first conference last year. There were four propositions before the meeting, which were voted upon as follows: For 25 per cent. advance, 10; for 20 per cent., 56; for 15 per cent., 70; for 10 per cent., 8; total, 144. There being so large a majority for 15 per cent., this amount was afterwards unanimously resolved upon. It was further resolved that a conference should be held at Manchester of the miners of Yorkshire, Lancashire, Cheshire, Derbyshire, North Stafford, Cannock Chase, South Stafford, East Worcestershire, Nottinghamshire, Warwickshire, and Leicestershire, with a view to secure co-operation in all these counties. The general impression was that it was needless for Yorkshire to attempt single-handed to secure this object. All the miners' delegates insisted that the recent advances in the prices of coals warranted the miners demanding another substantial advance in their wages.

The advances obtained during the past nine months have been stated by various officials of the Miners' Union to range from 1s. to 2s. per ton. Coalowners, with whom I have talked, say that if there had been any such advance, or anything approaching to it, no one would deny the right of the colliers to share in this prosperity. Coalowners contend, however, that the prices now being obtained for all classes of coal show but a slight increase over the prices realised in 1882, and leave but a small margin of profit to the coalowners. Taking a Barnsley bed colliery, which class of pit represents the bulk of the output of this district, it is found that the output consists of as near as possible 50 per cent. of hard or steam coal, 20 per cent. of house coal, 15 per cent. of pit smudge or small coal, and 15 per cent. of slack or nuts. Calculating the average selling price of each class of coal, and comparing the result with the period ending October, 1882, it will be seen that the increase obtained is about 4d. per ton. The price of coke has also to be taken into consideration. Owing to the depressed state of the coke trade, from 1s. to 1s. 6d. per ton less is now being obtained than was the case twelve months ago, and this consequently still further reduces the average selling price. The cost of production, calculated on as low a scale as possible, is given as 4s. 4d. per ton, which leaves a margin of about 9d. per ton, out of which a certain amount has to be taken for depreciation of capital, and after this amount is taken off, barely 3d. per ton will be left as profit to the coalowner. This amount is certainly not a fair return for the risk and uncertainty attending colliery operations. Yet it is upon this amount that the miners' delegates are persuading their constituents to demand an advance of 15 per cent.

Dronfield, the small Derbyshire town which was recently so seriously affected by the removal of the steel works to Workington, is stated to have been selected by a Liverpool firm as the seat of a new manufacture of aluminium, for which a patent has been obtained.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

IN the different branches of the iron trade there is no lack of animation, and the warrant market, with its low values, presents a rather anomalous aspect. Up till the end of last week the market was steady, with quotations almost unchanged at the lowest point. But this week there has been some movement in the market. At the same time there is no confidence that any upward turn which takes place can be other than temporary in its operation. The stocks are heavy, and have increased in the warrant stores during the past week by about 1200 tons, and although the shipments have been good, most of the trade is in the hands of the bears, whose interest it, of course, is to arrange matters so that they should continue to purchase at the cheapest possible rates.

Business was done in the warrant market on Friday forenoon at 46s. 0½d. to 46s. 1d. cash, and 46s. 3d. to 46s. 3½d. one month, the afternoon quotations being 46s. 1d. cash and 46s. 2½d. to 46s. 3d. one month. On Monday the market was quiet in the forenoon and afternoon at precisely the rates of the preceding day. A slight upward movement began on Tuesday, when business was done at 46s. 1½d. to 46s. 3d. cash, and 46s. 4d. to 46s. 5d. one month. On Wednesday business was done at 46s. 2d. to 46s. 6d. cash, and 46s. 5d. to 46s. 8d. one month. To-day—Thursday—transactions took place up to 46s. 8½d. cash, and 46s. 10d. one month.

The demand for makers' iron has been fair, but owing to the depression in the warrant market the values of the principal brands are in some cases easier. The quotations are as follow:—Gartsherrie f.o.b. at Glasgow, per ton, No. 1, 55s.; No. 3, 51s. 6d.;

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

(*From our own Correspondent.*)

MARKED bars and some other classes of good smithy iron were in somewhat improved request upon the week yesterday in Wolverhampton and also to-day—Thursday—in Birmingham. But the aggregate demand was hardly so conspicuous as a week ago.

The chief mails of the week have been less valuable. Iron is being shipped from Adelaide, and the Cuban trade has drooped.

While best iron is stronger, common iron has here and there shown signs of weakness; so that though £7 10s. is still the official quotation for marked bars, common bars are nearer £6 5s. as a minimum than they were last week.

The strip mills keep fairly active at prices which are mostly from 5s. to 10s. in advance of common bars.

In angles and girder plates the competition of the North of England was felt somewhat severely. That angles should be lower in the North of England than bars was to-day spoken of as very different to the custom of the trade in Staffordshire.

Black sheets of the "Woodford" brand, all subject to the usual 2½ per cent. discount, were quoted £9 up to 20 g., £10 10s. from 21 to 24 g., £12 from 25 to 26 g., and £12 10s. for 28 w.g. "Woodford best" close-annealed sheets were £13, £14 10s., £16, and £16 10s. respectively; ditto, "best best," £14, £15 10s., £17, and £17 10s.; ditto, "best best best" £15, £16 10s., £18, and £18 10s.; whilst Woodford charcoal were quoted, £15, £16 10s. £18, and £18 10s., according to gauge.

Of close-annealed mild steel sheets, by Siemens-Martin process, there were sold a few good lots without much concession upon list prices. About £15 was realised for 20 g., and £18 10s. for 28 w.g.

Good makes of corrugated sheets of 6ft. by 8ft. were quoted £12 10s. to £13 for 18 and 20 g., with the usual £1 extra for 24 g., another £2 for 26 g., and a further £2 for 28 g.

Galvanised tinned flat sheets of well-known quality, close annealed and cold rolled of 72ft. by 24ft. or 30ft., were £20 to £26, according to gauge, whilst a less high-class but still a serviceable sort was quoted £18 10s. to £24. Yet there were complaints that some galvanised singles are this week reaching the ports at prices which cannot yield profit.

On Saturday the accountants to the South Staffordshire Mill and Forge Wages Board—Messrs. B. Smith and Sons, Wolverhampton—issued their quarterly certificate of the selling price of bar iron, ascertained by an examination of the books of twelve selected bar firms. The period comprised June, July, and August. The declared average was £6 15s. 7·03d., or 3·68d. per ton more than in the quarter preceding. This advance is too small to carry any change in wages under the existing sliding scale, but had it been larger no alteration could have occurred, since the scale is under notice by the operatives for revision—a notice upon which the arbitrator, Mr. Alderman Avery, gives his award in Birmingham to-day, thus fixing the rate of wages to be paid from October 1st. The reduction of 7½ per cent. in Northern wages which comes into force on that date will not be likely to improve the case of the Staffordshire men, although it will have to be taken into consideration that, whereas this is the first reduction in the North this year, wages in Staffordshire have already suffered two reductions—5 per cent. at the beginning of April and 2½ per cent. in July. The wages for the two districts are now about level, for in the North the rate for puddling is 7s., with the usual extras, which amount to about 1s., and in Staffordshire the puddler gets 7s. 6d. per ton, with 6d. in lieu of extras.

The averages since the institution of the scale are as here, the dates indicaitng the termination of the respective quarters:—1880: May 31st, £7 17s. 10d.; August 31st, £6 19s. 8d.; November 30th, £6 15s. 6d. 1881: February 28th, £6 12s. 11d.; May 31st, £6 9s. 6d.; August 31st, £6 7s.; November 30th, £6 11s. 1d. 1882: Scale suspended; no average taken. 1883: February 28th, £6 19s. 6d.; May 31st, £6 15s. 3d.; August 31st—the one just issued—£6 15s. 7d.

The weight of opinion as to the basis on which the forthcoming revision should leave the scale is in favour of all classes of iron being included in the ascertaining of the selling price instead of bars only as now, and the concession also of a premium of 1s. in excess of equal shillings to pounds. There is, however, a suggestion that bars only should be retained, but with an alteration of the present restrictions as to sizes. At present the prices are collected on from ½in. up to 4in. rounds and squares, and from 1in. up to 6in. flats. It is asked that the sizes of rounds and squares shall be from ½in. up to 7in., or from 4in. down to $\frac{7}{16}$in., flats remaining unaltered.

The extension of Messrs. Hatton's tin-plate works at Bilston has so far proceeded that a portion of the "new side" has been already started. It consists of two pairs of sheet rolls out of the two trains, or five pairs, designed. These will be worked by a pair of condensing engines having automatic cut-off gear. The fly-wheel is of 40 tons, and the wheels which drive the train are 18in. across the teeth. The employment of steel in the production of stamping sheets and of tin-plates has called for the erection of a powerful steam hammer for the breaking-down of the ingots. The removal of broken or the replacing of new rolls will be facilitated by an overhead travelling crane, which has a 45ft. span, and is capable of lifting 25 tons, and travels on girders 138ft. long. The roof over the new mill will be 183ft. by 125ft., and 34ft. in height. Alike as to design and execution, the firm are their own engineers.

Pig iron was in plentiful supply both in Birmingham and Wolverhampton, and there were larger lots of foreign pigs of good quality upon offer than usual. All-mine iron was easy to buy at from 65s. down to 62s. 6d., medium qualities were 55s. down to 45s., and common sorts from that figure down to nearer 40s. Derbyshire pigs were from 50s. down to 47s. 6d.; and while there were some excellent Northampton brands which realised the last-named figure, there were others which were not difficult to buy at 45s. At this last figure some excellent orders have been booked by makers here, who are using the Northampton ore to produce a pig which competes with the Northampton iron; and their success has made them determine to prepare a second furnace for the production of that commodity.

NOTES FROM LANCASHIRE.

(*From our own Correspondents.*)

Manchester.—The continued absence of any real weight of new business coming into the market is causing a somewhat anxious feeling with regard to the future. For the present the leading branches of the iron trade, it is true, are kept as a rule actively employed. Pig iron makers have still contracts on their books, which afford them pretty near full employment; but their present sales are extremely small. Finished iron makers are in many cases so pressed with work for prompt specification that they can scarcely entertain new orders for quick delivery, but the amount of forward buying going on is very limited, and in the engineering branches of trade, although there is still a large amount of work in hand, orders in many departments are running out much faster than they are being replaced by new work. The general tendency all through the trade is in the direction of lessening activity, and in many quarters anything but a hopeful view is taken with regard to the prospects for the ensuing winter.

There was again only a very quiet market at Manchester on Tuesday. For pig iron the inquiry was extremely small, and one difficulty in the way of sales which I frequently hear referred to is the large quantity of scrap iron offering in the market at exceedingly low prices. Lancashire makers of pig iron, who are tolerably well sold for the remainder of the year, hold on firmly to late rates and are not disposed to book orders at anything under their list price of 45s. for forge and 45s. 6d. for foundry less 2½ delivered equal to Manchester. They are, however, undersold by district brands, and the new business at present being done in local iron is of a very trifling character. For good Lancashire brands 44s. 10d. to 45s. 10d. less 2½ for forge and foundry qualities delivered here is still quoted, but 6d. under these figures is being taken, and to secure any orders of weight concessions are necessary.

In hematites the business doing continues very small; nominally prices are unchanged, the few small sales that are made being on the basis of 59s. to 59s. 6d. less 2½ for good foundry brands delivered here.

Forge proprietors throughout this district are all very busy, but it is largely due to the usual pressure for the completion of orders with the approaching close of the season for shipments. The work in hand is chiefly for early delivery, but it is for the present so plentiful that prices are very firm. For delivery into the Manchester district £6 2s. 6d. to £6 5s. are the minimum quotations for bars; £6 12s. 6d. for hoops, and £8 5s. to £8 7s. 6d. per ton for sheets.

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THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THE miners' delegates have at length made up their minds. They are to ask for an advance of 15 per cent. This decision was arrived at by a conference of delegates held at Rotherham on Monday, when there were present 149 delegates, representing 38,745 men, or about 10,000 more than at the first conference last year. There were four propositions before the meeting, which were voted upon as follows: For 25 per cent. advance, 10; for 20 per cent., 56; for 15 per cent., 70; for 10 per cent., 8; total, 144. There being so large a majority for 15 per cent., this amount was afterwards unanimously resolved upon. It was further resolved that a conference should be held at Manchester of the miners of Yorkshire, Lancashire, Cheshire, Derbyshire, North Stafford, Cannock Chase, South Stafford, East Worcestershire, Nottinghamshire, Warwickshire, and Leicestershire, with a view to secure co-operation in all these counties. The general impression was that it was needless for Yorkshire to attempt single-handed to secure this object. All the miners' delegates insisted that the recent advances in the prices of coals warranted the miners demanding another substantial advance in their wages.

The advances obtained during the past nine months have been stated by various officials of the Miners' Union to range from 1s. to 2s. per ton. Coalowners, with whom I have talked, say that if there had been any such advance, or anything approaching to it, no one would deny the right of the colliers to share in this prosperity. Coalowners contend, however, that the prices now being obtained for all classes of coal show but a slight increase over the prices realised in 1882, and leave but a small margin of profit to the coalowners. Taking a Barnsley bed colliery, which class of pit represents the bulk of the output of this district, it is found that the output consists of as near as possible 50 per cent. of hard or steam coal, 20 per cent. of house coal, 15 per cent. of pit smudge or small coal, and 15 per cent. of slack or nuts. Calculating the average selling price of each class of coal, and comparing the result with the period ending October, 1882, it will be seen that the increase obtained is about 4d. per ton. The price of coke has also to be taken into consideration. Owing to the depressed state of the coke trade, from 1s. to 1s. 6d. per ton less is now being obtained than was the case twelve months ago, and this consequently still further reduces the average selling price. The cost of production, calculated on as low a scale as possible, is given as 4s. 4d. per ton, which leaves a margin of about 9d. per ton, out of which a certain amount has to be taken for depreciation of capital, and after this amount is taken off, barely 3d. per ton will be left as profit to the coalowner. This amount is certainly not a fair return for the risk and uncertainty attending colliery operations. Yet it is upon this amount that the miners' delegates are persuading their constituents to demand an advance of 15 per cent.

Dronfield, the small Derbyshire town which was recently so seriously affected by the removal of the steel works to Workington, is stated to have been selected by a Liverpool firm as the seat of a new manufacture of aluminium, for which a patent has been obtained.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

IN the different branches of the iron trade there is no lack of animation, and the warrant market, with its low values, presents a rather anomalous aspect. Up till the end of last week the market was steady, with quotations almost unchanged at the lowest point. But this week there has been some movement in the market. At the same time there is no confidence that any upward turn which takes place can be other than temporary in its operation. The stocks are heavy, and have increased in the warrant stores during the past week by about 1200 tons, and although the shipments have been good, most of the trade is in the hands of the bears, whose interest it, of course, is to arrange matters so that they should continue to purchase at the cheapest possible rates.

Business was done in the warrant market on Friday forenoon at 46s. 0½d. to 46s. 1d. cash, and 46s. 3d. to 46s. 3½d. one month, the afternoon quotations being 46s. 1d. cash and 46s. 2½d. to 46s. 3d. one month. On Monday the market was quiet in the forenoon and afternoon at precisely the rates of the preceding day. A slight upward movement began on Tuesday, when business was done at 46s. 1½d. to 46s. 3d. cash, and 46s. 4d. to 46s. 5d. one month. On Wednesday business was done at 46s. 2d. to 46s. 6d. cash, and 46s. 5d. to 46s. 8d. one month. To-day—Thursday—transactions took place up to 46s. 8½d. cash, and 46s. 10d. one month.

The demand for makers' iron has been fair, but owing to the depression in the warrant market the values of the principal brands are in some cases easier. The quotations are as follow:—Gartsherrie f.o.b. at Glasgow, per ton, No. 1, 55s.; No. 3, 51s. 6d.;

Coltness, 57s. 6d. and 52s.; Langloan, 58s. and 52s.; Summerlee, 56s. 6d. and 50s. 6d.; Chapelhall, 55s. and 52s.; Calder, 57s. and 49s.; Carnbroe, 54s. 6d. and 48s. 3d.; Clyde, 49s. 6d. and 47s. 9d.; Monkland, 47s. 3d. and 45s. 3d.; Quarter, 47s. and 44s. 9d.; Govan, at Broomielaw, 47s. 3d. and 45s. 6d.; Shotts at Leith, 58s. and 53s. 6d.; Carron, at Grangemouth, 48s. 6d. (specially selected, 54s. 6d.) and 47s.; Kinneil, at Bo'ness, 48s. and 47s.; Glengarnock, at Ardrossan, 54s. 3d. and 47s. 3d.; Eglinton, 48s. and 45s.; Dalmellington, 48s. 6d. and 47s. 6d.

The mineral import trade at Glasgow has become more important than of late. In the course of the past week six steamers landed cargoes of iron ore from Bilbao, the total quantity being 6415 tons.

The makers of malleable iron and steel are very busy, and so are engineers and the larger founders, particularly those engaged in the manufacture of marine engines and fittings. But some of the larger pipe-founders complain that they are becoming short of work. The export trade in iron and steel goods is brisk, and the week's shipments from Glasgow embraced £51,034 worth of machinery, £3800 sewing machines, £6700 steel manufactures, and £46,050 iron articles of many descriptions.

In the Lanarkshire coal trade there is still much activity in the shipping and manufacturing departments, the inquiry for coals for export and for fuel at the factories being very great. For these qualities there has been no material change in prices for several weeks. There is a rather improved inquiry in some districts for household coals, but this branch of the trade has yet much room for improvement. Furnace and steam coals are in good request in the Lothians, where the coal trade as a whole is at present represented to be in a favourable state. At Grangemouth the shipping trade is well maintained, the week's shipments there amounting to 6593 tons, the exports at Leith being about 7000 tons. In Fife the trade is likewise active.

The opinion gathers force among the coalmasters that in the present condition of affairs it would be injudicious to comply with the demand of the miners for increased wages. The probability is that the agitation will go on from week to week, until the demand for coals from abroad slackens, and then the men will perceive that it it impossible their request should be granted.

The Townmill Coal Company, of Dunfermline, has struck a seam known as the little splint. It is 3ft. in thickness, and well suited for household consumption.

WALES & ADJOINING COUNTIES.

(*From our own Correspondent.*)

The coal trade is unaltered in character and market rates, and 11s. 6d. is freely obtained for best varieties of steam coal f.o.b. House coal, too, is brisk, and the Monmouthshire valleys—notably Rhymney—presents a very active appearance. There is also good work being done near New Tredegar, where the Powell Duffryn Co., with which Sir George Elliot is connected, is sinking a new pit.

Small steam coal is not in such great requirement, and prices are not so firm.

The preliminary movements by the Barry promoters are progressing. Some are understood to be favourable to an amended and limited project, such as would not be attended with serious objections; but the principals rather support the entire project, and are confident of success. They claim that a gradient will be afforded equal to that of the Taff, a virgin coal tract developed, and a port secured nearer that of the port of discharge.

There is little or no difficulty in the wages market. The colliers are working tranquilly all over the district, quite satisfied with the prospects in store. The little social ferment amongst them has nothing, I imagine, to do with their relations to their employers. They are agitating as to the advisability of employing this doctor or that, or subscribing or not for scholarships at the Welsh University, and expressing their national indignation—as they did at a collier meeting at Merthyr this week—on the strictures of Judge Cox on "Welsh lying." Another meeting will be held on Monday week on the mountains, when Mr. Herbert Gladstone has been invited to attend, with other notabilities. This movement is being got up principally by the colliers of Merthyr and Dowlais.

The sister industry of iron and steel is not so prosperous as I could wish. Buyers are exhibiting great economy in their purchases. At steel works where there is a fair amount of trade being done, such as Rhymney, the chief rail is a 3ft. gauge, which is about half the cost and is much in demand just at present as cheaper and more useful.

Wire works are slack at present; orders few.

Tin bars are quieter than they have been on account of slackness in the tin-plate market. At Dowlais this branch has been entirely suspended, and I question very much if it will be resumed unless one of those occasional spurts took place which do sometimes come to the rescue of tin-plate workers.

I fear the reduction of wages, which will take effect in October, will amount to 10 per cent. Five will not afford the relief sought, but with a reduction of 10 makers may be better able to compete with other districts. At present it is claimed by the Welsh ironmasters that they give higher wages than are elsewhere in vogue, and thus cannot so effectually compete.

The Taff Vale Railway will give a reduction from the 1st of October on coal traffic to the extent of 300th of a penny per ton. This will be a large concession to the leading coalowners of the Rhondda, many of whom pay large totals. I happen to know of one whose little bill annually from the Taff is about £75,000. This will give an outsider some idea of the immense coal trade going on. The mountains are literally being carted away. The Taff Company is also prepared to give a substantial rebate to the large coalowners, and thus is not only holding out the olive branch, but is allowing the coalowners to dip into its exchequer. The sidings now being arranged at Cathays are beginning to figure.

The patent fuel trade at Swansea is satisfactory.

The plant of Plymouth Works is being sold, so a restart is hopeless.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

18th September, 1883.

4445. Revolving Furnaces, T. Cook, St. Helen's.
4446. Cardboard Boxes, A. H. Storey, London.
4447. Couplings, Clutches, and Pulleys, T. Greenwood, Elland.
4448. Cutting Corks, W. H. K. Bradford, London.
4449. Kilns, J. Watt, Banff.
4450. Cooking Ranges, D. Dow, Falkirk.
4451. Boiler Furnaces, S. Schuman, Glasgow.
4452. Excavating Machines, D. Macdonald, Glasgow.
4453. Measuring Electric Currents, &c., R. E. B. Crompton, London, and G. Kapp, Chelmsford.
4454. Wrenches, H. J. Haddan.—(*C. A. Blomquist, T. Buskirk, and A. J. J. Machen, Toledo, U.S.*)
4455. Gas and Petroleum Engines, H. J. Haddan.—(*M. F. Schiltz, Cologne.*)
4456. Rifles, C. D. Durnford, Guernsey.
4457. Application of Moss Peat, F. Wirth.—(*L. Stark, Mainz, Germany.*)
4458. Marking Lawn-tennis Courts, A. J. Boult.—(*D. D. Williamson, New Brunswick.*)
4459. Measuring Off Lengths of Ribbon, &c., W. P. Thompson.—(*Messrs. Desbrières Frères, Paris.*)
4460. Constructing Electric Cables, A. J. Boult.—(*J. B. Hyde, Brooklyn, U.S.*)
4461. Moulds for Making Heel Stiffeners, W. P. Thompson.—(*M. Hynes, W. G. Cruikshank, and B. F. Lamb, Montreal.*)
4462. Advertising, J. Redpath, Sheffield.
4463. Buttons and Studs, H. E. Newton.—(*T. W. F. Smitten, Brooklyn, U.S.*)
4464. Mills, &c., H. E. Newton.—(*International Fibre and Juice Extracting Company, Incorporated, New York, U.S.*)
4465. Fittings for Electric Lighting, J. H. Sheldrake, London.
4466. Letter-boxes and Bags, F. Wirth.—(*T. Maynz and C. O. Weber, Offenbach-on-the-Main.*)
4467. Solutions used in Galvanic Batteries, W. R. Lake.—(*F. H. Peckham, jun., Providence, U.S.*)
4468. Obtaining Benzol and other Hydrocarbons, G. E. Davis, Manchester.
4469. Preventing the Spread of Fire, A. M. Clark.—(*W. H. Dolman, St. Helen's, Columbia, U.S.*)
4470. Valve Gear, F. M. Stevens, New York.

19th September, 1883.

4471. Producing Designs upon Paper, &c., R. Brown, R. W. Barnes, and J. Bell, Liverpool.
4472. India-rubber Tires and Metal Rims, &c., T. Clarke, Manchester.
4473. Insulated Conductors, &c., A. R. Bennett, Glasgow.
4474. Covering of Laths, Springs, &c., H. M. Knight, London.
4475. Floating Anchor or Marine Drag, J. W. Collins, London.
4476. Fog Horn, J. W. Collins, London.
4477. Spanners, H. J. Haddan.—(*H. Port, France.*)
4478. Holders for Pictures, &c., H. J. Haddan.—(*C. Marot, Troyes, France.*)
4479. Detonating Signals, W. P. Thompson.—(*J. F. A. Mumm, Dayton, Kentucky.*)
4480. War Ships, &c., W. J. Clapp, Nantyglo.
4481. Gearing, F. Jenkin, Edinburgh.
4482. India-rubber Pumps, E. Edwards.—(*J. Ruffel, Paris.*)
4483. Railway Chairs, W. R. Lake.—(*C. E. Mark, Flint, Michigan, U.S.*)
4484. Tools used in the Manufacture of Bottles, H. Barrett.—(*J. Lippmann, Berlin.*)
4485. Carriages, E. M. Bon-Oliel, London.
4486. Locomotive Engines, W. R. Lake.—(*K. Weisz, Buda Pesth.*)

20th September, 1883.

4487. Winding Yarn, J. Dyson, Farnworth, and J. H. Stott, Rochdale.
4488. Roller-blind Furniture, W. M. Simons, Nottingham.
4489. Stays and Corsets, W. Rosenthal, London.
4490. Decorative Tiles, S. V. Campen, New York.
4491. Tramways or Railways, R. L. Urquhart, Edinburgh.
4492. Driving Drums and Pulleys, R. Woodhouse and S. Mitchell, Brighouse.
4493. Raising, &c., the Hoods of Carriages, R. W. Palmer and R. Randell, Manchester, and W. Hely, Bath.
4494. Torpedoes, T. Nordenfelt, London.
4495. Rock-boring Machines, E. T. Hughes.—(*W. F. Heshuysen, Amsterdam.*)
4496. Watches, W. Williams, Bury.
4497. Perforated Sheets for Mechanical Musical Instruments, H. J. Haddan.—(*M. Hock, Germany.*)
4498. Liquid and Gas Pumps, H. J. Haddan.—(*F. D. Maltby and D. B. Wilmot, New York.*)
4499. Cocks or Valves, G. Tidcombe, London.
4500. Pencil Cases, O. Bussler, London.
4501. Propelling Vehicles by Electricity, P. R. Allen, London.
4502. Compressing Air, R. P. Bolton, Broxbourne, and J. W. Hartley, Stoke-upon-Trent.
4503. Extinguishing Fires, W. P. Thompson.—(*T. André, Paris.*)
4504. Removing Dirt, Snow, &c., from Rails, G. A. Newton, Liverpool.

21st September, 1883.

4505. Pen and Ink Holders, J. F. Williams, Liverpool.
4506. Caps for Unstopping Aerated Water Bottles, R. A. Benson, Lichfield.
4507. Davits, R. Hudson, J. Grantham, and J. H. Broker, Blyth.
4508. Treating Hides, &c., G. W. von Nawrocki.—(*R. Spitta, sen., Brandenburg, Germany.*)
4509. Stop Valves, J. Tate, Bradford.
4510. Raising Sunken Vessels, &c., A. C. Henderson.—(*F. B. Picot, Nantes, France.*)
4511. Cleaning Ships' Bottoms, T. De Gruchy, Leytonstone.
4512. Working Tram-cars by means of Ropes, C. Hinksman, London.
4513. Suspenders for Hats, &c., J. Porter, Coalville.
4514. Life-saving Apparatus, F. Byrnes, Liverpool.
4515. Anchors, J. Imray.—(*J. A. Lannes, Paris.*)
4516. Crystallised Phosphate of Lime, J. Imray.—(*F. Barbe, Paris.*)
4517. Propelling Machinery by Atmospheric Pressure, S. B. Robertson, London.
4518. Removing Snow from Rails, P. M. Justice.—(*N. Jacobs, Brussels.*)
4519. Cigar Cutters, E. A. Brydges.—(*W. Fischbach, Berlin, Germany.*)
4520. Securing the Bills in Mill-bill Holders, E. B. Pearse, Exeter.
4521. Igniting Electric Candles, W. Gooch, London.
4522. Constructing Roadways, L. Stiebel, London.
4523. Turning Sacks after Stitching, &c., W. R. Lake.—(*S. T. Lockwood, Chicago, U.S.*)
4524. Gloves, J. Williams, Sheffield.
4525. Screwing Apparatus, J. Heap, Ashton-under-Lyne.
4526. Tramway Engines, R. Peacock and H. L. Lange, Gorton.
4527. Furnaces, &c., R. E. Cox, London.

22nd September, 1883.

4528. Wheels of Railway Rolling Stock, J. Holden, Swindon.
4529. Hand Tools for Cutting Paper, &c., J. Jackson, London.
4530. Delivering Sheets of Paper from Rotary Web Printing Machines, G. A. Wilson, Liverpool.
4531. Electric Accumulators, &c., A. C. Henderson.—(*G. Philippart, Paris.*)
4532. Preserving Beer, &c., B. G. Bell, Oxford.
4533. Locks, B. Wesselman, Hamburg.
4534. Pulleys and Wheels, C. L. Watchurst, Lee.
4535. Playing Cards, E. Seedhouse, Netherton.
4536. Fixing Railway Rails, J. Steen, Wolverhampton, and B. P. Walker, Birmingham.
4537. Hot-water Boilers, J. Keith, Edinburgh.
4538. Punching Holes in Metal Plates, J. Mayoh and C. M. Willson, Manchester.
4539. Raising Fallen Horses, M. J. Rowley and W. G. Hobill, London.
4540. Bouquet Holder, F. Wibberley, London.
4541. Plough Heads, J. Searby & I. Howe, Rotherham.
4542. Fastening Cravats, &c., F. Baker, Birmingham.
4543. Softening Water, W. Wyatt, Ellesmere.
4544. Permanent Way, S. W. Smith, near Coventry.
4545. Coffee Roasters, E. A. Brydges.—(*G. H. Pfeifer, Freiberg, Saxony.*)

24th September, 1883.

4546. Cowls for Ventilation, G. F. Harrington, Ryde.
4547. Distilling Tar, &c., F. Lennard, Shoreham.
4548. Securing the Bodies of Trousers, J. Baxter and W. Gould, Bristol.
4549. Stopping Holes in Ships, J. Richardson, North Shields.
4550. Making Illuminating Gas, M. Schwab.—(*J. Overhoff, Dortmund, Prussia.*)
4551. Churning Milk, T. Morgan.—(*A. Lebert, France.*)
4552. Water Meters, A. E. H. Johnson.—(*L. H. Nash, New York, U.S.*)
4553. Envelopes, E. Hely, Dublin.
4554. Safety Catch for Brooches, D. MacGregor, Perth.
4555. Folding Boxes, A. Wells and F. Fleischmann, Weybridge.
4556. Brush Cleaning and Cutting Machine, W. Walther-Vogel, Aargau, Switzerland.
4557. Touching-up Photographs, &c., E. G. Brewer.—(*J. Geesbergen and La Société Geruzet Frères, Brussels.*)
4558. Fastenings for Bracelets, &c., F. H. F. Engel.—(*E. Hamann, Hamburg.*)
4559. Steam Boilers, F. H. F. Engel.—(*A. Donneley, Hamburg.*)
4560. Breaking Pig Iron, W. R. Lake.—(*T. Blake, U.S.*)
4561. Manufacturing Knitted Fabrics, W. R. Lake.—(*L. E. Salisbury, Providence, U.S.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

4431. Producing Ice Flower-like Figures on Glass, C. Pieper, Berlin.—A communication from Dunkel und Compagnie, Herzogenrath, near Aachen, Germany.—*17th September*, 1883.
4454. Wrenches, H. J. Haddan, Kensington, London.—A communication from C. A. Blomquist, T. Buskirk, and J. J. Machen, Toledo, Lucas, Ohio, U.S.—*18th September*, 1883.
4455. Gas and Petroleum Engines, H. J. Haddan, Kensington, London.—A communication from M. V. Schiltz, Cologne, Germany.—*18th September*, 1883.
4510. Raising Sunken Vessels, A. C. Henderson, Bloomsbury, London.—A communication from F. B. Picot, Nantes, Lower Loire, France.—*21st September*, 1883.
4519. Cigar Cutters, E. A. Brydges, Berlin.—A communication from W. Fischbach, Berlin.—*21st September*, 1883.

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

3778. Permanent Way, J. Holden, Nelson.—*17th September*, 1880.
3783. Paper-cutting Machines, J. Salmon and J. Capper, Manchester.—*18th September*, 1880.
3812. Breaking Up Blast Furnace Slag, J. A. Birkbeck, Middlesbrough.—*20th September*, 1880.
3848. Sewing Machines, H. Mills, Birmingham.—*22nd September*, 1880.
3827. Iron and Steel, P. S. Justice, London.—*21st September*, 1880.
4290. Casting Copper Articles, &c., P. M. Parsons, Blackheath.—*21st October*, 1880.
3822. Iron and Steel, W. J. Clapp, Nantyglo.—*21st September*, 1880.
3877. Steam Brake Valves, J. Dewrance, London, and B. Malcolm, Belfast.—*24th September*, 1880.
3809. Dividing Electric Currents, J. B. Rogers, London.—*20th September*, 1880.
3829. Oil Lamps, W. P. Thompson, London.—*22nd September*, 1880.
3834. Quarrying Stone, J. Williams, Liverpool.—*22nd September*, 1880.
3891. Treating Sugar, A. Scott, jun., J. D. Scott, and T. R. Ogilvie, Greenock.—*25th September*, 1880.
3895. Carriage Axles and Bushes, J. Dakers, Aberdeen.—*25th September*, 1880.
3946. Railway Chairs, W. C. Wood, Barnard Castle.—*29th September*, 1880.
3845. Drying Hay, &c., W. A. Gibbs, Sewardstone.—*22nd September*, 1880.
3851. Combined Ploughs and Pulverising Apparatus, P. M. Justice, London.—*23rd September*, 1880.
3856. Steam Boiler and Furnace, J. Henderson, London.—*23rd September*, 1880.
3897. Washing Machines, E. Clements, London.—*25th September*, 1880.
3928. Generating, &c., Electricity, W. R. Lake, London.—*28th September*, 1880.
3951. Cog Wheels, &c., A. B. Childs, London.—*29th September*, 1880.
3832. Dynamo-electric Machines, W. Elmore, London.—*22nd September*, 1880.
3855. Cotton Cloths, J. Winter and T. Ivers, Farnworth.—*23rd September*, 1880.
3860. Traction Engines, J. Whittingham, Nantwich.—*23rd September*, 1880.
3868. Reeling and Testing Paper, P. Lowe, Darwen.—*24th September*, 1880.

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

3791. Applying Counter Pressure to Engines, J. H. Johnson, London.—*29th September*, 1876.
3781. Button-hole Stitching, T. Rose, London.—*28th September*, 1876.
3713. Refrigerating Liquids, W. Lawrence, London.—*22nd September*, 1876.
3736. Abdominal Supports, A. C. Herts, London.—*25th September*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, 12*th October*, 1883.)

2364. Making Knitted Under-shirts, M. Grieve, Leicester.—*9th May*, 1883.
2440. Reproducing at a Distance the Facsimile of Writing, &c., by Electricity, A. T. Collier, Wadebridge.—*15th May*, 1883.
2449. Ringing Bells, E. Edwards, London.—A communication from R. Latowski.—*15th May*, 1883.
2457. Looms, A. J. Boult, London.—A communication from M. Baltus.—*16th May*, 1883.
2461. Perforating and Printing upon Paper, W. R. Lake, London.—A communication from S. Wheeler.—*16th May*, 1883.
2462. Illuminating Gas, &c., W. R. Lake, London.—A communication from E. J. Frost.—*16th May*, 1883.
2464. Gas Stoves, &c., J. Adams, Glasgow.—*17th May* 1883.
2465. Grills or Gridirons, J. Adams, Glasgow.—*17th May*, 1883.
2468. Wool Washing Apparatus, J. Imray, London.—A communication from La Société Boca-Wulvéryck Frères.—*17th May*, 1883.
2478. Stays or Corsets, F. H. F. Engel, Hamburg.—A communication from E. Lerch, G. Lerch, and J. Meyer.—*17th May*, 1883.
2483. Utilising Liquid Fuel, H. H. Lake, London.—A com. from T. Urquhart.—*17th May*, 1883.
2490. Looms for Weaving, W. Tristram and W. Westhead, Bolton.—*18th May*, 1883.
2497. Covers for Protecting the Bindings of Books, S. S. Tuckerman, Kinver.—*18th May*, 1883.
2498. Non-conducting Coverings, A. J. Boult, London.—A com. from G. Kelly.—*18th May*, 1883.
2516. Carriage Door Lock, J. Holden, Swindon.—*19th May*, 1883.
2527. Amalgamation of Gold, &c., from their Ores, E. D. Chester, Surbiton.—*21st May*, 1883.
2566. Sulphate of Lime, J. H. Johnson, London.—A communication from P. G. Journet.—*22nd May*, 1883.
2567. Preserving Food, J. H. Johnson, London.—A com. from Messrs. Liautand and Co.—*22nd May*, 1883.
2568. Extracting Paraffine from Mineral Oils, J. Siddeley, Liverpool.—*23rd May*, 1883.
2578. Cleaning the Flues of Boilers, R. Sutcliffe, Idle.—*23rd May*, 1883.
2626. Moulding, &c., Clay Ware, W. Crawford, Glasgow, and P. Graham, Stockton-on-Tees.—*26th May*, 1883.
2631. Reverberatory Smelting Furnaces, H. J. Haddan, London.—A communication from R. P. Wilson.—*26th May*, 1883.
2642. Bill Files, &c., C. H. Brampton, Birmingham.—*28th May*, 1883.
2709. Producing Steam Power, S. J. Fear and G. C. Singleton, Bristol.—*31st May*, 1883.
2761. Combing Machines, E. de Pass, London.—A communication from J. Imbs.—*4th June*, 1883.
2820. Treatment of Beet Sugar, W. L. Wise, London.—A com. from G. A. Hagemann.—*6th June*, 1883.
2877. Ties or Buckles for Binding Cotton, &c., E. Ascherson, London.—A communication from W. M. Freeman.—*9th June*, 1883.
3137. Steam Boilers, G. C. and J. H. Fraser, Bromley-by-Bow.—*25th June*, 1883.
3202. Carriage Brake Apparatus, W. Corteen, Sheffield.—*27th June*, 1883.
3346. Holders for Knife Blades, &c., J. H. Johnson, London.—A communication from J. Reckendorfer.—*5th July*, 1883.
3360. Working Railway Points, &c., S. Pitt, Sutton.—A communication from J. Prince.—*6th July*, 1883.
3363. Coffee Pots, E. Boyes, London.—*6th July*, 1883.
3613. Cultivating Land, R. Hitchcock, Taunton.—*23rd July*, 1883.
3793. Manufacture of Cream, W. Horner, Cuddington.—*3rd August*, 1883.
3870. Paving Blocks from Furnace Slag, C. J. Dobbs, Middlesbrough.—*9th August*, 1883.
3922. Hydrochloric Acid, L. Mond, near Northwich.—*13th August*, 1883.
3923. Obtaining Ammonia, &c., from Coal, L. Mond, Northwich.—*13th August*, 1883.
3960. Chlorate of Potash, E. K. Muspratt, Liverpool, and G. Eschellmann, Widnes.—*15th August*, 1883.
4006. Looms, T. Crabtree, Shipley.—*17th August*, 1883.
4010. Trimming Grain from Elevators, I. A. Mack, Liverpool.—*18th August*, 1883.
4304. Lubricating the Cylinders of Air Engines, W. R. Lake, London.—A communication from F. J. Weiss.—*7th September*, 1883.
4382. Carrying, &c., Wire, H. J. Haddan, London.—A com. from L. P. Johnson.—*13th September*, 1883.

(*Last day for filing opposition*, 16*th October*, 1883.)

2517. Gas Engines, W. B. Haigh and J. Nuttall, Oldham.—*21st May*, 1883.
2528. Holders for Incandescent Electric Lamps, A. Swan, Gateshead.—*21st May*, 1883.
2537. Preventing Animals Falling, W. G. Kite, Romford.—*22nd May*, 1883.
2540. Negro Pots, &c., J. Millington, Wolverhampton.—*22nd May*, 1883.
2555. Holding Hats, A. Pyke, London.—*22nd May*, 1883.
2559. Feeding Bottles for Babies, A. Horne and J. Mancor, Liverpool.—*22nd May*, 1883.
2583. Merchant Rar Rolling Mills, G. G. M. Hardingham, London.—A communication from J. J. Roberts.—*23rd May*, 1883.
2584. Steam Engines, A. M. Clark, London.—A communication from W. F. Goodwin.—*23rd May*, 1883.
2587. Sofa Bedsteads, C. A. Barber, London.—A com. from R. W. Taylor and G. S. Barber.—*24th May*, 1883.
2592. Telephonic Apparatus, G. E. Gouraud, London.—*24th May*, 1883.
2597. Embroidering Machines, W. E. Gedge, London.—A com. from E. Cornely.—*24th May*, 1883.
2613. Traps for Flushing, &c., Drains, F. Newman, Ryde.—*25th May*, 1883.
2614. Torpedo Boats, W. R. Lake, London.—A communication from W. S. Sims.—*25th May*, 1883.
2623. Air Gas for Illuminating, &c., G. Macaulay-Cruikshank, Glasgow.—A communication from R. C. Dixon.—*26th May*, 1883.
2633. Propellers, N. D. Spartali, Liverpool.—*26th May*, 1883.
2641. Cleansing, &c., Cotton, J. Imray, London.—A communication from H. Koechlin.—*18th May*, 1883.
2657. Elastic Waterproof Compounds, W. Burnham, Chicago, U.S.—*29th May*, 1883.
2677. Changing, &c., Photographers' Backgrounds, A. M. Clark, London.—A communication from W. E. Lindop.—*30th May*, 1883.
2699. Coke Ovens, F. Wirth, Frankfort-on-the-Maine.—A com. from F. Brunck.—*30th May*, 1883.
2704. Trousers, &c., J. H. Clibran, Altrincham.—*31st May*, 1883.
2787. Marine Steam Engines, J. G. Kincaid, Greenock.—*5th June*, 1883.
2867. Quartz Crusher, &c., H. Sutherland, London.—*8th June*, 1883.
2875. Baby Jumpers, A. M. Clark, London.—A com. from R. M. Raymond and D. Barton.—*8th June*, 1883.
2908. Regulating the Feed in Roller Mills, T. Inglis and C. Herbert, London.—*12th June*, 1883.
3026. Carbon Plates, R. Applegarth, London.—*19th June*, 1883.
3399. Fastenings for Doors, F. Newman, Ryde.—*10th July*, 1883.
3463. Bakers' Ovens, R. A. Gilson and W. J. Booer, London.—*13th July*, 1883.
3658. Treatment of Fats, J. Imray, London.—A com. from I. A. F. Bang and J. de Castro.—*26th July*, 1883.
3683. Life Rafts, A. H. Williams, London.—*27th July*, 1883.
3728. Doors of Gas Retorts, J. Bartle, London.—*30th July*, 1883.
3842. Circuit Closers, H. W. Ferris, Merton.—*7th August*, 1883.
3988. Holders for Paper in the Roll, H. J. Fitch, London.—*17th August*, 1883.
3999. Concentrating Sugar-cane Juice, G. Davies, Manchester.—A communication from H. Y. y Lazarte and E. P. Larée.—*17th August*, 1883.
4001. Treating Solutions containing Ammonia, A. McDougall, Penrith.—*17th August*, 1883.
4005. Promoting the Surface Combustion of Fuel in Boiler Furnaces, A. M. Clark, London.—A communication from B. Sloper.—*17th August*, 1883.
4014. Shipping, &c., Grain, R. A. Sacré, West Kirby.—*18th August*, 1883.
4063. Lacing Hook for Boots, &c., H. H. Lake, London.—A com. from E. H. Train.—*22nd August*, 1883.
4113. Forming a Ground in the Meshes of Net, &c., Fabrics, C. J. Cox, Nottingham.—*25th August*, 1883.
4118. Improved Brake, H. Pilkington, Bury.—*25th August*, 1883.
4139. Treatment of Iron and Steel, W. Arthur, Cowes.—A communication from J. P. Gill.—*28th August*, 1883.

Coltness, 57s. 6d. and 52s.; Langloan, 58s. and 52s.; Summerlee, 56s. 6d. and 50s. 6d.; Chapelhall, 55s. and 52s.; Calder, 57s. and 49s.; Carnbroe, 54s. 6d. and 48s. 3d.; Clyde, 49s. 6d. and 47s. 9d.; Monkland, 47s. 3d. and 45s. 3d.; Quarter, 47s. and 44s. 9d.; Govan, at Broomielaw, 47s. 3d. and 45s. 6d.; Shotts at Leith, 58s. and 53s. 6d.; Carron, at Grangemouth, 48s. 6d. (specially selected, 54s. 6d.) and 47s.; Kinneil, at Bo'ness, 48s. and 47s.; Glengarnock, at Ardrossan, 54s. 3d. and 47s. 3d.; Eglinton, 48s. and 45s.; Dalmellington, 48s. 6d. and 47s. 6d.

The mineral import trade at Glasgow has become more important than of late. In the course of the past week six steamers landed cargoes of iron ore from Bilbao, the total quantity being 6415 tons.

The makers of malleable iron and steel are very busy, and so are engineers and the larger founders, particularly those engaged in the manufacture of marine engines and fittings. But some of the larger pipe-founders complain that they are becoming short of work. The export trade in iron and steel goods is brisk, and the week's shipments from Glasgow embraced £51,034 worth of machinery, £3800 sewing machines, £6700 steel manufactures, and £46,050 iron articles of many descriptions.

In the Lanarkshire coal trade there is still much activity in the shipping and manufacturing departments, the inquiry for coals for export and for fuel at the factories being very great. For these qualities there has been no material change in prices for several weeks. There is a rather improved inquiry in some districts for household coals, but this branch of the trade has yet much room for improvement. Furnace and steam coals are in good request in the Lothians, where the coal trade as a whole is at present represented to be in a favourable state. At Grangemouth the shipping trade is well maintained, the week's shipments there amounting to 6593 tons, the exports at Leith being about 7000 tons. In Fife the trade is likewise active.

The opinion gathers force among the coalmasters that in the present condition of affairs it would be injudicious to comply with the demand of the miners for increased wages. The probability is that the agitation will go on from week to week, until the demand for coals from abroad slackens, and then the men will perceive that it it impossible their request should be granted.

The Townmill Coal Company, of Dunfermline, has struck a seam known as the little splint. It is 3ft. in thickness, and well suited for household consumption.

WALES & ADJOINING COUNTIES.

(*From our own Correspondent.*)

THE coal trade is unaltered in character and market rates, and 11s. 6d. is freely obtained for best varieties of steam coal f.o.b. House coal, too, is brisk, and the Monmouthshire valleys—notably Rhymney—presents a very active appearance. There is also good work being done near New Tredegar, where the Powell Duffryn Co., with which Sir George Elliot is connected, is sinking a new pit.

Small steam coal is not in such great requirement, and prices are not so firm.

The preliminary movements by the Barry promoters are progressing. Some are understood to be favourable to an amended and limited project, such as would not be attended with serious objections; but the principals rather support the entire project, and are confident of success. They claim that a gradient will be afforded equal to that of the Taff, a virgin coal tract developed, and a port secured nearer that of the port of discharge.

There is little or no difficulty in the wages market. The colliers are working tranquilly all over the district, quite satisfied with the prospects in store. The little social ferment amongst them has nothing, I imagine, to do with their relations to their employers. They are agitating as to the advisability of employing this doctor or that, or subscribing or not for scholarships at the Welsh University, and expressing their national indignation—as they did at a collier meeting at Merthyr this week—on the strictures of Judge Cox on "Welsh lying." Another meeting will be held on Monday week on the mountains, when Mr. Herbert Gladstone has been invited to attend, with other notabilities. This movement is being got up principally by the colliers of Merthyr and Dowlais.

The sister industry of iron and steel is not so prosperous as I could wish. Buyers are exhibiting great economy in their purchases. At steel works where there is a fair amount of trade being done, such as Rhymney, the chief rail is a 3ft. gauge, which is about half the cost and is much in demand just at present as cheaper and more useful.

Wire works are slack at present; orders few.

Tin bars are quieter than they have been on account of slackness in the tin-plate market. At Dowlais this branch has been entirely suspended, and I question very much if it will be resumed unless one of those occasional spurts took place which do sometimes come to the rescue of tinplate workers.

I fear the reduction of wages, which will take effect in October, will amount to 10 per cent. Five will not afford the relief sought, but with a reduction of 10 makers may be better able to compete with other districts. At present it is claimed by the Welsh ironmasters that they give higher wages than are elsewhere in vogue, and thus cannot so effectually compete.

The Taff Vale Railway will give a reduction from the 1st of October on coal traffic to the extent of 300th of a penny per ton. This will be a large concession to the leading coalowners of the Rhondda, many of whom pay large totals. I happen to know of one whose little bill annually from the Taff is about £75,000. This will give an outsider some idea of the immense coal trade going on. The mountains are literally being carted away. The Taff Company is also prepared to give a substantial rebate to the large coalowners, and thus is not only holding out the olive branch, but is allowing the coalowners to dip into its exchequer. The sidings now being arranged at Cathays are beginning to figure.

The patent fuel trade at Swansea is satisfactory.

The plant of Plymouth Works is being sold, so a restart is hopeless.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

18th September, 1883.

4445. REVOLVING FURNACES, T. Cook, St. Helen's.
4446. CARDBOARD BOXES, A. H. Storey, London.
4447. COUPLINGS, CLUTCHES, and PULLEYS, T. Greenwood, Elland.
4448. CUTTING CORKS, W. H. K. Bradford, London.
4449. KILNS, J. Watt, Banff.
4450. COOKING RANGES, D. Dow, Falkirk.
4451. BOILER FURNACES, S. Schuman, Glasgow.
4452. EXCAVATING MACHINES, D. Macdonald, Glasgow.
4453. MEASURING ELECTRIC CURRENTS, &c., R. E. B. Crompton, London, and G. Kapp, Chelmsford.
4454. WRENCHES, H. J. Haddan.—(*C. A. Blomquist, T. Buskirk, and A. J. J. Machen, Toledo, U.S.*)
4455. GAS and PETROLEUM ENGINES, H. J. Haddan.—(*M. V. Schiltz, Cologne.*)
4456. RIFLES, C. D. Durnford, Guernsey.
4457. APPLICATION of MOSS PEAT, F. Wirth.—(*L. Stark, Mainz, Germany.*)
4458. MARKING LAWN-TENNIS COURTS, A. J. Boult.—(*D. D. Williamson, New Brunswick.*)
4459. MEASURING OFF LENGTHS of RIBBON, &c., W. P. Thompson.—(*Messrs. Desbrières Frères, Paris.*)
4460. CONSTRUCTING ELECTRIC CABLES, A. J. Boult.—(*J. B. Hyde, Brooklyn, U.S.*)
4461. MOULDS for MAKING HEEL STIFFENERS, W. P. Thompson.—(*M. Hynes, W. G. Cruikshank, and B. F. Lamb, Montreal.*)
4462. ADVERTISING, J. Redpath, Sheffield.
4463. BUTTONS and STUDS, H. E. Newton.—(*T. W. F. Smitten, Brooklyn, U.S.*)
4464. MILLS, &c., H. E. Newton.—(*International Fibre and Juice Extracting Company, Incorporated, New York, U.S.*)
4465. FITTINGS for ELECTRIC LIGHTING, J. H. Sheldrake, London.
4466. LETTER-BOXES and BAGS, F. Wirth.—(*T. Maynz and C. O. Weber, Offenbach-on-the-Main.*)
4467. SOLUTIONS USED in GALVANIC BATTERIES, W. R. Lake.—(*F. H. Peckham, jun., Providence, U.S.*)
4468. OBTAINING BENZOL and other HYDROCARBONS, G. E. Davis, Manchester.
4469. PREVENTING the SPREAD of FIRE, A. M. Clark.—(*W. H. Dolman, St. Helen's, Columbia, U.S.*)
4470. VALVE GEAR, F. M. Stevens, New York.

19th September, 1883.

4471. PRODUCING DESIGNS upon PAPER, &c., R. Brown, R. W. Barnes, and J. Bell, Liverpool.
4472. INDIA-RUBBER TIRES and METAL RIMS, &c., T. Clarke, Manchester.
4473. INSULATED CONDUCTORS, &c., A. R. Bennett, Glasgow.
4474. COVERING of LATHS, SPRINGS, &c., H. M. Knight, London.
4475. FLOATING ANCHOR or MARINE DRAG, J. W. Collins, London.
4476. FOG HORN, J. W. Collins, London.
4477. SPANNERS, H. J. Haddan.—(*H. Port, France.*)
4478. HOLDERS for PICTURES, &c., H. J. Haddan.—(*C. Marot, Troyes, France.*)
4479. DETONATING SIGNALS, W. P. Thompson.—(*J. F. A. Mumm, Dayton, Kentucky.*)
4480. WAR SHIPS, &c., W. J. Clapp, Nantyglo.
4481. GEARING, F. Jenkin, Edinburgh.
4482. INDIA-RUBBER PUMPS, E. Edwards.—(*J. Ruffel, Paris.*)
4483. RAILWAY CHAIRS, W. R. Lake.—(*C. E. Mark, Flint, Michigan, U.S.*)
4484. TOOLS USED in the MANUFACTURE of BOTTLES, H. Barrett.—(*J. Lippmann, Berlin.*)
4485. CARRIAGES, H. M. Bonfield, London.
4486. LOCOMOTIVE ENGINES, W. R. Lake.—(*K. Weiss, Buda Pesth.*)

20th September, 1883.

4487. WINDING YARN, J. Dyson, Farnworth, and J. H. Stott, Rochdale.
4488. ROLLER-BLIND FURNITURE, W. M. Simons, Nottingham.
4489. STAYS and CORSETS, W. Rosenthal, London.
4490. DECORATIVE TILES, S. V. Campen, New York.
4491. TRAMWAYS or RAILWAYS, R. L. Urquhart, Edinburgh.
4492. DRIVING DRUMS and PULLEYS, R. Woodhouse and S. Mitchell, Brighouse.
4493. RAISING, &c., the HOODS of CARRIAGES, R. W. Palmer and R. Randell, Manchester, and W. Hely, Bath.
4494. TORPEDOES, T. Nordenfelt, London.
4495. ROCK-BORING MACHINES, E. T. Hughes.—(*W. F. Heshuysen, Amsterdam.*)
4496. WATCHES, W. Williams, Bury.
4497. PERFORATED SHEETS for MECHANICAL MUSICAL INSTRUMENTS, H. J. Haddan.—(*M. Hock, Germany.*)
4498. LIQUID and GAS PUMPS, H. J. Haddan.—(*F. D. Maltby and D. B. Wilmot, New York.*)
4499. COCKS or VALVES, G. Tidcombe, London.
4500. PENCIL CASES, O. Bussler, London.
4501. PROPELLING VEHICLES by ELECTRICITY, P. R. Allen, London.
4502. COMPRESSING AIR, R. P. Bolton, Broxbourne, and J. W. Hartley, Stoke-upon-Trent.
4503. EXTINGUISHING FIRES, W. P. Thompson.—(*T. André, Paris.*)
4504. REMOVING DIRT, SNOW, &c., from RAILS, G. A. Newton, Liverpool.

21st September, 1883.

4505. PEN and INK HOLDERS, J. F. Williams, Liverpool.
4506. CAPS for UNSTOPPING AERATED WATER BOTTLES, R. A. Benson, Lichfield.
4507. DAVITS, R. Hudson, J. Grantham, and J. H. Broker, Blyth.
4508. TREATING HIDES, &c., G. W. von Nawrocki.—(*R. Spitta, sen., Brandenburg, Germany.*)
4509. STOP VALVES, J. Tate, Bradford.
4510. RAISING SUNKEN VESSELS, &c., A. C. Henderson.—(*F. B. Picot, Nantes, France.*)
4511. CLEANING SHIPS' BOTTOMS, T. De Gruchy, Leytonstone.
4512. WORKING TRAM-CARS by MEANS of ROPES, C. Hinksman, London.
4513. SUSPENDERS for HATS, &c., J. Porter, Coalville.
4514. LIFE-SAVING APPARATUS, F. Byrnes, Liverpool.
4515. ANCHORS, J. Imray.—(*J. A. Lannes, Paris.*)
4516. CRYSTALLISED PHOSPHATE of LIME, J. Imray.—(*F. Barbe, Paris.*)
4517. PROPELLING MACHINERY by ATMOSPHERIC PRESSURE, S. B. Robertson, London.
4518. REMOVING SNOW from RAILS, P. M. Justice.—(*N. Jacobs, Brussels.*)
4519. CIGAR CUTTERS, E. A. Brydges.—(*W. Fischbach, Berlin, Germany.*)
4520. SECURING the BILLS in MILL-BILL HOLDERS, E. B. Pearse, Exeter.
4521. IGNITING ELECTRIC CANDLES, W. Gooch, London.
4522. CONSTRUCTING ROADWAYS, L. Stiebel, London.
4523. TURNING SACKS after STITCHING, &c., W. R. Lake.—(*S. T. Lockwood, Chicago, U.S.*)
4524. GLOVES, J. Williams, Sheffield.
4525. SCREWING APPARATUS, J. Heap, Ashton-under-Lyne.
4526. TRAMWAY ENGINES, R. Peacock and H. L. Lange, Gorton.
4527. FURNACES, &c., R. E. Cox, London.

22nd September, 1883.

4528. WHEELS of RAILWAY ROLLING STOCK, J. Holden, Swindon.
4529. HAND TOOLS for CUTTING PAPER, &c., J. Jackson, London.
4530. DELIVERING SHEETS of PAPER from ROTARY WEB PRINTING MACHINES, G. A. Wilson, Liverpool.
4531. ELECTRIC ACCUMULATORS, &c., A. C. Henderson.—(*G. Philippart, Paris.*)
4532. PRESERVING BEER, &c., B. G. Bell, Oxford.
4533. LOCKS, B. Wesselman, Hamburg.
4534. PULLEYS and WHEELS, C. L. Watchurst, Lee.
4535. PLAYING CARDS, E. Seedhouse, Netherton.
4536. FIXING RAILWAY RAILS, J. Steen, Wolverhampton, and B. P. Walker, Birmingham.
4537. HOT-WATER BOILERS, J. Keith, Edinburgh.
4538. PUNCHING HOLES in METAL PLATES, J. Mayoh and C. M. Willson, Manchester.
4539. RAISING FALLEN HORSES, M. J. Rowley and W. G. Hobill, London.
4540. BOUQUET HOLDER, F. Wibberley, London.
4541. PLOUGH HEADS, J. Searby & I. Howe, Rotherham.
4542. FASTENING CRAVATS, &c., F. Baker, Birmingham.
4543. SOFTENING WATER, W. Wyatt, Ellesmere.
4544. PERMANENT WAY, S. W. Smith, near Coventry.
4545. COFFEE ROASTERS, E. A. Brydges.—(*G. H. Pfeifer, Freiberg, Saxony.*)

24th September, 1883.

4546. COWLS for VENTILATION, G. F. Harrington, Ryde.
4547. DISTILLING TAR, &c., F. Lennard, Shoreham.
4548. SECURING the BODIES of TROUSERS, J. Baxter and W. Gould, Bristol.
4549. STOPPING HOLES in SHIPS, J. Richardson, North Shields.
4550. MAKING ILLUMINATING GAS, M. Schwab.—(*J. Overhoff, Dortmund, Prussia.*)
4551. CHURNING MILK, T. Morgan.—(*A. Lebert, France.*)
4552. WATER METERS, A. E. H. Johnson.—(*L. H. Nash, New York, U.S.*)
4553. ENVELOPES, E. Hely, Dublin.
4554. SAFETY CATCH for BROOCHES, D. MacGregor, Perth.
4555. FOLDING BOXES, A. Wells and F. Fleischmann, Weybridge.
4556. BRUSH CLEANING and CUTTING MACHINE, W. Walther-Vogel, Aargau, Switzerland.
4557. TOUCHING-UP PHOTOGRAPHS, &c., E. G. Brewer.—(*J. Geesbergen and La Société Geruzet Frères, Brussels.*)
4558. FASTENINGS for BRACELETS, &c., F. H. F. Engel.—(*E. Hamann, Hamburg.*)
4559. STEAM BOILERS, F. H. F. Engel.—(*A. Donneley, Hamburg.*)
4560. BREAKING PIG IRON, W. R. Lake.—(*T. Blake, U.S.*)
4561. MANUFACTURING KNITTED FABRICS, W. R. Lake.—(*L. E. Salisbury, Providence, U.S.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

4431. PRODUCING ICE FLOWER-LIKE FIGURES on GLASS, C. Pieper, Berlin.—A communication from Dunkel und Compagnie, Herzogenrath, near Aachen, Germany.—*17th September*, 1883.
4454. WRENCHES, H. J. Haddan, Kensington, London.—A communication from C. A. Blomquist, T. Buskirk, and J. J. Machen, Toledo, Lucas, Ohio, U.S.—*18th September*, 1883.
4455. GAS and PETROLEUM ENGINES, H. J. Haddan, Kensington, London.—A communication from M. V. Schiltz, Cologne, Germany.—*18th September*, 1883.
4510. RAISING SUNKEN VESSELS, A. C. Henderson, Bloomsbury, London.—A communication from F. B. Picot, Nantes, Lower Loire, France.—*21st September*, 1883.
4519. CIGAR CUTTERS, E. A. Brydges, Berlin.—A communication from W. Fischbach, Berlin.—*21st September*, 1883.

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

3778. PERMANENT WAY, J. Holden, Nelson.—*17th September*, 1880.
3783. PAPER-CUTTING MACHINES, J. Salmon and J. Capper, Manchester.—*18th September*, 1880.
3812. BREAKING UP BLAST FURNACE SLAG, J. A. Birkbeck, Middlesbrough.—*20th September*, 1880.
3848. SEWING MACHINES, H. Mills, Birmingham.—*22nd September*, 1880.
3827. IRON and STEEL, P. S. Justice, London.—*21st September*, 1880.
4290. CASTING COPPER ARTICLES, &c., P. M. Parsons, Blackheath.—*21st October*, 1880.
3822. IRON and STEEL, W. J. Clapp, Nantyglo.—*21st September*, 1880.
3877. STEAM BRAKE VALVES, J. Dewrance, London, and B. Malcolm, Belfast.—*24th September*, 1880.
3809. DIVIDING ELECTRIC CURRENTS, J. B. Rogers, London.—*20th September*, 1880.
3829. OIL LAMPS, W. P. Thompson, London.—*22nd September*, 1880.
3834. QUARRYING STONE, J. Williams, Liverpool.—*22nd September*, 1880.
3891. TREATING SUGAR, A. Scott, jun., J. D. Scott, and T. R. Ogilvie, Greenock.—*25th September*, 1880.
3895. CARRIAGE AXLES and BUSHES, J. Dakers, Aberdeen.—*25th September*, 1880.
3946. RAILWAY CHAIRS, W. C. Wood, Barnard Castle.—*29th September*, 1880.
3845. DRYING HAY, &c., W. A. Gibbs, Sewardstone.—*22nd September*, 1880.
3851. COMBINED PLOUGHS and PULVERISING APPARATUS, P. M. Justice, London.—*23rd September*, 1880.
3856. STEAM BOILER and FURNACE, J. Henderson, London.—*23rd September*, 1880.
3897. WASHING MACHINES, E. Clements, London.—*25th September*, 1880.
3928. GENERATING, &c., ELECTRICITY, W. R. Lake, London.—*28th September*, 1880.
3951. COG WHEELS, &c., A. B. Childs, London.—*29th September*, 1880.
3832. DYNAMO-ELECTRIC MACHINES, W. Elmore, London.—*22nd September*, 1880.
3855. COTTON CLOTHS, J. Winter and T. Ivers, Farnworth.—*23rd September*, 1880.
3860. TRACTION ENGINES, J. Whittingham, Nantwich.—*23rd September*, 1880.
3868. REELING and TESTING PAPER, P. Lowe, Darwen.—*24th September*, 1880.

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

3791. APPLYING COUNTER PRESSURE to ENGINES, J. H. Johnson, London.—*29th September*, 1876.
3781. BUTTON-HOLE STITCHING, T. Rose, London.—*28th September*, 1876.
3713. REFRIGERATING LIQUIDS, W. Lawrence, London.—*22nd September*, 1876.
3736. ABDOMINAL SUPPORTS, A. C. Herts, London.—*25th September*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, 12*th October*, 1883.)

2364. MAKING KNITTED UNDER-SHIRTS, M. Grieve, Leicester.—*9th May*, 1883.
2440. REPRODUCING at a DISTANCE the FACSIMILE of WRITING, &c., by ELECTRICITY, A. T. Collier, Wadebridge.—*15th May*, 1883.
2449. RINGING BELLS, E. Edwards, London.—A communication from R. Latowski.—*15th May*, 1883.
2457. LOOMS, A. J. Boult, London.—A communication from M. Baltus.—*16th May*, 1883.
2461. PERFORATING and PRINTING upon PAPER, W. R. Lake, London.—A communication from S. Wheeler.—*16th May*, 1883.
2462. ILLUMINATING GAS, &c., W. R. Lake, London.—A communication from E. J. Frost.—*16th May*, 1883.
2464. GAS STOVES, &c., J. Adams, Glasgow.—*17th May* 1883.
2465. GRILLS or GRIDIRONS, J. Adams, Glasgow.—*17th May*, 1883.
2468. WOOL WASHING APPARATUS, J. Imray, London.—A communication from La Société Boca-Wulveryck Frères.—*17th May*, 1883.
2478. STAYS or CORSETS, F. H. F. Engel, Hamburg.—A communication from E. Lerch, G. Lerch, and J. Meyer.—*17th May*, 1883.
2483. UTILISING LIQUID FUEL, H. H. Lake, London.—A com. from T. Urquhart.—*17th May*, 1883.
2490. LOOMS for WEAVING, W. Tristram and W. Westhead, Bolton.—*18th May*, 1883.
2497. COVERS for PROTECTING the BINDINGS of BOOKS, S. S. Tuckerman, Kinver.—*18th May*, 1883.
2498. NON-CONDUCTING COVERINGS, A. J. Boult, London.—A com. from G. Kelly.—*18th May*, 1883.
2516. CARRIAGE DOOR LOCK, J. Holden, Swindon.—*19th May*, 1883.
2527. AMALGAMATION of GOLD, &c., from their ORES, E. D. Chester, Surbiton.—*21st May*, 1883.
2566. SULPHATE of LIME, J. H. Johnson, London.—A communication from P. G. Journet.—*22nd May*, 1883.
2567. PRESERVING FOOD, J. H. Johnson, London.—A com. from Messrs. Liautand and Co.—*22nd May*, 1883.
2568. EXTRACTING PARAFFINE from MINERAL OILS, J. Siddeley, Liverpool.—*23rd May*, 1883.
2578. CLEANING the FLUES of BOILERS, R. Sutcliffe, Idle.—*23rd May*, 1883.
2626. MOULDING, &c., CLAY WARE, W. Crawford, Glasgow, and P. Graham, Stockton-on-Tees.—*26th May*, 1883.
2631. REVERBERATORY SMELTING FURNACES, H. J. Haddan, London.—A communication from R. P. Wilson.—*26th May*, 1883.
2642. BILL FILES, &c., C. H. Brampton, Birmingham.—*28th May*, 1883.
2709. PRODUCING STEAM POWER, S. J. Fear and G. C. Singleton, Bristol.—*31st May*, 1883.
2761. COMBING MACHINES, E. de Pass, London.—A communication from J. Imbs.—*4th June*, 1883.
2820. TREATMENT of BEET SUGAR, W. L. Wise, London.—A com. from G. A. Hagemann.—*6th June*, 1883.
2877. TIES or BUCKLES for BINDING COTTON, &c., E. Ascherson, London.—A communication from W. M. Freeman.—*9th June*, 1883.
3137. STEAM BOILERS, G. C. and J. H. Fraser, Bromley-by-Bow.—*25th June*, 1883.
3202. CARRIAGE BRAKE APPARATUS, W. Corteen, Sheffield.—*27th June*, 1883.
3346. HOLDERS for KNIFE BLADES, &c., J. H. Johnson, London.—A communication from J. Reckendorfer.—*5th July*, 1883.
3360. WORKING RAILWAY POINTS, &c., S. Pitt, Sutton.—A communication from J. Prince.—*6th July*, 1883.
3363. COFFEE POTS, E. Boyes, London.—*6th July*, 1883.
3613. CULTIVATING LAND, R. Hitchcock, Taunton.—*23rd July*, 1883.
3793. MANUFACTURE of CREAM, W. Horner, Cuddington.—*3rd August*, 1883.
3870. PAVING BLOCKS from FURNACE SLAG, C. J. Dobbs, Middlesbrough.—*9th August*, 1883.
3922. HYDROCHLORIC ACID, L. Mond, near Northwich.—*13th August*, 1883.
3923. OBTAINING AMMONIA, &c., from COAL, L. Mond, Northwich.—*13th August*, 1883.
3960. CHLORATE of POTASH, E. K. Muspratt, Liverpool, and G. Eschellmann, Widnes.—*15th August*, 1883.
4006. LOOMS, T. Crabtree, Shipley.—*17th August*, 1883.
4010. TRIMMING GRAIN from ELEVATORS, I. A. Mack, Liverpool.—*18th August*, 1883.
4304. LUBRICATING the CYLINDERS of AIR ENGINES, W. R. Lake, London.—A communication from F. J. Weiss.—*7th September*, 1883.
4382. CARRYING, &c., WIRE, H. J. Haddan, London.—A com. from L. P. Johnson.—*13th September*, 1883.

(*Last day for filing opposition*, 16*th October*, 1883.)

2517. GAS ENGINES, W. B. Haigh and J. Nuttall, Oldham.—*21st May*, 1883.
2528. HOLDERS for INCANDESCENT ELECTRIC LAMPS, A. Swan, Gateshead.—*21st May*, 1883.
2537. PREVENTING ANIMALS FALLING, W. G. Kite, Romford.—*22nd May*, 1883.
2540. NEGRO POTS, &c., J. Millington, Wolverhampton.—*22nd May*, 1883.
2555. HOLDING HATS, A. Pyke, London.—*22nd May*, 1883.
2559. FEEDING BOTTLES for BABIES, A. Horne and J. Mancor, Liverpool.—*22nd May*, 1883.
2583. MERCHANT RAR ROLLING MILLS, G. G. M. Hardingham, London.—A communication from J. J. Roberts.—*23rd May*, 1883.
2584. STEAM ENGINES, A. M. Clark, London.—A communication from W. F. Goodwin.—*23rd May*, 1883.
2587. SOFA BEDSTEADS, C. A. Barber, London.—A com. from R. W. Taylor and G. S. Barber.—*24th May*, 1883.
2592. TELEPHONIC APPARATUS, G. E. Gouraud, London.—*24th May*, 1883.
2597. EMBROIDERING MACHINES, W. E. Gedge, London.—A com. from E. Cornely.—*24th May*, 1883.
2613. TRAPS for FLUSHING, &c., DRAINS, F. Newman, Ryde.—*25th May*, 1883.
2614. TORPEDO BOATS, W. R. Lake, London.—A communication from W. S. Sims.—*25th May*, 1883.
2623. AIR GAS for ILLUMINATING, &c., G. Macaulay-Cruikshank, Glasgow.—A communication from R. C. Dixon.—*26th May*, 1883.
2633. PROPELLERS, N. D. Spartali, Liverpool.—*26th May*, 1883.
2641. CLEANSING, &c., COTTON, J. Imray, London.—A communication from H. Koechlin.—*18th May*, 1883.
2657. ELASTIC WATERPROOF COMPOUNDS, W. Burnham, Chicago, U.S.—*29th May*, 1883.
2677. CHANGING, &c., PHOTOGRAPHERS' BACKGROUNDS, A. M. Clark, London.—A communication from W. E. Lindop.—*30th May*, 1883.
2699. COKE OVENS, F. Wirth, Frankfort-on-the-Maine.—A com. from F. Brunck.—*30th May*, 1883.
2704. TROUSERS, &c., J. H. Clibran, Altrincham.—*31st May*, 1883.
2787. MARINE STEAM ENGINES, J. G. Kincaid, Greenock.—*5th June*, 1883.
2867. QUARTZ CRUSHER, &c., H. Sutherland, London.—*8th June*, 1883.
2875. BABY JUMPERS, A. M. Clark, London.—A com. from R. M. Raymond and D. Barton.—*8th June*, 1883.
2908. REGULATING the FEED in ROLLER MILLS, T. Inglis and C. Herbert, London.—*12th June*, 1883.
3026. CARBON PLATES, R. Applegarth, London.—*19th June*, 1883.
3399. FASTENINGS for DOORS, F. Newman, Ryde.—*10th July*, 1883.
3463. BAKERS' OVENS, R. A. Gilson and W. J. Booer, London.—*13th July*, 1883.
3658. TREATMENT of FATS, J. Imray, London.—A com. from I. A. F. Bang and J. de Castro.—*26th July*, 1883.
3683. LIFE RAFTS, A. H. Williams, London.—*27th July*, 1883.
3728. DOORS of GAS RETORTS, J. Bartle, London.—*30th July*, 1883.
3842. CIRCUIT CLOSERS, H. W. Ferris, Merton.—*7th August*, 1883.
3988. HOLDERS for PAPER in the ROLL, H. J. Fitch, London.—*17th August*, 1883.
3999. CONCENTRATING SUGAR-CANE JUICE, G. Davies, Manchester.—A communication from H. Y. y Lazarte and E. P. Larée.—*17th August*, 1883.
4001. TREATING SOLUTIONS containing AMMONIA, A. McDougall, Penrith.—*17th August*, 1883.
4005. PROMOTING the SURFACE COMBUSTION of FUEL in BOILER FURNACES, A. M. Clark, London.—A communication from B. Sloper.—*17th August*, 1883.
4014. SHIPPING, &c., GRAIN, R. A. Sacré, West Kirby.—*18th August*, 1883.
4063. LACING HOOK for BOOTS, &c., H. H. Lake, London.—A com. from E. H. Train.—*22nd August*, 1883.
4113. FORMING a GROUND in the MESHES of NET, &c., FABRICS, C. J. Cox, Nottingham.—*25th August*, 1883.
4118. IMPROVED BRAKE, H. Pilkington, Bury.—*25th August*, 1883.
4139. TREATMENT of IRON and STEEL, W. Arthur, Cowes.—A communication from J. P. Gill.—*28th August*, 1883.

4140. Treatment of Iron Ores, W. Arthur, Cowes.—A communication from J. P. Gill.—28th August, 1883.
4160. Solitaires, &c., E. E. Ashing, London.—28th August, 1883.
4431. Producing Ice-flower-like Figures on Glass, C. Pieper, Berlin.—A communication from Dunkel und Compagnie.—17th September, 1883.

Patents Sealed.

(List of Letters Patent which passed the Great Seal on the 21st September, 1883.)

1150. Putting on Boots, &c., A. J. Boult, London.—3rd March, 1883.
1501. Storing Illuminating Gas, R. M. Marchant and T. Wrigley, London.—22nd March, 1883.
1519. Pulverising, &c., Ore, A. J. Struthers, Glasgow.—22nd March, 1883.
1520. Steam Boiler Furnaces, S. Schuman, Glasgow.—22nd March, 1883.
1525. Cartridge Carriers, G. Pitt, Sutton.—22nd March, 1883.
1529. Skates, W. P. Thompson, Liverpool.—24th March, 1883.
1531. Jacquard Apparatus, J. Chapman, Nottingham.—24th March, 1883.
1542. Pans for Melting Pitch, J. B. Stewart, Liverpool.—27th March, 1883.
1550. Drawing Apparatus, W. and T. S. Bucknall, Kidderminster.—27th March, 1883.
1568. Saddles for Bicycles, J. B. Brooks, Birmingham.—28th March, 1883.
1606. Spring Scales, C. Pieper, Berlin.—30th March, 1883.
1638. Corking Bottles, J. J. H. Schultz, Hamburg.—31st March, 1883.
1671. Attaching Handles to Cutlery, G. T. Tuke, Sheffield.—3rd April, 1883.
1741. Fly-wheels, &c., W. Hargreaves and R. Harwood, Bolton.—6th April, 1883.
1788. Colouring Matters, P. J. Meyer, Berlin.—9th April, 1883.
1877. Measuring Electric Currents, R. E. B. Crompton, London, and G. Kapp, Chelmsford.—13th April, 1883.
1883. Explosive Compounds, F. W. Gilles, Germany.—13th April, 1883.
1978. Printing Fabrics, W. Mather, Manchester.—19th April, 1883.
2042. Magneto-electric Machines, G. Hookham, Birmingham.—21st April, 1883.
2224. Hammerless Guns, J. Darby, Birmingham.—2nd May, 1883.
2395. Contact Boxes on Electric Railways, W. E. Ayrton and J. Perry, London.—11th May, 1883.
2515. Carriage Wheel Tires, H. R. Townsend, London.—19th May, 1883.
2973. Barbed Fence Wire, A. M. Clark, London.—15th June, 1883.
3063. Fly-wheel, H. Blank, Berlin.—20th June, 1883.
3304. Spinning, &c., Fibrous Materials, J. Farran, Manchester.—4th July, 1883.
3310. Cutting by means of Circular Saws, A. W. McMurdo, Scotby.—4th July, 1883.
3655. Looms for Weaving, R. H. Brandon, Paris.—25th July, 1883.

(List of Letters Patent which passed the Great Seal on the 25th September, 1883.)

1383. Controlling, &c., Clocks, H J. Haddan, London.—15th March, 1883.
1386. Securely Holding Braces to Trousers, N. P. Davison, London.—15th March, 1883.
1541. Electric Batteries, H. H. Lake, London.—26th March, 1883.
1569. Composition for Incrusting Metal, A. Bailiff, Paris.—28th March, 1883.
1575. Electro-magnetic Printing Telegraph Apparatus, W. P. Thompson, Liverpool.—28th March, 1883.
1576. Electro-magnetic Printing Telegraphs, W. P. Thompson, Liverpool.—28th March, 1883.
1577. Manufacture of Alumina, W. P. Thompson, Liverpool.—28th March, 1883.
1582. Cards for Sewing Silk, &c., J. H. Johnson, London.—29th March, 1883.
1583. Double-ribbed Warp Looms, J. D. Harris and A. Shuttlewood, Leicester.—29th March, 1883.
1584. Distilling, &c., Glycerine, F. J. O'Farrell, Dublin.—29th March, 1883.
1587. Coupling, &c., Railway Carriages, J. T. Leighton, Edinburgh.—29th March, 1883.
1592. Stoves, L. C. Besant, Greenock.—29th March, 1883.
1597. Wire Fencing, W. J. Smith, Inverness.—29th March, 1883.
1609. Fire Alarms, I. Thomas, Aberdare.—30th March, 1883.
1619. Puddling Furnaces, J. Imray, London.—31st March, 1883.
1630. Ground Colour or Priming, F. Wirth, Frankfort-on-the-Maine.—31st March, 1883
1631. Traction Engines, W. Wilkinson, Wigan.—31st March, 1883.
1648. Laces for Machine Belts, R. Paton, Johnstone.—2nd April, 1883.
1709. Manufacture of Racquets, G. A. Adkins, London.—5th April, 1883.
1726. Making Jewellery of Wood, &c., W. R. Lake, London.—5th April, 1883.
1731. Rapidly Heating Water, W. H. Williams, Birmingham.—6th April, 1883.
1736. Dynamo-electric Machines, M. Deprez, Paris.—6th April, 1883.
1737. Transforming Electric Currents, M. Deprez, Paris.—6th April, 1883.
1769. Cut Pile Fabrics, J. H. Johnson, London.—7th April, 1883.
1789. Galvanic Batteries, G. B. de Overbeck, London.—9th April, 1883.
1807. Compressing, &c., Ensilage, T. Potter, Alresford.—10th April, 1883.
1811. Adjusting the Shafts of Wheel Carriages, C. Healey, Gloucester.—10th April, 1883.
1852. Shag or Pile Fabrics, H. J. Haddan, London.—12th April, 1883.
1866. Treatment of Flax, &c., W. R. Lake, London.—12th April, 1883.
1890. Sewing the Soles of Boots, &c., W. R. Lake, London.—13th April, 1883.
1903. Breech-loading Fire-arms, E. Harrison and F. Beesley, London.—14th April, 1883.
1953. Manufacture of Bread, J. H. Johnson, London.—17th April, 1883.
1961. Slide Valves, J. F. Johnstone, Belvedere.—18th April, 1883.
1967. Galvanising Sheet Iron, J. Tinn, Bristol.—18th April, 1883.
1974. Decorticating Flax, &c., W. R. Lake, London.—18th April, 1883.
2000. Colouring Kerosine, A. M. Clark, London.—19th April, 1883.
2010. Cutting, &c., Fodder, J. H. Johnson, London.—20th April, 1883.
2039. Fish-plates, G. Robson, Newcastle-upon-Tyne.—21st April, 1883.
2862. Making Refined Cast Steel, T. Sheeham, London.—8th June, 1883.
3058. Preserving Milk, &c., W. H. Thew, Waterloo.—20th June, 1883.
3094. Friction Gearing, W. E. Ayrton and J. Perry, London.—21st June, 1883.
3154. Cooking Ranges, J. McI. Shaw, Glasgow.—26th June, 1883.
3188. Piled Fabrics, D. Marcon, Paris.—27th June, 1883.
3189. Metallic Tubes, R. Heeley, Shirley.—27th June, 1883.
3263. Stiffening Fustians, &c., J. Sellars, Manchester.—2nd July, 1883.
3280. Gas Engines, W. Foulis, Glasgow.—3rd July, 1883.
3350. Treatment of Tin and Lead Dross, T. Lloyd, Aberdylais.—6th July, 1883.
3400. Oiling, &c., Hemp, A. V. Newton, London.—10th July, 1883.
3455. Tin and other Metal Cases, J. Maconochie, Lowestoft.—13th July, 1883.
3462. Cylinders for Picking, &c., Machines, W. R. Lake, London.—13th July, 1883.
3489. Shears for Cutting Metal, J. Seligman, London.—16th July, 1883.
3690. Alcohols, H. A. Bonneville, London.—28th July, 1883.
3723. Burners, J. S. Muir, London.—31st July, 1883.

List of Specifications published during the week ending September 22nd, 1883.

5104*, 4d ; 4440, 4d.; 5583, 2d.; 5623, 2d.; 5715, 2d.; 5811, 2d.; 5871, 2d.; 5975, 2d.; 6153, 2d.; 6165, 2d.; 6173, 2d.; 197, 6d.; 230, 4d.; 258, 4d.; 341, 10d.; 350, 6d.; 353, 8d.; 361, 6d.; 368, 8d.; 377, 4d.; 393, 4d.; 416, 6d.; 418, 2d.; 420, 4d.; 422, 2d.; 427, 4d.; 433, 6d.; 439, 6d.; 440, 6d.; 441, 4d.; 442, 6d.; 443, 6d.; 444, 2d.; 446, 2d.; 447, 6d.; 451, 2d.; 452, 2d.; 453, 2d.; 454, 10d.; 456, 6d.; 457, 2d.; 462, 8d.; 464, 6d.; 465, 2d.; 466, 2d.; 467, 2d.; 468, 2d.; 469, 6d.; 471, 6d.; 472, 2d.; 473, 4d.; 474, 2d.; 475, 2d.; 476, 4d.; 477, 2d.; 478, 8d.; 479, 6d.; 480, 2d.; 481, 8d.; 482, 2d.; 483, 2d.; 484, 10d.; 485, 2d.; 486, 2d.; 488, 6d.; 489, 2d.; 492, 2d.; 494, 6d.; 495, 4d.; 496, 6d.; 499, 8d.; 500, 2d.; 501, 2d.; 502, 6d.; 503, 6d.; 504, 2d.; 505, 6d.; 506, 8d.; 507, 2d.; 508, 6d.; 509, 4d.; 511, 6d.; 512, 4d.; 513, 2d.; 514, 2d.; 515, 6d.; 517, 2d.; 518, 4d.; 520, 2d.; 520, 6d.; 522, 6d.; 523, 8d.; 525, 6d.; 526, 2d.; 527, 6d.; 530, 6d.; 531, 4d.; 532, 4d.; 533, 8d.; 534, 6d.; 538, 6d.; 539, 6d.; 541, 2d.; 542, 6d.; 543, 6d.; 547, 6d.; 548, 2d.; 549, 6d.; 550, 6d.; 551, 4d.; 554, 6d.; 555, 4d.; 556, 6d.; 558, 6d.; 559, 6d.; 562, 2d.; 563, 6d.; 568, 2d.; 570, 2d.; 571, 2d.; 573, 2d.; 574, 6d.; 576, 6d.; 577, 6d.; 579, 4d.; 581, 6d.; 582, 6d.; 583, 2d.; 584, 6d.; 585, 6d.; 587, 4d.; 588, 6d.; 589, 6d.; 590, 6d.; 591, 6d.; 592, 6d.; 595, 6d.; 596, 6d.; 598, 4d.; 599, 6d.; 601, 6d.; 602, 6d.; 604, 6d.; 607, 6d.; 610, 6d.; 612, 6d.; 614, 6d.; 627, 6d.; 638, 6d.; 639, 6d.; 647, 6d.; 653, 6d.; 660, 4d.; 666, 4d.; 677, 6d.; 679, 4d.; 683, 6d.; 688, 6d.; 711, 6d.; 725, 6d.; 729, 6d.; 732, 2d.; 777, 8d.; 799, 6d.; 800, 6d.; 801, 6d.; 827, 2d.; 893, 8d.; 896, 4d.; 922, 6d.; 1046, 6d.; 2616, 4d.; 2781, 6d.; 2789, 6d.

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

ABSTRACTS OF SPECIFICATIONS.

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

4440. Removing both Iron and Manganese from Certain Solutions, *C. Semper, Philadelphia.—19th September*, 1882. 4*d*.
This consists in removing both the iron and manganese by a single operation from ferruginous solutions—of such salts as are not decomposed in the operation of the process—containing manganous salts, by treating them with a permanganate and subjecting them to heat.

5583. Measuring Men and Objects, *E. P. Wilford, Bristol.—23rd November*, 1883.—(*Provisional protection not allowed.*) 2*d*.
This relates particularly to devices for measuring army recruits round the chest, and consists of a band of metal or wire gauze divided into inches.

5623. Aerial Railway, *E. P. Alexander, London.—27th November*, 1883.—(*A communication from P. M. T. imbaud, Paris.*)—(*Provisional protection not allowed.*) 2*d*.
This consists in the construction of a railway so that the trains travel first down an incline, and the impetus they receive in such descent enables them to ascend an opposite incline.

5715. Manufacture of Magnetic and Ventilating Wearing Apparel for the Prevention or Cure of Disease, *W. R. Lake, London.—30th November*, 1882.—(*A communication from S. A. B. Wilson, Boston, Mass., U.S.*)—(*Provisional protection not allowed.*) 2*d*.
This relates to wearing apparel containing plates of magnetic metal.

5811. Casing and Marking of Casing for Meal used as a Substitute for Milk for Rearing Young Animals, *T. and T. G. Bowick, Bedford.—6th December*, 1882.—(*Provisional protection not allowed.*) 2*d*.
The object is to enable meal which is to be used as a substitute for milk for rearing calves and other young animals to be kept for a longer period, by enclosing it in an inner bag of waterproof paper in an outer bag of jute, on which any suitable design is printed or painted.

5871. Lenses for Lanterns, *R. E. Frank, London.—9th December*, 1882.—(*A communication from L. Micciullo, Italy.*)—(*Provisional protection not allowed.*) 2*d*.
The lens is cast like a disc with a projecting centre, upon which facets are ground or cut. Flutings are arranged in rings round the surface of the disc.

5975. A New Aerated Water containing Bismuth, to be Employed for Medicinal Purposes, *J. Sellers, London.—14th December*, 1882.—(*Provisional protection not allowed.*) 2*d*.
This consists in combining a solution or soluble preparation of bismuth with aerated waters, charged with carbonic acid gas in the usual manner.

6153. Electric and other Lamps, *J. M. Fletcher, London.—23rd December*, 1882.—(*Provisional protection not allowed.*) 2*d*.
An incandescent lamp is immersed in a vessel suitable for holding flowers or fish.

6165. Composition of Flour and other Materials for Food, *W. P. Thompson, London.—26th December*, 1882.—(*A communication from P. Thorpe, New York.*)—(*Provisional protection not allowed.*) 2*d*.
An alkaline bicarbonate, preferably in the anhydrous form of flour, is incorporated with butter or other edible fat, and pressed into bags or casks, so as to exclude air.

6173. Soap for Toilet Purposes, *S. Birley, London.—27th December*, 1882.—(*Provisional protection not allowed.*) 2*d*.
This consists in adding phosphate of iron to ordinary soap.

197. Knit Stockings, *W. P. Thompson, Liverpool.—12th January*, 1883.—(*A communication from F. Lasher and W. H. Bradford, Bennington, U.S.*) 6*d*.
This relates to the formation of the heels of stockings produced by continuous tubular knitting.

230. Composition of Materials for Damp-proof Socks or Soles for Boots and Shoes, &c., *R. J. Baggaley, Nottingham.—15th January*, 1883. 4*d*.
Ground or pulverised cork is mixed with anti-rheumatic oils and boiled linseed oil, and prepared by rolling under great pressure into sheets or lengths, being at the same operation covered on one side with wool or other suitable non-conductor of heat, thus forming a compact material rendering any subsequent stitching or binding operations unnecessary.

258. Strain Governor for Marine and Stationary Steam Engines, &c., *J. Munro, West Croydon.—16th January*, 1883.—(*A communication from G. Keith, Cuba.*)—(*Complete.*) 6*d*.
The inventor claims the mode of governing steam engines or other motors and electric generators by means of the torsional strain on their main shafts through the medium of springs, excentrics, or other connecting mechanism.

341. Machinery and Tools for Dressing, Shaping, Sinking, Turning, and Moulding Stone, &c., *F. Trier, Westminster.—20th January*, 1883. 10*d*.
This relates partly to the methods of applying revolving cutters, whether tubular, conical, or discoidal, to the surface of the stone to be operated upon, so as to remove the inequalities thereof, or that portion of the stone which is superfluous, and to leave a surface plain, circular, moulded, sunk, or otherwise shaped, as may be desired, the said tubular, concoidal, or discoidal cutters in every case rolling when working.

350. Bascules or See-saws, *H. J. T. Piercy, Birmingham.—22nd January*, 1883. 6*d*.
This relates to the general construction and arrangement of the parts.

353. Locks and Latches, &c., *J. M. Hart, London.—22nd January*, 1883. 8*d*.
The object is partly to facilitate the withdrawal of the latch bolt of locks and latches by arranging the parts thereof, so that such withdrawal may be readily effected, not only as now by the partial rotation of the handles in one or the other direction, but also by pressure exerted on either or both handles in any of several directions.

360. Moulding Socketed Pipes, &c., *G. Smith, Leicester.—22nd January*, 1883. 8*d*.
The moulding apparatus may be combined with a pug mill, so that the charging of the moulds will be effected mechanically. In the lower part of the pug mill a conical guide conveys the plastic material to a central opening in a die plate, which closes the bottom of the mill. To the under side of the guide, and projecting through the die plate so as to leave an annular space, is secured a hollow core to form the inside of the socket, and within it is a second core to form the body of the pipe, and which rests on a table caused to rise and fall by cams or cranks. The mould also rests on the table, is formed in parts hinged together, and within it is an annular core to form a socket at the other end of the pipe if desired.

361. Electric Lamps or Lighting Apparatus, *H. H. Lake, London.—22nd January*, 1883.—(*A communication from H. R. Boissier, New York, U.S.*) 6*d*.
This relates to that class of electric lamps in which the upper carbon holder is provided with a toothed rack engaging with a train of gearing carried by a pivotted swinging frame connected with the armatures of two electro-magnets, one of low resistance placed in the main circuit, the other, of high resistance, being in a shunt circuit. The failure of the arc fuses a piece of fusible metal, which permits a lever to make contact and complete a shunt circuit round the carbon.

362. Process and Apparatus for the Production of Metallic Aluminium and Aluminium Alloys, *G. B. de Overbeck, London.—22nd January*, 1883.—(*A communication from H. Niewerth, Hanover.*) 6*d*.
The first process consists in mixing ferro-silicum with fluoride of aluminium, and submitted to a melting heat when the charge is decomposed into volatile silicon fluoride, iron, and aluminium, the two latter forming an alloy. To obtain an alloy of aluminium with copper from this iron-aluminium alloy, the latter is melted with metallic copper which will unite with the aluminium, leaving the iron with but a small amount of aluminium. The Second process consists in the compound of aluminium with chlorine or fluorine decomposed into a volatile state, is heated and brought into contact with a mixture of 62 parts carbonate of soda, 28 parts coal, and 10 parts chalk, also in a highly heated state. A Third process is described and a special furnace for carrying out the same.

363. Bobbins for Cotton and Woollen Spinning, *H. Southwell, Heywood, and W. H. Dawson, Manchester.—23rd January*, 1883. 4*d*.
This consists in casting a rim or band of metal into a groove formed in the top or bottom or both ends of the bobbin so as to strengthen the same.

365. Velocipedes, *J. Hopwood, Heaton-Norris, Lancashire.—23rd January*, 1883. 6*d*.
This relates principally to tricycles, the objects being to improve the steering and to enable a tricycle of ordinary width to carry two passengers both of whom can drive. The seats are arranged one behind the other, and the rear rider can work treadles connected by chain gearing with the rear axle. The rear wheel is connected to a backbone pivotted to the frame of the front wheels, and capable of being turned either from the front or rear seat.

366. Bracelets to be used in Connection with Gloves, *A. Watson, Willesden.—23rd January*, 1883. 6*d*.
This consists in bracelets which can be readily secured to and detached from gloves, and which serve as a means of fastening the glove round the wrist.

368. Condensers for Pumping Engines, *W. A. Miles, New York.—23rd January*, 1883. 8*d*.
This relates to the arrangement of the valves.

370. Vehicles or Rolling Stock for Railways and Tramways, *J. Cleminson, Westminster.—23rd January*, 1883. 6*d*.
The object is to facilitate the travelling of vehicles along curved portions of railways or tramways, and it consists in arranging each wheel axle in a frame separate from the main frame and each capable of turning on pivots.

371. Electric Lamps, *A. E. Swonnikoff, London.—23rd January*, 1883. 6*d*.
The descent of the upper carbon is controlled by the step-by-step movement of an escapement wheel acted on by pallets operated by an electro-magnet or solenoid in a shunt circuit of high resistance. In a lamp for burning more than one pair of carbons a lever and contra spring is operated by the descent of the upper carbon rods. This breaks contact for that pair of carbons, and completes the circuit for the next pair.

373. Indicating the Names of Stations in Railway Carriages, *H. B. Palmer, Putney.—23rd January*, 1883.—(*Not proceeded with.*) 4*d*.
This consists in the use of a "next station" indicator and a "train-destination" indicator, both operated by the engine-driver or guard by means of compressed air or by a vacuum.

374. Manufacture of Horseshoes, *T. D Richardson, North Greenwich.—23rd January*, 1883.—(*Not proceeded with.*) 2*d*.
This consists in the use of a roll with an excentric surface with bevelled or flattened parts, so as to form a shoe blank with a thick toe gradually decreasing towards the heel, the blank being afterwards bent to the required form.

376. Combination of Refuse Materials of Glass Works with other Substances for Making Flags, Flattening Stones, Bricks, Tiles, &c., *W. D. Herman, St. Helen's, Lancashire.—23rd January*, 1883. 4*d*.
The refuse silicious materials are combined with an alkaline silicate (preferably silicate of soda) as a binding material by means of heat, and either with or without the admixture of other materials, such as asbestos, emery, steatite, or colouring matter.

377. Method and Apparatus for Producing Combustible Gaseous Fluid, &c., *T. Cooper, Great Ryburgh.—23rd January*, 1883.—(*Not proceeded with.*) 4*d*.
This relates principally to the construction of the apparatus.

378. Spring Motor Apparatus for Propelling Tramway Cars, &c., *W. R. Lake, London.—23rd January*, 1883.—(*A communication from G. Stites, R. Steel, S. Austin, J. Vannste, H. G. Donnelly, and C. Mace, Philadelphia.*) 8*d*.
With a stationary shaft, a series of drums carrying springs are combined and adapted to be brought into action consecutively. A series of clutches enable the spring drums to be connected with a master wheel which transmits, through a train of gearing, the power of the springs to the wheel axles, the reverse movement of the clutches disconnecting the drums as the power of the springs is expended consecutively, the movement of the clutches being controlled by the driver.

379. Apparatus for Treating Sugar Cane from which Juice is to be Expressed, *W. L. Wise, London.—23rd January*, 1883.—(*A communication from La Société Anonyme des Anciens Etablissements Cail et Monsieur A. Ferron, Paris.*) 6*d*.
This relates to the use, in conjunction with a mill for expressing juice, of apparatus arranged in front of the crushing rolls, and serving to split or divide the canes before they enter the crushing rolls. The apparatus consists of two rolls with helicoidal channels, and between which the canes pass lengthwise, being received in a direction that is in a horizontal plane parallel to the axes of the rolls, and in vertical planes at right angles thereto. The rolls in rotating split the canes lengthwise, and in directions presenting the form of an elongated helix.

381. "Wires" employed in the Manufacture of Crinolines, Bonnets, &c., *G. F. Smeeton, Halifax.—23rd January*, 1883.—(*Not proceeded with.*) 2*d*.
The wires are composed of two or more wires of hardened and tempered steel of round, elliptical, or other section, secured in position to each other in the form of a tape or band by weaving or interlacing the whole with cotton, wool, silk, or other threads or yarn.

382. Vehicles Propelled by the Riders, *J. Watson and G. Whalley, Keighley, and T. Weatherill, Leeds.—24th January*, 1883. 6*d*.
The driving wheel axle is formed with one or more cranks, and either wheel can be connected to or disengaged from the axle. The crank is driven through rods by treadles, and the seat of the vehicle is provided with a movable back so connected to the treadle levers as to aid in propelling the vehicle when moved backwards and forwards by the rider pressing against it.

383. Obtaining Motive Power, &c., *S. Hart, Hull.—24th January*, 1883.—(*Void.*) 2*d*.
A shaft with a fly-wheel is mounted in bearings, and is formed with cranks, to each of which is connected by a link one end of a lever mounted on a fulcrum, and having its other end connected by another link to a wheel on another crank shaft, the cranks of which are similarly connected with other series of wheels and levers, the last shaft being driven by manual, steam, water, or other power.

385. Axle-boxes, *C. Friedrichsen, Germany.—24th January*, 1883.—(*Not proceeded with.*) 2*d*.
The object is to facilitate the application to and removal of rollers from axle-boxes, and consists in making the bore of the box wider than usual, and inserting conical rings fitted with rollers in the front and back end. The rollers have pins at both extremities running in concentric grooves arranged at both sides of the channel serving to receive them.

386. Finishing of Hats, *G. Atherton, Stockport.—24th January*, 1883.—(*A communication from G. Yule, Newark, U.S.*) 6*d*.
The object is to dispense with the ironing and finishing processes. Heated sand is poured or placed upon the hat, which is supported by a block, and the hat with the sand on it is subjected to hydraulic or screw pressure, the hot sand finishing the surface and abstracting the moisture from the hat.

387. Ventilating Sewers, *G. F. Harrington, Ryde.—24th January*, 1883. 6*d*.
Cowls of special construction are applied to ventilating shafts, which may be built of wicker or basket work coated with cement inside and out. The cowls direct air down the shaft. The mouth is at right angles to and much larger than the throat. The cowl is mounted on a centre pivot, and its edges are trapped where they are connected to the shaft.

388. Gas Engines, *J. Howard and E. T. Bousfield, Bedford.—24th January*, 1883.—(*Not proceeded with.*) 4*d*.
The piston-rod of the working cylinder works through a stuffing-box in the lid, and the cylinder is connected at each end by passages with a combustion chamber running alongside the cylinder, and into which the charge is delivered by the cylinder and compressed by the back stroke of the piston, suitable valves being provided and actuated by cams to control the passage of the charge to and from the cylinder to the combustion tube.

389. Window or Casement Stays or Holders, *E. and J. M. Verity and B. Banks, Leeds.—24th January*, 1883.—(*Not proceeded with.*) 2*d*.
This consists in the use of a stay or holder for fixing windows or casements composed of two metal bars of unequal length jointed together, and provided with means to fix them in any desired position.

390. Flour and Middlings Dressing Machines, *M. Lyon, London.—24th January*, 1883.—(*A communication from A. Hunter, Chicago, U.S.*) 6*d*.
The meal is fed into a hopper with a tight cover, in which is a tube for the escape of air. A horizontal shaft passes through the hopper and carries arms, against which the meal is held up by a wire cloth hung in the hopper. In the bottom of the hopper is a screw conveyor below the wire cloth, and which delivers the meal through a trap door opening outwards to a chamber with a hopper-shaped bottom and containing a hollow skeleton cylinder, the upper openings of which are closed by silk bolting cloth and the lower by canvas. A shaft with horizontal bars or helical beaters attached to arms thereon revolves within the cylinder. An eduction opening leads from near the centre of the cylinder, and is fitted with an outwardly opening valve. An air chamber communicates with the top of the cylinder. Two screw conveyors are placed below the cylinders, and are separated by a partition with adjustable openings. Across the upper part of the chamber containing the cylinder is a partition of cloth. A fan is attached to the tail end of the machine on the beater shaft.

391. Paper Knives, *F. L. H. Aumont, Camberwell.—24th January*, 1883.—(*Not proceeded with.*) 4*d*.
A box or receptacle is formed in the handle to receive postage stamps, and its lid slides in grooves and is acted upon by a bow spring to keep the lid always tight.

392. Friction Clutches, *A. M. Clark, London.—24th January*, 1883.—(*A communication from G. N. Schoenberg, Paris.*) 1*s*. 10*d*.
This consists essentially in fixing between two metal rings of suitable form a flat band, and in applying the friction to the edges of this band by means of a third ring. The band is of leather, india-rubber, gutta-percha, canvas, or other fabric, and is wound in the space between the two rings by special apparatus.

393. Photometer, *A. J. Beer, Canterbury.—24th January*, 1883. 4*d*.
The instrument consists of a plain table or disc, with an indicator supported on a tripod or other stand, which disc is so constructed as to assume a level position independent of unevenness of surface of land or other causes to throw it out of level, the indicator being erected perpendicular to the axis of the disc from whence the shadows of light are read off. The form of adjustment consists in a weighted rod or pendulum acting with a universal or similar joint.

394. Velocipedes, *W. H. J. Grout, Stoke Newington.—24th January*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to means for varying the speed and power, and it consists of a pair of levers with sliding blocks capable of being moved by racks and pinions so as to travel along the levers, from which power is transmitted by rods or chains to a pair of oscillating pulleys fitted with pawls working in ratchets cut in a brake drum enclosing a set of wheels. Means are described for reducing the width of the vehicle when required.

395. Railways, and Rolling Stock for Same, *P. Jensen, London.—24th January*, 1883.—(*A communication from F. H. Danchell, Paris.*) 8*d*.
The main object is to provide an auxiliary railway for carrying parcels and other light goods. The permanent way consists of an upper and lower rail, the

4140. Treatment of Iron Ores, W. Arthur, Cowes.—A communication from J. P. Gill.—28th August, 1883.
4160. Solitaires, &c., E. E. Ashing, London.—28th August, 1883.
4431. Producing Ice-flower-like Figures on Glass, C. Pieper, Berlin.—A communication from Dunkel und Compagnie.—17th September, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 21st September, 1883.*)

1150. Putting on Boots, &c., A. J. Boult, London.—3rd March, 1883.
1501. Storing Illuminating Gas, R. M. Marchant and T. Wrigley, London.—22nd March, 1883.
1519. Pulverising, &c., Ore, A. J. Struthers, Glasgow.—22nd March, 1883.
1520. Steam Boiler Furnaces, S. Schuman, Glasgow.—22nd March, 1883.
1525. Cartridge Carriers, G. Pitt, Sutton.—22nd March, 1883.
1529. Skates, W. P. Thompson, Liverpool.—24th March, 1883.
1531. Jacquard Apparatus, J. Chapman, Nottingham.—24th March, 1883.
1542. Pans for Melting Pitch, J. B. Stewart, Liverpool.—27th March, 1883.
1550. Drawing Apparatus, W. and T. S. Bucknall, Kidderminster.—27th March, 1883.
1568. Saddles for Bicycles, J. B. Brooks, Birmingham.—28th March, 1883.
1606. Spring Scales, C. Pieper, Berlin.—30th March, 1883.
1638. Corking Bottles, J. J. H. Schultz, Hamburg.—31st March, 1883.
1671. Attaching Handles to Cutlery, G. T. Tuke, Sheffield.—3rd April, 1883.
1741. Fly-wheels, &c., W. Hargreaves and R. Harwood, Bolton.—6th April, 1883.
1788. Colouring Matters, P. J. Meyer, Berlin.—9th April, 1883.
1877. Measuring Electric Currents, R. E. B. Crompton, London, and G. Kapp, Chelmsford.—13th April, 1883.
1883. Explosive Compounds, F. W. Gilles, Germany.—13th April, 1883.
1978. Printing Fabrics, W. Mather, Manchester.—19th April, 1883.
2042. Magneto-electric Machines, G. Hookham, Birmingham.—21st April, 1883.
2224. Hammerless Guns, J. Darby, Birmingham.—2nd May, 1883.
2395. Contact Boxes on Electric Railways, W. E. Ayrton and J. Perry, London.—11th May, 1883.
2515. Carriage Wheel Tires, H. R. Townsend, London.—19th May, 1883.
2973. Barbed Fence Wire, A. M. Clark, London.—15th June, 1883.
3063. Fly-wheel, H. Blank, Berlin.—20th June, 1883.
3304. Spinning, &c., Fibrous Materials, J. Farran, Manchester.—4th July, 1883.
3310. Cutting by means of Circular Saws, A. W. McMurdo, Scotby.—4th July, 1883.
3655. Looms for Weaving, R. H. Brandon, Paris.—25th July, 1883.

(*List of Letters Patent which passed the Great Seal on the 25th September, 1883.*)

1383. Controlling, &c., Clocks, H J. Haddan, London.—15th March, 1883.
1386. Securely Holding Braces to Trousers, N. P. Davison, London.—15th March, 1883.
1541. Electric Batteries, H. H. Lake, London.—26th March, 1883.
1569. Composition for Incrusting Metal, A. Bailiff, Paris.—28th March, 1883.
1575. Electro-magnetic Printing Telegraph Apparatus, W. P. Thompson, Liverpool.—28th March, 1883.
1576. Electro-magnetic Printing Telegraphs, W. P. Thompson, Liverpool.—28th March, 1883.
1577. Manufacture of Alumina, W. P. Thompson, Liverpool.—28th March, 1883.
1582. Cards for Sewing Silk, &c., J. H. Johnson, London.—29th March, 1883.
1583. Double-ribbed Warp Looms, J. D. Harris and A. Shuttlewood, Leicester.—29th March, 1883.
1584. Distilling, &c., Glycerine, F. J. O'Farrell, Dublin.—29th March, 1883.
1587. Coupling, &c., Railway Carriages, J. T. Leighton, Edinburgh.—29th March, 1883.
1592. Stoves, L. C. Besant, Greenock.—29th March, 1883.
1597. Wire Fencing, W. J. Smith, Inverness.—29th March, 1883.
1609. Fire Alarms, I. Thomas, Aberdare.—30th March, 1883.
1619. Puddling Furnaces, J. Imray, London.—31st March, 1883.
1630. Ground Colour or Priming, F. Wirth, Frankfort-on-the-Maine.—31st March, 1883
1631. Traction Engines, W. Wilkinson, Wigan.—31st March, 1883.
1648. Laces for Machine Belts, R. Paton, Johnstone.—2nd April, 1883.
1709. Manufacture of Racquets, G. A. Adkins, London.—5th April, 1883.
1726. Making Jewellery of Wood, &c., W. R. Lake, London.—5th April, 1883.
1731. Rapidly Heating Water, W. H. Williams, Birmingham.—6th April, 1883.
1736. Dynamo-electric Machines, M. Deprez, Paris.—6th April, 1883.
1737. Transforming Electric Currents, M. Deprez, Paris.—6th April, 1883.
1769. Cut Pile Fabrics, J. H. Johnson, London.—7th April, 1883.
1789. Galvanic Batteries, G. B. de Overbeck, London.—9th April, 1883.
1807. Compressing, &c., Ensilage, T. Potter, Alresford.—10th April, 1883.
1811. Adjusting the Shafts of Wheel Carriages, C. Healey, Gloucester.—10th April, 1883.
1852. Shag or Pile Fabrics, H. J. Haddan, London.—12th April, 1883.
1866. Treatment of Flax, &c., W. R. Lake, London.—12th April, 1883.
1890. Sewing the Soles of Boots, &c., W. R. Lake, London.—13th April, 1883.
1903. Breech-loading Fire-arms, E. Harrison and F. Beesley, London.—14th April, 1883.
1953. Manufacture of Bread, J. H. Johnson, London.—17th April, 1883.
1961. Slide Valves, J. F. Johnstone, Belvedere.—18th April, 1883.
1967. Galvanising Sheet Iron, J. Tinn, Bristol.—18th April, 1883.
1974. Decorticating Flax, &c., W. R. Lake, London.—18th April, 1883.
2000. Colouring Kerosine, A. M. Clark, London.—19th April, 1883.
2010. Cutting, &c., Fodder, J. H. Johnson, London.—20th April, 1883.
2039. Fish-plates, G. Robson, Newcastle-upon-Tyne.—21st April, 1883.
2862. Making Refined Cast Steel, T. Sheeham, London.—8th June, 1883.
3058. Preserving Milk, &c., W. H. Thew, Waterloo.—20th June, 1883.
3094. Friction Gearing, W. E. Ayrton and J. Perry, London.—21st June, 1883.
3154. Cooking Ranges, J. McI. Shaw, Glasgow.—26th June, 1883.
3188. Piled Fabrics, D. Marcon, Paris.—27th June, 1883.
3189. Metallic Tubes, R. Heeley, Shirley.—27th June, 1883.
3263. Stiffening Fustians, &c., J. Sellars, Manchester.—2nd July, 1883.
3280. Gas Engines, W. Foulis, Glasgow.—3rd July, 1883.
3350. Treatment of Tin and Lead Dross, T. Lloyd, Aberdylais.—6th July, 1883.
3400. Oiling, &c., Hemp, A. V. Newton, London.—10th July, 1883.
3455. Tin and other Metal Cases, J. Maconochie, Lowestoft.—13th July, 1883.
3462. Cylinders for Picking, &c., Machines, W. R. Lake, London.—13th July, 1883.
3489. Shears for Cutting Metal, J. Seligman, London.—16th July, 1883.
3690. Alcohols, H. A. Bonneville, London.—28th July, 1883.
3723. Burners, J. S. Muir, London.—31st July, 1883.

List of Specifications published during the week ending September 22nd, 1883.

5104*, 4d ; 4440, 4d.; 5583, 2d.; 5623, 2d.; 5715, 2d.; 5811, 2d.; 5871, 2d.; 5975, 2d.; 6153, 2d.; 6165, 2d.; 6173, 2d.; 197, 6d.; 230, 4d.; 258, 4d.; 341, 10d.; 350, 6d.; 353, 8d.; 361, 6d.; 368, 8d.; 377, 4d.; 393, 4d.; 416, 6d.; 418, 2d.; 420, 4d.; 422, 2d.; 427, 4d.; 433, 6d.; 439, 6d.; 440, 6d.; 441, 4d.; 442, 6d.; 443, 6d.; 444, 2d.; 446, 2d.; 447, 6d.; 451, 2d.; 452, 2d.; 453, 2d.; 454, 10d.; 456, 6d.; 457, 2d.; 462, 8d.; 464, 6d.; 465, 2d.; 466, 2d.; 467, 2d.; 468, 2d.; 469, 6d.; 471, 6d.; 472, 2d.; 473, 4d.; 474, 2d.; 475, 2d.; 476, 4d.; 477, 2d.; 478, 8d.; 479, 6d.; 480, 2d.; 481, 8d.; 482, 2d.; 483, 2d.; 484, 10d.; 485, 2d.; 486, 2d.; 488, 6d.; 489, 2d.; 492, 2d.; 494, 6d.; 495, 4d.; 496, 6d.; 499, 8d.; 500, 2d.; 501, 2d.; 503, 6d.; 503, 2d.; 504, 2d.; 505, 6d.; 506, 8d.; 507, 2d.; 508, 6d.; 509, 4d.; 511, 6d.; 512, 4d.; 513, 2d.; 514, 2d.; 515, 6d.; 517, 2d.; 518, 4d.; 519, 2d.; 520, 6d.; 522, 6d.; 523, 6d.; 525, 6d.; 526, 2d.; 527, 6d.; 530, 6d.; 531, 4d.; 532, 4d.; 533, 8d.; 534, 6d.; 538, 6d.; 539, 6d.; 541, 2d.; 542, 6d.; 543, 6d.; 547, 6d.; 548, 2d.; 549, 6d.; 550, 6d.; 551, 4d.; 554, 6d.; 555, 4d.; 556, 2d.; 558, 6d.; 559, 6d.; 562, 2d.; 563, 6d.; 568, 2d.; 570, 2d.; 571, 2d.; 573, 2d.; 574, 6d.; 576, 6d.; 577, 6d.; 579, 4d.; 581, 6d.; 582, 6d.; 583, 2d.; 584, 6d.; 585, 6d.; 587, 4d.; 588, 6d.; 589, 6d.; 590, 6d.; 591, 6d.; 592, 6d.; 595, 6d.; 596, 6d.; 598, 4d.; 599, 6d.; 601, 6d.; 602, 6d.; 604, 6d.; 607, 6d.; 610, 6d.; 612, 6d.; 614, 6d.; 627, 6d.; 638, 6d.; 639, 6d.; 647, 6d.; 653, 6d.; 660, 4d.; 666, 4d.; 677, 6d.; 679, 4d.; 683, 6d.; 688, 6d.; 711, 6d.; 725, 6d.; 729, 6d.; 732, 2d.; 777, 8d.; 799, 6d.; 800, 6d.; 801, 6d.; 827, 2d.; 893, 8d.; 896, 4d.; 922, 6d.; 1046, 6d.; 2616, 4d.; 2781, 6d.; 2789, 6d.

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

ABSTRACTS OF SPECIFICATIONS.

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

4440. Removing both Iron and Manganese from Certain Solutions, *C. Semper, Philadelphia.*—19*th September*, 1882. 4*d.*

This consists in removing both the iron and manganese by a single operation from ferruginous solutions—of such salts as are not decomposed in the operation of the process—containing manganous salts, by treating them with a permanganate and subjecting them to heat.

5583. Measuring Men and Objects, *E. P. Wilford, Bristol.*—23*rd November*, 1883.—(*Provisional protection not allowed.*) 2*d.*

This relates particularly to devices for measuring army recruits round the chest, and consists of a band of metal or wire gauze divided into inches.

5623. Aerial Railway, *E. P. Alexander, London.*—27*th November*, 1883.—(*A communication from P. M. T. imbaud, Paris.*)—(*Provisional protection not allowed.*) 2*d.*

This consists in the construction of a railway so that the trains travel first down an incline, and the impetus they receive in such descent enables them to ascend an opposite incline.

5715. Manufacture of Magnetic and Ventilating Wearing Apparel for the Prevention or Cure of Disease, *W. R. Lake, London.*—30*th November*, 1882.—(*A communication from S. A. B. Wilson, Boston, Mass., U.S.*)—(*Provisional protection not allowed.*) 2*d.*

This relates to wearing apparel containing plates of magnetic metal.

5811. Casing and Marking of Casing for Meal used as a Substitute for Milk for Rearing Young Animals, *T. and T. G. Bowick, Bedford.*—6*th December*, 1882.—(*Provisional protection not allowed.*) 2*d.*

The object is to enable meal which is to be used as a substitute for milk for rearing calves and other young animals to be kept for a longer period, by enclosing it in an inner bag of waterproof paper in an outer bag of jute, on which any suitable design is printed or painted.

5871. Lenses for Lanterns, *R. E. Frank, London.*—9*th December*, 1882.—(*A communication from L. Micciullo, Italy.*)—(*Provisional protection not allowed.*) 2*d.*

The lens is cast like a disc with a projecting centre, upon which facets are ground or cut. Flutings are arranged in rings round the surface of the disc.

5975. A New Aerated Water containing Bismuth, to be Employed for Medicinal Purposes, *J. Sellers, London.*—14*th December*, 1882.—(*Provisional protection not allowed.*) 2*d.*

This consists in combining a solution or soluble preparation of bismuth with aerated waters, charged with carbonic acid gas in the usual manner.

6153. Electric and other Lamps, *J. M. Fletcher, London.*—23*rd December*, 1882.—(*Provisional protection not allowed.*) 2*d.*

An incandescent lamp is immersed in a vessel suitable for holding flowers or fish.

6165. Composition of Flour and other Materials for Food, *W. P. Thompson, London.*—26*th December*, 1882.—(*A communication from P. Thorpe, New York.*)—(*Provisional protection not allowed.*) 2*d.*

An alkaline bicarbonate, preferably in the anhydrous form of flour, is incorporated with butter or other edible fat, and pressed into bags or casks, so as to exclude air.

6173. Soap for Toilet Purposes, *S. Birley, London.*—27*th December*, 1882.—(*Provisional protection not allowed.*) 2*d.*

This consists in adding phosphate of iron to ordinary soap.

197. Knit Stockings, *W. P. Thompson, Liverpool.*—12*th January*, 1883.—(*A communication from F. Lasher and W. H. Bradford, Bennington, U.S.*) 6*d.*

This relates to the formation of the heels of stockings produced by continuous tubular knitting.

230. Composition of Materials for Damp-proof Socks or Soles for Boots and Shoes, &c., *R. J. Buggaley, Nottingham.*—15*th January*, 1883. 4*d.*

Ground or pulverised cork is mixed with anti-rheumatic oils and boiled linseed oil, and prepared by rolling under great pressure into sheets or lengths, being at the same operation covered on one side with wool or other suitable non-conductor of heat, thus forming a compact material rendering any subsequent stitching or binding operations unnecessary.

258. Strain Governor for Marine and Stationary Steam Engines, &c., *J. Munro, West Croydon.*—16*th January*, 1883.—(*A communication from G. Keith, Cuba.*)—(*Complete.*) 6*d.*

The inventor claims the mode of governing steam engines or other motors and electric generators by means of the torsional strain on their main shafts through the medium of springs, excentrics, or other connecting mechanism.

341. Machinery and Tools for Dressing, Shaping, Sinking, Turning, and Moulding Stone, &c., *F. Trier, Westminster.*—20*th January*, 1883. 10*d.*

This relates partly to the methods of applying revolving cutters, whether tubular, conical, or discoidal, to the surface of the stone to be operated upon, so as to remove the inequalities thereof, or that portion of the stone which is superfluous, and to leave a surface plain, circular, moulded, sunk, or otherwise shaped, as may be desired, the said tubular, concoidal, or discoidal cutters in every case rolling when working.

350. Bascules or See-saws, *H. J. T. Piercy, Birmingham.*—22*nd January*, 1883. 6*d.*

This relates to the general construction and arrangement of the parts.

353. Locks and Latches, &c., *J. M. Hart, London.*—22*nd January*, 1883. 8*d.*

The object is partly to facilitate the withdrawal of the latch bolt of locks and latches by arranging the parts thereof, so that such withdrawal may be readily effected, not only as now by the partial rotation of the handles in one or the other direction, but also by pressure exerted on either or both handles in any of several directions.

360. Moulding Socketed Pipes, &c., *G. Smith, Leicester.*—22*nd January*, 1883. 8*d.*

The moulding apparatus may be combined with a pug mill, so that the charging of the moulds will be effected mechanically. In the lower part of the pug mill a conical guide conveys the plastic material to a central opening in a die plate, which closes the bottom of the mill. To the under side of the guide, and projecting through the die plate so as to leave an annular space, is secured a hollow core to form the inside of the socket, and within it is a second core to form the body of the pipe, and which rests on a table caused to rise and fall by cams or cranks. The mould also rests on the table, is formed in parts hinged together, and within it is an annular core to form a socket at the other end of the pipe if desired.

361. Electric Lamps or Lighting Apparatus, *H. H. Lake, London.*—22*nd January*, 1883.—(*A communication from H. R. Boissier, New York, U.S.*) 6*d.*

This relates to that class of electric lamps in which the upper carbon holder is provided with a toothed rack engaging with a train of gearing carried by a pivotted swinging frame connected with the armatures of two electro-magnets, one of low resistance placed in the main circuit, the other, of high resistance, being in a shunt circuit. The failure of the arc fuses a piece of fusible metal, which permits a lever to make contact and complete a shunt circuit round the carbon.

362. Process and Apparatus for the Production of Metallic Aluminium and Aluminium Alloys, *G. B. de Overbeck, London.*—22*nd January*, 1883.—(*A communication from H. Niewerth, Hanover.*) 6*d.*

The first process consists in mixing ferro-silicum with fluoride of aluminium, and submitted to a melting heat when the charge is decomposed into volatile silicon fluoride, iron, and aluminium, the two latter forming an alloy. To obtain an alloy of aluminium with copper from this iron-aluminium alloy, the latter is melted with metallic copper which will unite with the aluminium, leaving the iron with but a small amount of aluminium. The Second process consists in the compound of aluminium with chlorine or fluorine decomposed into a volatile state, is heated and brought into contact with a mixture of 62 parts carbonate of soda, 28 parts coal, and 10 parts chalk, also in a highly heated state. A Third process is described and a special furnace for carrying out the same.

363. Bobbins for Cotton and Woollen Spinning, *H. Southwell, Heywood, and W. H. Dawson, Manchester.*—23*rd January*, 1883. 4*d.*

This consists in casting a rim or band of metal into a groove formed in the top or bottom or both ends of the bobbin so as to strengthen the same.

365. Velocipedes, *J. Hopwood, Heaton-Norris, Lancashire.*—23*rd January*, 1883. 6*d.*

This relates principally to tricycles, the objects being to improve the steering and to enable a tricycle of ordinary width to carry two passengers both of whom can drive. The seats are arranged one behind the other, and the rear rider can work treadles connected by chain gearing with the rear axle. The rear wheel is connected to a backbone pivotted to the frame of the front wheels, and capable of being turned either from the front or rear seat.

366. Bracelets to be used in Connection with Gloves, *A. Watson, Willesden.*—23*rd January*, 1883. 6*d.*

This consists in bracelets which can be readily secured to and detached from gloves, and which serve as a means of fastening the glove round the wrist.

368. Condensers for Pumping Engines, *W. A. Miles, New York.*—23*rd January*, 1883. 8*d.*

This relates to the arrangement of the valves.

370. Vehicles or Rolling Stock for Railways and Tramways, *J. Cleminson, Westminster.*—23*rd January*, 1883. 6*d.*

The object is to facilitate the travelling of vehicles along curved portions of railways or tramways, and it consists in arranging each wheel axle in a frame separate from the main frame and each capable of turning on pivots.

371. Electric Lamps, *A. E. Swonnikoff, London.*—23*rd January*, 1883. 6*d.*

The descent of the upper carbon is controlled by the step-by-step movement of an escapement wheel acted on by pallets operated by an electro-magnet or solenoid in a shunt circuit of high resistance. In a lamp for burning more than one pair of carbons a lever and contra spring is operated by the descent of the upper carbon rods. This breaks contact for that pair of carbons, and completes the circuit for the next pair.

373. Indicating the Names of Stations in Railway Carriages, *H. B. Palmer, Putney.*—23*rd January*, 1883.—(*Not proceeded with.*) 4*d.*

This consists in the use of a "next station" indicator and a "train-destination" indicator, both operated by the engine-driver or guard by means of compressed air or by a vacuum.

374. Manufacture of Horseshoes, *T. D Richardson, North Greenwich.*—23*rd January*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in the use of a roll with an excentric surface with bevelled or flattened parts, so as to form a shoe blank with a thick toe gradually decreasing towards the heel, the blank being afterwards bent to the required form.

376. Combination of Refuse Materials of Glass Works with other Substances for Making Flags, Flattening Stones, Bricks, Tiles, &c., *W. D. Herman, St. Helen's, Lancashire.*—23*rd January*, 1883. 4*d.*

The refuse silicious materials are combined with an alkaline silicate (preferably silicate of soda) as a binding material by means of heat, and either with or without the admixture of other materials, such as asbestos, emery, steatite, or colouring matter.

377. Method and Apparatus for Producing Combustible Gaseous Fluid, &c., *T. Cooper, Great Ryburgh.*—23*rd January*, 1883.—(*Not proceeded with.*) 4*d.*

This relates principally to the construction of the apparatus.

378. Spring Motor Apparatus for Propelling Tramway Cars, &c., *W. R. Lake, London.*—23*rd January*, 1883.—(*A communication from G. Stites, R. Steel, S. Austin, J. Vannste, H. G. Donnelly, and C. Mace, Philadelphia.*) 8*d.*

With a stationary shaft, a series of drums carrying springs are combined and adapted to be brought into action consecutively. A series of clutches enable the spring drums to be connected with a master wheel which transmits, through a train of gearing, the power of the springs to the wheel axles, the reverse movement of the clutches disconnecting the drums as the power of the springs is expended consecutively, the movement of the clutches being controlled by the driver.

379. Apparatus for Treating Sugar Cane from which Juice is to be Expressed, *W. L. Wise, London.*—23*rd January*, 1883.—(*A communication from La Société Anonyme des Anciens Etablissements Cail et Monsieur A. Ferron, Paris.*) 6*d.*

This relates to the use, in conjunction with a mill for expressing juice, of apparatus arranged in front of the crushing rolls, and serving to split or divide the canes before they enter the crushing rolls. The apparatus consists of two rolls with helicoidal channels, and between which the canes pass lengthwise, being received in a direction that is in a horizontal plane parallel to the axes of the rolls, and in vertical planes at right angles thereto. The rolls in rotating split the canes lengthwise, and in directions presenting the form of an elongated helix.

381. "Wires" employed in the Manufacture of Crinolines, Bonnets, &c., *G. F. Smeeton, Halifax.*—23*rd January*, 1883.—(*Not proceeded with.*) 2*d.*

The wires are composed of two or more wires of hardened and tempered steel of round, elliptical, or other section, secured in position to each other in the form of a tape or band by weaving or interlacing the whole with cotton, wool, silk, or other threads or yarn.

382. Vehicles Propelled by the Riders, *J. Watson and G. Whalley, Keighley, and T. Weatherill, Leeds.*—24*th January*, 1883. 6*d.*

The driving wheel axle is formed with one or more cranks, and either wheel can be connected to or disengaged from the axle. The crank is driven through rods by treadles, and the seat of the vehicle is provided with a movable back so connected to the treadle levers as to aid in propelling the vehicle when moved backwards and forwards by the rider pressing against it.

383. Obtaining Motive Power, &c., *S. Hart, Hull.*—24*th January*, 1883.—(*Void.*) 2*d.*

A shaft with a fly-wheel is mounted in bearings, and is formed with cranks, to each of which is connected by a link one end of a lever mounted on a fulcrum, and having its other end connected by another link to a wheel on another crank shaft, the cranks of which are similarly connected with other series of wheels and levers, the last shaft being driven by manual, steam, water, or other power.

385. Axle-boxes, *C. Friedrichsen, Germany.*—24*th January*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to facilitate the application to and removal of rollers from axle-boxes, and consists in making the bore of the box wider than usual, and inserting conical rings fitted with rollers in the front and back end. The rollers have pins at both extremities running in concentric grooves arranged at both sides of the channel serving to receive them.

386. Finishing of Hats, *G. Atherton, Stockport.*—24*th January*, 1883.—(*A communication from G. Yule, Newark, U.S.*) 6*d.*

The object is to dispense with the ironing and finishing processes. Heated sand is poured or placed upon the hat, which is supported by a block, and the hat with the sand on it is subjected to hydraulic or screw pressure, the hot sand finishing the surface and abstracting the moisture from the hat.

387. Ventilating Sewers, *G. F. Harrington, Ryde.*—24*th January*, 1883. 6*d.*

Cowls of special construction are applied to ventilating shafts, which may be built of wicker or basket work coated with cement inside and out. The cowls direct air down the shaft. The mouth is at right angles to and much larger than the throat. The cowl is mounted on a centre pivot, and its edges are trapped where they are connected to the shaft.

388. Gas Engines, *J. Howard and E. T. Bousfield. Bedford.*—24*th January*, 1883.—(*Not proceeded with.*) 4*d.*

The piston-rod of the working cylinder works through a stuffing-box in the lid, and the cylinder is connected at each end by passages with a combustion chamber running alongside the cylinder, and into which the charge is delivered by the cylinder and compressed by the back stroke of the piston, suitable valves being provided and actuated by cams to control the passage of the charge to and from the cylinder to the combustion tube.

389. Window or Casement Stays or Holders, *E. and J. M. Verity and B. Banks, Leeds.*—24*th January*, 1883.—(*Not proceeded with.*) 2*d.*

This consists in the use of a stay or holder for fixing windows or casements composed of two metal bars of unequal length jointed together, and provided with means to fix them in any desired position.

390. Flour and Middlings Dressing Machines, *M. Lyon, London.*—24*th January*, 1883.—(*A communication from A. Hunter, Chicago, U.S.*) 6*d.*

The meal is fed into a hopper with a tight cover, in which is a tube for the escape of air. A horizontal shaft passes through the hopper and carries arms, against which the meal is held up by a wire cloth hung in the hopper. In the bottom of the hopper is a screw conveyor below the wire cloth, and which delivers the meal through a trap door opening outwards to a chamber with a hopper-shaped bottom and containing a hollow skeleton cylinder, the upper openings of which are closed by silk bolting cloth and the lower by canvas. A shaft with horizontal bars or helical beaters attached to arms thereon revolves within the cylinder. An eduction opening leads from near the centre of the cylinder, and is fitted with an outwardly opening valve. An air chamber communicates with the top of the cylinder. Two screw conveyors are placed below the cylinders, and are separated by a partition with adjustable openings. Across the upper part of the chamber containing the cylinder is a partition of cloth. A fan is attached to the tail end of the machine on the beater shaft.

391. Paper Knives, *F. L. H. Aumont, Camberwell.*—24*th January*, 1883.—(*Not proceeded with.*) 2*d.*

A box or receptacle is formed in the handle to receive postage stamps, and its lid slides in grooves and is acted upon by a bow spring to keep the lid always tight.

392. Friction Clutches, *A. M. Clark, London.*—24*th January*, 1883.—(*A communication from G. N. Schoenberg, Paris.*) 1*s.* 10*d.*

This consists essentially in fixing between two metal rings of suitable form a flat band, and in applying the friction to the edges of this band by means of a third ring. The band is of leather, india-rubber, gutta-percha, canvas, or other fabric, and is wound in the space between the two rings by special apparatus.

393. Photometer, *A. J. Beer, Canterbury.*—24*th January*, 1883. 4*d.*

The instrument consists of a plain table or disc, with an indicator supported on a tripod or other stand, which disc is so constructed as to assume a level position independent of unevenness of surface of land or other causes to throw it out of level, the indicator being erected perpendicular to the axis of the disc from whence the shadows of light are read off. The form of adjustment consists in a weighted rod or pendulum acting with a universal or similar joint.

394. Velocipedes, *W. H. J. Grout, Stoke Newington.*—24*th January*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to means for varying the speed and power, and it consists of a pair of levers with sliding blocks capable of being moved by racks and pinions so as to travel along the levers, from which power is transmitted by rods or chains to a pair of oscillating pulleys fitted with pawls working in ratchets cut in a brake drum enclosing a set of wheels. Means are described for reducing the width of the vehicle when required.

395. Railways, and Rolling Stock for Same, *P. Jensen, London.*—24*th January*, 1883.—(*A communication from F. H. Danchell, Paris.*) 8*d.*

The main object is to provide an auxiliary railway for carrying parcels and other light goods. The permanent way consists of an upper and lower rail, the carriages being constructed with corresponding wheels and provided with electro-motor engines. The top rail serves as a lateral guide and current conductor, the current being collected by brushes or elastic contact wheels.

396. PULPING COFFEE BERRIES, *W. Walker, London.—24th January*, 1883.—*(A communication from Messrs. Arens Irmaos, Brazil.)* 6*d*.

The berries pass between a cylinder or drum with a roughened surface, and an upper and lower plate arranged on one side, the upper plate being formed of a number of elastic plates or keys arranged closely side by side, and capable of yielding to allow hard substances to pass, and yet offer the requisite resistance to effect the proper pulping of the ripe berries.

397. ELECTRIC LIGHTING, *J. Cooper, London.—24th January*, 1883. 2*d*.

The incandescent part of a lamp is composed of a stick of carbon enclosed in a tube of alumina.

398. LATHES FOR CUTTING SCREWS, &c., *F. Wirth, Germany.—24th January*, 1883.—*(A communication from H. Voigt and W. Braun, Germany.)—(Not proceeded with.)* 2*d*.

This relates to an automatic universal screw-cutting and turning lathe, the object being to produce screws and other articles of different sizes without loss of time, from bars of different materials.

399. IMPERMEABLE COATING FOR WATERPROOFING, &c., *L. A. Groth, London.—24th January*, 1883.—*(A communication from N. Bellefroid, Belgium.)* 4*d*.

This consists in a solution of stearine pitch, which must first be completely oxidised by exposure to the air, and then dissolved by boiling it with water and caustic soda.

401. EXPRESSING JUICE FROM SUGAR CANE, *W. L. Wise, London.—24th January*, 1883.—*(A communication from La Société Anonyme des Anciens Etablissements Cail, Paris.)* 6*d*.

This consists in forming the frame of sugar-cane mills of wrought iron or wrought iron and steel, whereby the distance apart of the two bottom rollers may be diminished, and a corresponding reduction in the width of the cane or trash guide effected. The vertical thrust against the top roll is sustained at each end by two bolts, screwed into a steel collar, rivetted between the plates of the frame, and enclosing the roll bearing. The horizontal thrust against the lower rolls is similarly sustained by four screw bolts, passing through the frames and through caps of the bearings, and the vertical thrust is sustained by the wrought iron framing. A wrought iron girder supports the trash guide, and it can be adjusted by means of a screwed rod without stopping the mill.

402. ELEVATED SINGLE-LINE RAILWAYS AND CARRIAGES THEREFOR, *A. M. Clark, London.—24th January*, 1883.—*(A communication from H. Carpentier, Paris.)* 8*d*.

The object is to increase the width of the rolling surface in order to diminish the wear of the wheel, and to provide an improved wheel and rail. The rail is made in two parts with a groove between, and the wheel has a central flange to run in the groove, and a tread on each side to bear on the two heads of the rail. The wheel may be provided with lateral steadying rollers and couplings to connect carriages together.

404. DISCHARGING OR TRANSFERRING MATERIALS RAISED BY DREDGING, EXCAVATING, AND OTHER ELEVATING MACHINERY, &c., *A. M. Clark, London.—25th January*, 1883.—*(A communication from La Compagnie Nationale de Travaux Publics, Paris.)* 8*d*.

This consists essentially of an endless apron of caoutchouc travelling over end drums, and formed with raised edges, for the purpose of discharging and transferring materials raised by dredging and other elevating machinery, a brush being provided to clean the apron at the discharge end.

405. INSULATORS FOR TELEGRAPH POSTS, &c., *P. R. de Fauchoux d'Humy, London.—25th January*, 1883. 6*d*.

Fixed to, but insulated from the post is a metal frame, to which the insulators are attached. The insulators consist of an earthenware slab formed with a number of perforations, through each of which a wire is passed.

406. MATERIAL TO BE USED AS A CARPET LINING, *A. Bruckner, London.—25th January*, 1883. 2*d*.

The object is to provide a lining which will better protect the carpet from unevenness of the flooring and from dust, whilst the elasticity of the carpet under the foot is greatly increased, such lining being composed of paper or fabric covered with glue, on to which a layer of cork waste or granulated cork is distributed.

407. OPERATING TRAMWAY POINTS, *F. A. Abeleven, Amsterdam.—25th January*, 1883. 6*d*.

Part of the roadway is mounted on a rocking frame, which, by a system of levers, is connected to the point to be shifted, and the driver by pulling the horses to one side or the other shifts the rocking frame and so operates the point as desired.

408. STEAM AND OTHER PISTONS, *A. MacLaine, Belfast.—25th January*, 1883. 6*d*.

This relates to elastic metallic packings with a double expansion movement. The piston is fitted with two or more metal rings cut through in one or more places, and with a wave spring inserted between the rings to hold them tightly in the piston, and a coil spring inserted between the ends of the rings where cut to press the ends apart and expand the rings circumferentially.

409. SEWING MACHINES, *I. Nasch, London.—25th January*, 1883. 6*d*.

This relates chiefly to improvements on the attachment to sewing machines for making button-holes, over-seaming, herring-bone stitching, and the like, described in patent No. 4520, A.D. 1882, the object being to enable the attachment to be readily disconnected so as to put it out of action; it further relates to bending the needle; and, lastly, to improvements in the needle plate of sewing machines. To disconnect the attachment a lever is caused to act upon a pawl by which the attachment is actuated. The needle slot in the shuttle race is inclined so as to bend the needle to bring the loop in such a position that the shuttle can pass through it. The needle plate is provided with a removable projection or guide, which is inserted and fixed in position when stitching button-holes or over-seaming, and is removed when doing ordinary sewing.

410. SMOKING PIPE, *R. C. Christian, Dublin.—25th January*, 1883. 4*d*.

The bowl consists of an outer and an inner chamber with an intermediate space, closed at top, where the two are secured together. A conical passage leads from the bottom of the inner chamber to a vessel below the outer chamber, and in which any oily matter collects. Three slanting holes in the inner chamber put it in communication with the intermediate space into which the bore of the pipe stem also opens.

411. PERAMBULATORS, *C. Thompson, London.—25th January*, 1883.—*(Not proceeded with.)* 2*d*.

This consists in mounting the carriage frame on the under frame, so that it can be turned round by means of suitable gearing actuated by a handle at the back of the carriage.

412. BITS OR CUTTERS FOR BORING AND TURNING METALS, &c., *J. W. Hall, Cardiff.—25th January*, 1883.—*(Not proceeded with.)* 2*d*.

This consists, First, of a cylindrical piece of steel with a hole through its centre to receive the boring bar, and the outer periphery of which is formed with a number of grooves running spirally from end to end, and which form the cutting edges; Secondly, in cutting similar grooves as those described on the inside of a cylinder, which is secured to the slide rest of a lathe and used to cut externally.

413. PRINTING MACHINES, *A. Coates, Rawtenstall, Lancashire.—25th January*, 1883. 6*d*.

The object is to enable the printing rollers to be set more easily. A face worm wheel is secured to the printing roller by a key, and is fitted loosely into the spur or box wheel. A worm is held in brackets attached to a large washer fastened to the face of the spur or box wheel and gears with the worm wheel, so that by turning the worm the pitch or position of the printing roller can be adjusted.

414. GRINDING, POLISHING, OR FACING STONE, GLASS, SLATE, &c., *G. and A. Coates, Rawtenstall, Lancashire.—25th January*, 1883. 6*d*.

The stones are laid on a bed, and an upright shaft is caused to revolve and has arms projecting over the bed, and which carry a top layer of stones moving in contact with the first. Each stone of the top layer is carried by a shaft at the end of one of the arms, and which is driven from the main shaft by gearing, so as to cause the stone to turn on its axis at the same time that it is carried round over the lower stones.

416. HAMMERS, *F. Wirth, Frankfort.—25th January*, 1883.—*(A communication from G. Speckhart and H. Wiedmann, Nürnberg.)* 6*d*.

The main feature of the invention is a straight flat bar or spring of elastic material, such as steel, which constitutes the stem of the haft, and the upper end of which is only sufficiently less wide than the diameter of the hole in the hammer head, to allow of its being passed through the said hole. It having been passed through, it is hammered out or rivetted on to the head, and wedges are driven on each side into the hole of the hammer head, and are then bolted to the stem through a hole provided for the purpose.

417. SCRAPING, PEELING, PARING, AND SLICING POTATOES, &c., *T. Marshall, Mile End.—25th August*, 1883.—*(A communication from J. B. Carter, New Jersey, U.S.)—(Not proceeded with.)* 2*d*.

A tapered tube of metal has a longitudinal slot near its smaller end, and is provided with a steel blade set at an angle to the slot, so that its cutting edge projects.

418. RAILWAY CHAIRS, &c., *W. Hopkins and C. Turner, Birmingham.—25th January*, 1883.—*(Not proceeded with.)* 2*d*.

In one modification the chair is made with one loose jaw, and the body parts of both jaws are made with opposite bolt holes, and the opposite faces of the jaws are made with recesses fitted with blocks of wood, which grasp each side of the web of the rail. A bolt formed with a key piece near one end is then passed through the said bolt holes and turned so that its key piece is outside one jaw; the two jaws are then nipped between the head and key of the bolt, and the rail is thus firmly held.

419. BARRELS OR CASKS, &c., *F. Myers, New York.—25th January*, 1883. 10*d*.

This relates to the general construction of machines for making barrels or casks, and comprises an improved method for bulging the staves as they are fed to and before they reach stave supporting or retaining discs, used instead of the ordinary barrel former; feeding mechanism for the staves; mechanism for withdrawing the stave-supporting discs when the barrel is formed; sliding truss hoop carriers and mechanism to place the hoops on the barrel and press them firmly on, and then to withdraw the carriers; also elastic cushions between the truss hoops and carriers to allow the hoops to yield; also a machine to cut the staves to the required length, and various details of construction.

420. LAMPS, &c., *T. Cooper, Great Ryburgh.—25th January*, 1883.—*(Not proceeded with.)* 4*d*.

This relates to the construction of lamps or apparatus for producing light and heat by the combustion of gaseous fluids, such as air impregnated with hydrocarbon, either in the presence of refractory material which is raised to incandescence, or without the same, the production of the combustible vapour and its admixture with the requisite quantity of air being effected by the action of the lamp itself.

421. RAILWAY SIGNALS, *J. H. Cureton, London.—25th January*, 1883. 6*d*.

The object is to signal drivers of trains in foggy weather, and it consists of a triangular block placed between the rails and actuated by the signal lever, so as to come in contact with a tongue suspended from the engine and strike a gong thereon when the signal is at danger. An indicator disc is also actuated at the same time as the block and is attached to the signal post near the ground.

422. UNIVERSAL PENHOLDER, *T. Nordenfelt, London.—25th January*, 1883.—*(A communication from Lieut. Ferraccin, Venice.)—(Not proceeded with.)* 2*d*.

A penholder to hold metallic pens of all sizes is constructed by inserting and fixing within a metal tube a spirally-formed strip of metal.

425. VALVE GEAR FOR ENGINES, *J. H. Johnson, London.—25th January*, 1883.—*(A communication from G. W. Storer, Philadelphia.)* 8*d*.

This consists mainly in the combination of the inlet and exhaust valves of a steam or other engine with electro-magnets, batteries, or other generators of electricity and a commutator controlled by the engine. Two valve chests are formed on top of the cylinder, and each have an inlet port, one communicating with the front and the other with the rear of the piston in the cylinder. Both chests are connected with the steam inlet pipe, and contain a piston valve to open and close the ports when necessary. Similar chests below the cylinder communicate with the exhaust pipe, and the valves of all of them are actuated by electro-magnets controlled by a battery or other electric generator by means of a commutator on the engine shaft.

427. MANUFACTURE OF FIBROUS MATERIAL APPLICABLE FOR FLOORCLOTH, ROOFING FELT, &c., *C. Weygang, Child's Hill.—25th January*, 1883. 4*d*.

This relates to the manufacture of a fibrous material, consisting of a fibrous mass mixed preferably in the beating engine with a siccative oil, with or without a resinous substance, the oil having been previously reduced to a thick consistency by boiling or otherwise oxidising, and, together with the resinous substance, rendered miscible with water by means of an alkali, and subsequently precipitated in an insoluble condition.

428. FURNACE BARS, &c., *C. J. Chubb, Clifton.—26th January*, 1883. 4*d*.

This consists in forming the fire bars of oval section and perforating them to allow air to have free access to the fuel. These bars are placed transversely to the length of the furnace, and are caused to rotate on their longitudinal axis and cause the fuel to travel to the back of the furnace, the oval form of the bars also imparting a lateral motion to the fuel so as to open it and allow air to pass through. The fuel is fed to the grate from a hopper at front, the bottom of which is formed by some of the rotating fire-bars.

429. METALLIC PENS AND PENHOLDERS, *H. Hewitt, Birmingham.—26th January*, 1883. 6*d*.

The underside of the nibs are provided with projections or flaps to enable more ink to be retained in the pen. The projections or flaps are perforated to allow the ink to flow freely in writing. A channel is formed at the point end of the pen and its convex side is on the concave side of the pen, and its inner end opens into the ink space between the flaps. The point of the pen may be in the form of a minute cup with its convex side downwards, and which cup is divided by the slit in the pen. The penholder is made with an enlarged middle portion to ensure a firm grip of the fingers, and also to prevent the pen touching and inking the table or other surface when put down.

430. STRINGING AND TUNING PIANOFORTES, *C. F. Southack, London.—26th January*, 1883. 6*d*.

Each string is connected to a block capable of screw adjustment on a base-plate connected to the iron frame or wrest plank, and a metal tongue or arm bears on each wire, and is acted upon by a screw so as to regulate the pressure.

431. INKSTANDS, *F. E. Godwin, Gloucester.—26th January*, 1883.—*(Not proceeded with.)* 2*d*.

This consists in arranging three or more ink-holders, so that either one can be brought under the dipping aperture.

432. WEFT FORKS AND HOLDERS EMPLOYED IN LOOMS FOR WEAVING, *W. B. White, Colne, Lancashire.—26th January*, 1883. 6*d*.

The forks are made of sheet metal, preferably steel, which is ground before the fork is cut out or formed. The central bearing is formed by a bar of cast malleable metal, with flanges at each end and projecting pins, the bar being secured to the fork by rivetting. The holder on which the fork is mounted has an adjustable instead of a fixed bearing.

433. AIR EXTRACTING APPARATUS, *T. Rowan, London.—26th January*, 1883. 6*d*.

The object is to provide an air extractor for railway and other carriages, or for ships, or for ventilating pipes, whereby the forward motion of the carriage or ship, or the natural action of the wind, will produce an induced current, whereby the air from the interior of the carriage, or ship, or otherwise, will be extracted in a more simple and efficient manner than hitherto.

434. TREATING SEWAGE WATER, &c., *J. Young, Kelly, N.B.—26th January*, 1883. 6*d*.

The vessels in which the sewage water is treated are arranged so that the water can flow continuously through the series.

435. VENTILATION OF APARTMENTS, &c., *A. R. Holland, Westminster.—26th January*, 1883. 6*d*.

This consists in forming openings in the meeting rails of sash windows and fitting them with covers capable of being raised to a smaller or greater extent as required.

436. APPLIANCES TO BE EMPLOYED IN CONNECTION WITH CHIMNEYS OR CHIMNEY POTS FOR PREVENTING DOWN DRAUGHTS IN CHIMNEYS, &c., *W. Lord, Middlesbrough.—26th January*, 1883.—*(Not proceeded with.)* 2*d*.

A central tube is fixed in the chimney-pot and on it is fixed one or more tubes overlapping each other, the spaces between them being divided into inclined channels, and above the highest tube a flat top is placed.

437. TUBE SCRAPERS OR CLEANERS, *W. S. Turner, Walworth.—26th January*, 1883. 4*d*.

Two bent arms carry a scraper of conical form, the front of which is turned outwards and forms the cutting edge. Between the arms a spring is placed and presses them outwards.

438. MANUFACTURE OF PHOSPHATES, *S. G. Thomas and T. Twynam, London.—26th January*, 1883. 4*d*.

This consists in treating metallurgical slags containing phosphoric acid by first dissolving them in hydrochloric acid, and precipitating the phosphoric acid in combination with oxide of iron, and then decomposing the iron phosphate by excess of sulphuric acid.

439. STANDS AND STRIKING MECHANISM FOR ALARUMS AND OTHER TIMEKEEPERS, *A. M. Clark, London.—26th January*, 1883.—*(A communication from D. Roussialle, Lyons.)* 6*d*.

This relates to a striking mechanism independent of and contained in a pedestal or support for any description of timekeeper, the striking mechanism, although independent of the timekeeper, being so combined therewith as to be actuated thereby at desired moments by a mechanism applied to and operated from the hands arbor of the timekeeper.

440. VELOCIPEDES, &c., *W. T. Shaw, Surbiton, and W. Sydenham, London.—26th January*, 1883. 6*d*.

This relates, First, to the construction of differential gear for velocipedes; Secondly, to the combination with differential gear for driving velocipedes of mechanism for putting this gear out of action when the velocipede is running in a straight course, and for bringing it into action whenever the velocipede is directed in a curved course.

441. COMPOSITION TO BE USED AS A SUBSTITUTE FOR HARD INDIA-RUBBER, CELLULOID, IVORY, &c., *A. M. Clark, London.—26th January*, 1883.—*(A communication from S. Barbier and C. H. Coiffier, Paris.)* 4*d*.

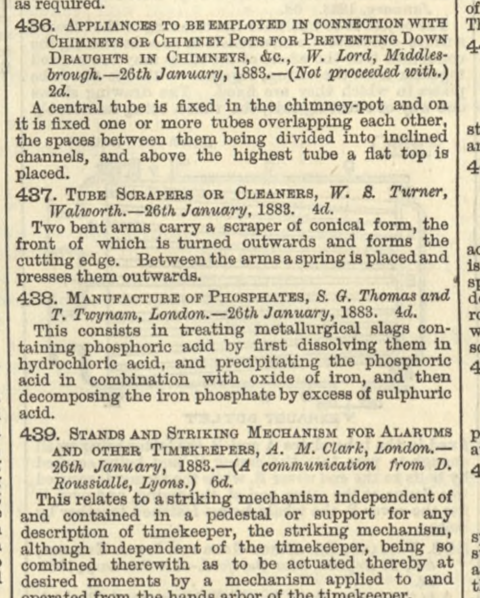
The composition or material consists essentially of a mixture of ivory waste or dust with horn, treated in any suitable manner, but preferably agglutinated by means of egg albumen.

442. APPARATUS FOR COOKING FOOD, &c., *A. F. Link, London.—27th January*, 1883.—*(A communication from F. Desplas, Conques, France.)* 6*d*.

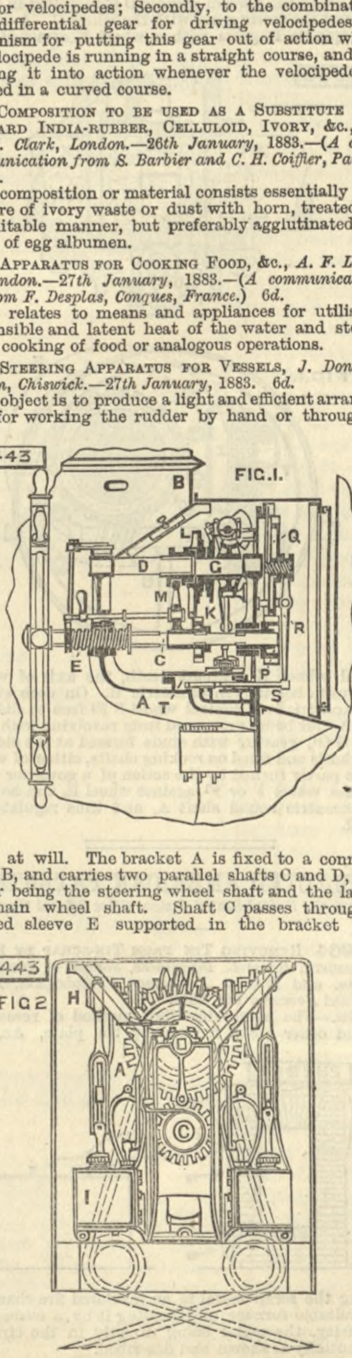
This relates to means and appliances for utilising the sensible and latent heat of the water and steam in the cooking of food or analogous operations.

443. STEERING APPARATUS FOR VESSELS, *J. Donaldson, Chiswick.—27th January*, 1883. 6*d*.

The object is to produce a light and efficient arrangement for working the rudder by hand or through a



motor at will. The bracket A is fixed to a conning tower B, and carries two parallel shafts C and D, the former being the steering wheel shaft and the latter the chain wheel shaft. Shaft C passes through a screwed sleeve E supported in the bracket and



rotating with the shaft, actuating a finger so as to indicate the position of the rudder. On shaft D is a worm wheel G gearing with a worm on the crank shaft H of the engine, the cylinders I of which are arranged on each side of the frame. The chain wheel K is normally free to turn on shaft D, and is formed in one with a spur wheel L and part of a clutch, the other part of which is movable lengthwise on shaft D. On shaft C is an arm M engaging with the clutch, and partaking of the endwise motion of the shaft, so as to throw the coupling in and out of gear. On the end of shaft C is a wheel P capable of revolving with the shaft or remaining stationary, and it gears with a wheel Q having a screwed boss working on a screw on shaft D. R is a forked lever jointed to the bracket A, and taking into a groove in the boss of the wheel Q, and it serves to actuate the reversing distributing valve T by a rod S.

444. MANUFACTURE OF PACKING CASES, &c., *G. H. Ellis, London.—27th January*, 1883.—*(Not proceeded with.)* 2*d*.

The principle is that employed in the tongued metallic paper fastener, or the one familiarly known to mechanics as the tongue and slit.

445. FOLDING LATTICE SHUTTER, *P. Born, London.—27th January*, 1883. 6*d*.

The object is to provide better means for guarding doors and windows, and it consists of a folding lattice shutter applied to the door and window, and provided with a lock to secure it when closed, but which when not in use folds back into the frame and is out of sight.

446. MOTOR MACHINE, *W. E. Gedge, London.—27th January*, 1883.—*(A communication from M. F. D. Cavalerie, Paris.)—(Not proceeded with.)* 2*d*.

This consists, First, in the utilisation as motive power of the weight of two fly-wheels turning upon an oscillating frame at a speed of from one to three revolutions a minute; Secondly, in the utilisation of a third fly-wheel turning upon a fixed point, at a speed of from two to six revolutions a second, as accumulator of motion and as multiplier of the motive power; Thirdly, in the combination of mechanical parts.

447. SCREW SWAGING MACHINES, *F. J. Cheesbrough, Liverpool.—27th January*, 1883.—*(A communication from S. A. Davis and R. Blake, New Jersey, U.S.)* 6*d*.

This relates to improvements in the general construction of the machine, and particularly to the arrangement of the dies.

448. SCREW SWEDGING MACHINES, *F. J. Cheesbrough, Liverpool.—27th January*, 1883.—*(A communication from S. A. Davis and R. Blake, New Jersey, U.S.)* 6*d*.

A vertical cam shaft is arranged in a frame and actuates the swedging dies to which the screw blank is fed by a socket below, so as to bear on the blank. A spindle with a screw driver at its lower end then descends and grips the head of the blank, and by its rotation causes the thread on the blank to be formed, when the dies are actuated so as to release the finished screw.

451. PADDLES TO ASSIST LOCOMOTION IN WATER, *W. Carter, Masham.—27th January*, 1883.—*(Not proceeded with.)* 2*d*.

The paddle consists of a spindle or stem, the upper portion of which forms a handle, and to the lower part are attached two wings or flaps of book-back form.

452. BICYCLE AND TRICYCLE SADDLES, *F. W. Small, Walsall.—27th January*, 1883.—*(Not proceeded with.)* 2*d*.

This consists of a metal support attached to the spring of the bicycle or tricycle, the back of which support is forked, and to this forked end is hinged another forked bar. This bar acts as a support to a thin metal plate which supports the leather saddle, which is rivetted to it.

453. SIDE SADDLES, *W. Winans, Brighton.—27th January*, 1883.—*(Not proceeded with.)* 2*d*.

The object is to prevent the pommels of a lady's side saddle injuring the rider if the horse falls and rolls on her, and it consists in so connecting them with the saddle that they will fall down when pressure is brought to bear on them, and will spring upright when such pressure is removed.

454. CIRCUITS AND APPARATUS FOR ELECTRIC TEMPERATURE AND PRESSURE INDICATORS, *W. P. Thompson, Liverpool.—27th January*, 1883.—*(A communication from R. Hewett and C. L. Clarke, New York, U.S.)* 10*d*.

Relates to apparatus for indicating at any required station variations in the temperature or pressure exerted by fluids, &c., at distant points. The indications are caused by a movable contact arm, actuated by the expansion or contraction of a thermometer, traversing a series of contacts, corresponding in number to the divisions of the thermometric scale.

455. APPARATUS FOR HOLDING AND DELIVERING TICKETS, PACKETS, &c., *T. H. Harper, Redditch.—27th January*, 1883. 6*d*.

This relates to the manufacture of cabinets or receptacles consisting of one or more shelves divided into compartments, and closed by hanging or other lids or doors.

456. KILNS FOR DRYING MALT, &c., *P. R. Norton, Dublin.—27th January*, 1883. 6*d*.

The kiln is formed with two floors one above the other, the malt being first placed on the top floor and then falling to the floor beneath.

457. FASTENINGS FOR DOORS, *A. Arnott, Wandsworth.—27th January*, 1883.—*(Not proceeded with.)* 2*d*.

This relates to the use of a spring lever or tumbler, against which the bolt is brought to bear when shot, and which is hinged, so that when a certain pressure is brought to bear on one side of the door it will yield, but no amount of pressure on the other side of the door will allow it to open unless the bolt be withdrawn by actuating the lock.

459. SELF-ACTING COUPLINGS, &c., *W. Stableford, Oldbury.—27th January*, 1883. 10*d*.

The buffer head is formed on the outer end of the draw-bar, and its face is composed of a central hook and two side wings between which the shackle can rest when in a downward position, the shackle being loosely pinned to the draw-bar behind the buffer head and can be lifted so as to clear it. The outer end has an inclined lip to ride against the face of the hook of the next carriage and automatically couple the two together. A second arrangement is also described.

461. PRODUCTION OF CARBURETTED AIR FOR LIGHTING, HEATING, &c., *H. H. Lake, London.—27th January*, 1883.—*(A communication from J. Blondel, jun., France.)* 6*d*.

The apparatus for bringing air into the carburetter consists of two air holders, one of which descends in order to force air into the carburetter, and when in its lowest position a cock is opened, and allows the other holder to descend, while the first rises again. The air is converted into gas by circulating round a woollen or other cloth arranged spirally, and to which the liquid hydro-carbon is supplied by the capillary attraction of the fabric.

462. MACHINERY OR APPARATUS FOR BINDING SHEAVES OR TRUSSES, *J. Howard and E. T. Bousfield, Bedford.—27th January*, 1883. 8*d*.

This relates to improvements in binding mechanism of the class described in specification dated 22nd September, 1881, No. 4092, and specification dated 26th August, 1882, No. 4093, and has for its object the simplification and increased efficiency of parts of such mechanism, and also the adaptation thereof in a modified form to the purpose of binding and tying straw into trusses as the same is delivered from a threshing machine.

463. AXLE BOXES, *F. Wirth, Germany.—27th January*, 1883.—*(A communication from Messrs. Dick and Kirschten, Germany.)* 6*d*.

This consists in fixing axle-boxes on axles by means of a ring serving as a nut, and having a flange and an octagon head to turn the ring by a spanner. Inside the head teeth are formed, and gear with teeth on a sleeve, which can be moved without being turned on a projection of the axle, and is secured by a pin or cotter.

carriages being constructed with corresponding wheels and provided with electro-motor engines. The top rail serves as a lateral guide and current conductor, the current being collected by brushes or elastic contact wheels.

396. PULPING COFFEE BERRIES, *W. Walker, London.—24th January*, 1883.—(*A communication from Messrs. Arens Irmaos, Brazil.*) 6d.

The berries pass between a cylinder or drum with a roughened surface, and an upper and lower plate arranged on one side, the upper plate being formed of a number of elastic plates or keys arranged closely side by side, and capable of yielding to allow hard substances to pass, and yet offer the requisite resistance to effect the proper pulping of the ripe berries.

397. ELECTRIC LIGHTING, *J. Cooper, London.—24th January*, 1883. 2d.

The incandescent part of a lamp is composed of a stick of carbon enclosed in a tube of alumina.

398. LATHES FOR CUTTING SCREWS, &c., *F. Wirth, Germany.—24th January*, 1883.—(*A communication from H. Voigt and W. Braun, Germany.*)—(*Not proceeded with.*) 2d.

This relates to an automatic universal screw-cutting and turning lathe, the object being to produce screws and other articles of different sizes without loss of time, from bars of different materials.

399. IMPERMEABLE COATING FOR WATERPROOFING, &c., *L. A. Groth, London.—24th January*, 1883.—(*A communication from N. Bellefroid, Belgium.*) 4d.

This consists in a solution of stearine pitch, which must first be completely oxidised by exposure to the air, and then dissolved by boiling it with water and caustic soda.

401. EXPRESSING JUICE FROM SUGAR CANE, *W. L. Wise, London.—24th January*, 1883.—(*A communication from La Société Anonyme des Anciens Etablissements Cail, Paris.*) 6d.

This consists in forming the frame of sugar-cane mills of wrought iron or wrought iron and steel, whereby the distance apart of the two bottom rollers may be diminished, and a corresponding reduction in the width of the cane or trash guide effected. The vertical thrust against the top roll is sustained at each end by two bolts, screwed into a steel collar, rivetted between the plates of the frame, and enclosing the roll bearing. The horizontal thrust against the lower rolls is similarly sustained by four screw bolts, passing through the frames and through caps of the bearings, and the vertical thrust is sustained by the wrought iron framing. A wrought iron girder supports the trash guide, and it can be adjusted by means of a screwed rod without stopping the mill.

402. ELEVATED SINGLE-LINE RAILWAYS AND CARRIAGES THEREFOR, *A. M. Clark, London.—24th January*, 1883.—(*A communication from H. Carpentier, Paris.*) 8d.

The object is to increase the width of the rolling surface in order to diminish the wear of the wheel, and to provide an improved wheel and rail. The rail is made in two parts with a groove between, and the wheel has a central flange to run in the groove, and a tread on each side to bear on the two heads of the rail. The wheel may be provided with lateral steadying rollers and couplings to connect carriages together.

404. DISCHARGING OR TRANSFERRING MATERIALS RAISED BY DREDGING, EXCAVATING, AND OTHER ELEVATING MACHINERY, &c., *A. M. Clark, London.—25th January*, 1883.—(*A communication from La Compagnie Nationale de Travaux Publics, Paris.*) 8d.

This consists essentially of an endless apron of caoutchouc travelling over end drums, and formed with raised edges, for the purpose of discharging and transferring materials raised by dredging and other elevating machinery, a brush being provided to clean the apron at the discharge end.

405. INSULATORS FOR TELEGRAPH POSTS, &c., *P. R. de Fauchoux d'Humy, London.—25th January*, 1883. 6d.

Fixed to, but insulated from the post is a metal frame, to which the insulators are attached. The insulators consist of an earthenware slab formed with a number of perforations, through each of which a wire is passed.

406. MATERIAL TO BE USED AS A CARPET LINING, *A. Bruckner, London.—25th January*, 1883. 2d.

The object is to provide a lining which will better protect the carpet from unevenness of the flooring and from dust, whilst the elasticity of the carpet under the foot is greatly increased, such lining being composed of paper or fabric covered with glue, on to which a layer of cork waste or granulated cork is distributed.

407. OPERATING TRAMWAY POINTS, *F. A. Abeleven, Amsterdam.—25th January*, 1883. 6d.

Part of the roadway is mounted on a rocking frame, which, by a system of levers, is connected to the point to be shifted, and the driver by pulling the horses to one side or the other shifts the rocking frame and so operates the point as desired.

408. STEAM AND OTHER PISTONS, *A. MacLaine, Belfast.—25th January*, 1883. 6d.

This relates to elastic metallic packings with a double expansion movement. The piston is fitted with two or more metal rings cut through in one or more places, and with a wave spring inserted between the rings to hold them tightly in the piston, and a coil spring inserted between the ends of the rings where cut to press the ends apart and expand the rings circumferentially.

409. SEWING MACHINES, *I. Nasch, London. — 25th January*, 1883. 6d.

This relates chiefly to improvements on the attachment to sewing machines for making button-holes, over-seaming, herring-bone stitching, and the like, described in patent No. 4520, A.D. 1882, the object being to enable the attachment to be readily disconnected so as to put it out of action; it further relates to bending the needle; and, lastly, to improvements in the needle plate of sewing machines. To disconnect the attachment a lever is caused to act upon a pawl by which the attachment is actuated. The needle slot in the shuttle race is inclined so as to bend the needle to bring the loop in such a position that the shuttle can pass through it. The needle plate is provided with a removable projection or guide, which is inserted and fixed in position when stitching button-holes or over-seaming, and is removed when doing ordinary sewing.

410. SMOKING PIPE, *R. C. Christian, Dublin.—25th January*, 1883. 4d.

The bowl consists of an outer and an inner chamber with an intermediate space, closed at top, where the two are secured together. A conical passage leads from the bottom of the inner chamber to a vessel below the outer chamber, and in which any oily matter collects. Three slanting holes in the inner chamber put it in communication with the intermediate space into which the bore of the pipe stem also opens.

411. PERAMBULATORS, *C. Thompson, London.—25th January*, 1883.—(*Not proceeded with.*) 2d.

This consists in mounting the carriage frame on the under frame, so that it can be turned round by means of suitable gearing actuated by a handle at the back of the carriage.

412. BITS OR CUTTERS FOR BORING AND TURNING METALS, &c., *J. W. Ball, Cardiff.—25th January*, 1883.—(*Not proceeded with.*) 2d.

This consists, First, of a cylindrical piece of steel with a hole through its centre to receive the boring bar, and the outer periphery of which is formed with a number of grooves running spirally from end to end, and which form the cutting edges; Secondly, in cutting similar grooves as those described on the inside of a cylinder, which is secured to the slide rest of a lathe and used to cut externally.

413. PRINTING MACHINES, *A. Coates, Rawtenstall, Lancashire.—25th January*, 1883. 6d.

The object is to enable the printing rollers to be set more easily. A face worm wheel is secured to the printing roller by a key, and is fitted loosely into the spur or box wheel. A worm is held in brackets attached to a large washer fastened to the face of the spur or box wheel and gears with the worm wheel, so that by turning the worm the pitch or position of the printing roller can be adjusted.

414. GRINDING, POLISHING, OR FACING STONE, GLASS, SLATE, &c., *G. and A. Coates, Rawtenstall, Lancashire.—25th January*, 1883. 6d.

The stones are laid on a bed, and an upright shaft is caused to revolve and has arms projecting over the bed, and which carry a top layer of stones moving in contact with the first. Each stone of the top layer is carried by a shaft at the end of one of the arms, and which is driven from the main shaft by gearing, so as to cause the stone to turn on its axis at the same time that it is carried round over the lower stones.

416. HAMMERS, *F. Wirth, Frankfort.—25th January*, 1883.—(*A communication from G. Speckhart and H. Wiedmann, Nürnberg.*) 6d.

The main feature of the invention is a straight flat bar or spring of elastic material, such as steel, which constitutes the stem of the haft, and the upper end of which is only sufficiently less wide than the diameter of the hole in the hammer head, to allow of its being passed through the said hole. It having been passed through, it is hammered out or rivetted on to the head, and wedges are driven on each side into the hole of the hammer head, and are then bolted to the stem through a hole provided for the purpose.

417. SCRAPING, PEELING, PARING, AND SLICING POTATOES, &c., *T. Marshall, Mile End.—25th August*, 1883.—(*A communication from J. B. Carter, New Jersey, U.S.*)—(*Not proceeded with.*) 2d.

A tapered tube of metal has a longitudinal slot near its smaller end, and is provided with a steel blade set at an angle to the slot, so that its cutting edge projects.

418. RAILWAY CHAIRS, &c., *W. Hopkins and C. Turner, Birmingham.—25th January*, 1883.—(*Not proceeded with.*) 2d.

In one modification the chair is made with one loose jaw, and the body parts of both jaws are made with opposite bolt holes, and the opposite faces of the jaws are made with recesses fitted with blocks of wood, which grasp each side of the web of the rail. A bolt formed with a key piece near one end is then passed through the said bolt holes and turned so that its key piece is outside one jaw; the two jaws are then nipped between the head and key of the bolt, and the rail is thus firmly held.

419. BARRELS OR CASKS, &c., *F. Myers, New York.—25th January*, 1883. 10d.

This relates to the general construction of machines for making barrels or casks, and comprises an improved method for bulging the staves as they are fed to and before they reach stave supporting or retaining discs, used instead of the ordinary barrel former; feeding mechanism for the staves; mechanism for withdrawing the stave-supporting discs when the barrel is formed; sliding truss hoop carriers and mechanism to place the hoops on the barrel and press them firmly on, and then to withdraw the carriers; also elastic cushions between the truss hoops and carriers to allow the hoops to yield; also a machine to cut the staves to the required length, and various details of construction.

420. LAMPS, &c., *T. Cooper, Great Ryburgh.—25th January*, 1883.—(*Not proceeded with.*) 4d.

This relates to the construction of lamps or apparatus for producing light and heat by the combustion of gaseous fluids, such as air impregnated with hydrocarbon, either in the presence of refractory material which is raised to incandescence, or without the same, the production of the combustible vapour and its admixture with the requisite quantity of air being effected by the action of the lamp itself.

421. RAILWAY SIGNALS, *J. H. Cureton, London.—25th January*, 1883. 6d.

The object is to signal drivers of trains in foggy weather, and it consists of a triangular block placed between the rails and actuated by the signal lever, so as to come in contact with a tongue suspended from the engine and strike a gong thereon when the signal is at danger. An indicator disc is also actuated at the same time as the block and is attached to the signal post near the ground.

422. UNIVERSAL PENHOLDER, *T. Nordenfelt, London.—25th January*, 1883. — (*A communication from Lieut. Ferraccin, Venice.*)—(*Not proceeded with.*) 2d.

A penholder to hold metallic pens of all sizes is constructed by inserting and fixing within a metal tube a spirally-formed strip of metal.

425. VALVE GEAR FOR ENGINES, *J. H. Johnson, London.—25th January*, 1883.—(*A communication from G. W. Storer, Philadelphia.*) 8d.

This consists mainly in the combination of the inlet and exhaust valves of a steam or other engine with electro-magnets, batteries, or other generators of electricity and a commutator controlled by the engine. Two valve chests are formed on top of the cylinder, and each have an inlet port, one communicating with the front and the other with the rear of the piston in the cylinder. Both chests are connected with the steam inlet pipe, and contain a piston valve to open and close the ports when necessary. Similar chests below the cylinder communicate with the exhaust pipe, and the valves of all of them are actuated by electro-magnets controlled by a battery or other electric generator by means of a commutator on the engine shaft.

427. MANUFACTURE OF FIBROUS MATERIAL APPLICABLE FOR FLOORCLOTH, ROOFING FELT, &c., *C. Weygang, Child's Hill.—26th January*, 1883. 4d.

This relates to the manufacture of a fibrous material, consisting of a fibrous mass mixed preferably in the beating engine with a siccative oil, with or without a resinous substance, the oil having been previously reduced to a thick consistency by boiling or otherwise oxidising, and, together with the resinous substance, rendered miscible with water by means of an alkali, and subsequently precipitated in an insoluble condition.

428. FURNACE BARS, &c., *C. J. Chubb, Clifton.—26th January*, 1883. 4d.

This consists in forming the fire bars of oval section and perforating them to allow air to have free access to the fuel. These bars are placed transversely to the length of the furnace, and are caused to rotate on their longitudinal axis and cause the fuel to travel to the back of the furnace, the oval form of the bars also imparting a lateral motion to the fuel so as to open it and allow air to pass through. The fuel is fed to the grate from a hopper at front, the bottom of which is formed by some of the rotating fire-bars.

429. METALLIC PENS AND PENHOLDERS, *H. Hewitt, Birmingham.—26th January*, 1883. 6d.

The underside of the nibs are provided with projections or flaps to enable more ink to be retained in the pen. The projections or flaps are perforated to allow the ink to flow freely in writing. A channel is formed at the point end of the pen and its convex side is on the concave side of the pen, and its inner end opens into the ink space between the flaps. The point of the pen may be in the form of a minute cup with its convex side downwards, and which cup is divided by the slit in the pen. The penholder is made with an enlarged middle portion to ensure a firm grip of the fingers, and also to prevent the pen touching and inking the table or other surface when put down.

430. STRINGING AND TUNING PIANOFORTES, *C. F. Southack, London.—26th January*, 1883. 6d.

Each string is connected to a block capable of screw adjustment on a base-plate connected to the iron frame or wrest plank, and a metal tongue or arm bears on each wire, and is acted upon by a screw so as to regulate the pressure.

431. INKSTANDS, *F. E. Godwin, Gloucester.—26th January*, 1883.—(*Not proceeded with.*) 2d.

This consists in arranging three or more ink-holders, so that either one can be brought under the dipping aperture.

432. WEFT FORKS AND HOLDERS EMPLOYED IN LOOMS FOR WEAVING, *W. B. White, Colne, Lancashire.—26th January*, 1883. 6d.

The forks are made of sheet metal, preferably steel, which is ground before the fork is cut out or formed. The central bearing is formed by a bar of cast malleable metal, with flanges at each end and projecting pins, the bar being secured to the fork by rivetting. The holder on which the fork is mounted has an adjustable instead of a fixed bearing.

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This relates, First, to the construction of differential gear for velocipedes; Secondly, to the combination with differential gear for driving velocipedes of mechanism for putting this gear out of action when the velocipede is running in a straight course, and for bringing it into action whenever the velocipede is directed in a curved course.

441. COMPOSITION TO BE USED AS A SUBSTITUTE FOR HARD INDIA-RUBBER, CELLULOID, IVORY, &c., *A. M. Clark, London.—26th January*, 1883.—(*A communication from S. Barbier and C. H. Coiffier, Paris.*) 4d.

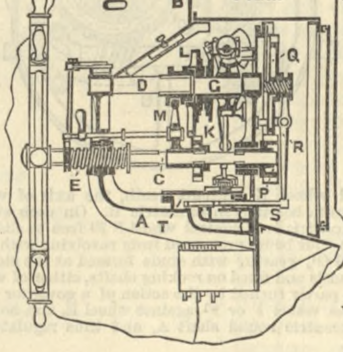
The composition or material consists essentially of a mixture of ivory waste or dust with horn, treated in any suitable manner, but preferably agglutinated by means of egg albumen.

442. APPARATUS FOR COOKING FOOD, &c., *A. F. Link, London.—27th January*, 1883.—(*A communication from F. Desplas, Conques, France.*) 6d.

This relates to means and appliances for utilising the sensible and latent heat of the water and steam in the cooking of food or analogous operations.

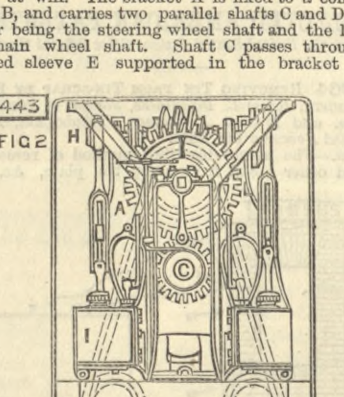
443. STEERING APPARATUS FOR VESSELS, *J. Donaldson, Chiswick.—27th January*, 1883. 6d.

The object is to produce a light and efficient arrangement for working the rudder by hand or through a



443 FIG. 1.

motor at will. The bracket A is fixed to a conning tower B, and carries two parallel shafts C and D, the former being the steering wheel shaft and the latter the chain wheel shaft. Shaft C passes through a screwed sleeve E supported in the bracket and



443 FIG. 2

rotating with the shaft, actuating a finger so as to indicate the position of the rudder. On shaft D is a worm wheel G gearing with a worm on the crank shaft H of the engine, the cylinders I of which are arranged on each side of the frame. The chain wheel K is normally free to turn on shaft D, and is formed in one with a spur wheel L and part of a clutch, the other part of which is movable lengthwise on shaft D. On shaft C is an arm M engaging with the clutch, and partaking of the endwise motion of the shaft, so as to throw the coupling in and out of gear. On the end of shaft C is a wheel P capable of revolving with the shaft or remaining stationary, and it gears with a wheel Q having a screwed boss working on a screw on shaft D. R is a forked lever jointed to the bracket A, and taking into a groove in the boss of the wheel Q, and it serves to actuate the reversing distributing valve T by a rod S.

444. MANUFACTURE OF PACKING CASES, &c., *G. H. Ellis, London.—27th January*, 1883.—(*Not proceeded with.*) 2d.

The principle is that employed in the tongued metallic paper fastener, or the one familiarly known to mechanics as the tongue and slit.

445. FOLDING LATTICE SHUTTER, *P. Born, London.—27th January*, 1883. 6d.

The object is to provide better means for guarding doors and windows, and it consists of a folding lattice shutter applied to the door and window, and provided with a lock to secure it when closed, but which when not in use folds back into the frame and is out of sight.

446. MOTOR MACHINE, *W. E. Gedge, London.—27th January*, 1883.—(*A communication from M. F. D. Cavalerie, Paris.*)—(*Not proceeded with.*) 2d.

This consists, First, in the utilisation as motive power of the weight of two fly-wheels turning upon an oscillating frame at a speed of from one to three revolutions a minute; Secondly, in the utilisation of a third fly-wheel turning upon a fixed point, at a speed of from two to six revolutions a second, as accumulator of motion and as multiplier of the motive power; Thirdly, in the combination of mechanical parts.

447. SCREW SWAGING MACHINES, *F. J. Cheesbrough, Liverpool.—27th January*, 1883.—(*A communication from S. A. Davis and R. Blake, New Jersey, U.S.*) 6d.

This relates to improvements in the general construction of the machine, and particularly to the arrangement of the dies.

448. SCREW SWEDGING MACHINES, *F. J. Cheesbrough, Liverpool.—27th January*, 1883.—(*A communication from S. A. Davis and R. Blake, New Jersey, U.S.*) 6d.

A vertical cam shaft is arranged in a frame and actuates the swedging dies to which the screw blank is fed by a socket below, so as to bear on the blank. A spindle with a screw driver at its lower end then descends and grips the head of the blank, and by its rotation causes the thread on the blank to be formed, when the dies are actuated so as to release the finished screw.

451. PADDLES TO ASSIST LOCOMOTION IN WATER, *W. Carter, Masham.—27th January*, 1883.—(*Not proceeded with.*) 2d.

The paddle consists of a spindle or stem, the upper portion of which forms a handle, and to the lower part are attached two wings or flaps of book-back form.

452. BICYCLE AND TRICYCLE SADDLES, *F. W. Small, Walsall.—27th January*, 1883.—(*Not proceeded with.*) 2d.

This consists of a metal support attached to the spring of the bicycle or tricycle, the back of which support is forked, and to this forked end is hinged another forked bar. This bar acts as a support to a thin metal plate which supports the leather saddle, which is rivetted to it.

453. SIDE SADDLES, *W. Winans, Brighton.—27th January*, 1883.—(*Not proceeded with.*) 2d.

The object is to prevent the pommels of a lady's side saddle injuring the rider if the horse falls and rolls on her, and it consists in so connecting them with the saddle that they will fall down when pressure is brought to bear on them, and will spring upright when such pressure is removed.

454. CIRCUITS AND APPARATUS FOR ELECTRIC TEMPERATURE AND PRESSURE INDICATORS, *W. P. Thompson, Liverpool.—27th January*, 1883.—(*A communication from R. Hewett and C. L. Clarke, New York, U.S.*) 10d.

Relates to apparatus for indicating at any required station variations in the temperature or pressure exerted by fluids, &c., at distant points. The indications are caused by a movable contact arm, actuated by the expansion or contraction of a thermometer, traversing a series of contacts, corresponding in number to the divisions of the thermometric scale.

455. APPARATUS FOR HOLDING AND DELIVERING TICKETS, PACKETS, &c., *T. H. Harper, Redditch.—27th January*, 1883. 6d.

This relates to the manufacture of cabinets or receptacles consisting of one or more shelves divided into compartments, and closed by hanging or other lids or doors.

456. KILNS FOR DRYING MALT, &c., *P. R. Norton, Dublin.—27th January*, 1883. 6d.

The kiln is formed with two floors one above the other, the malt being first placed on the top floor and then falling to the floor beneath.

457. FASTENINGS FOR DOORS, *A. Arnott, Wandsworth.—27th January*, 1883.—(*Not proceeded with.*) 2d.

This relates to the use of a spring lever or tumbler, against which the bolt is brought to bear when shot, and which is hinged, so that when a certain pressure is brought to bear on one side of the door it will yield, but no amount of pressure on the other side of the door will allow it to open unless the bolt be withdrawn by actuating the lock.

459. SELF-ACTING COUPLINGS, &c., *W. Stableford, Oldbury.—27th January*, 1883. 10d.

The buffer head is formed on the outer end of the draw-bar, and its face is composed of a central hook and two side wings between which the shackle can rest when in a downward position, the shackle being loosely pinned to the draw-bar behind the buffer head and can be lifted so as to clear it. The outer end has an inclined lip to ride against the face of the hook of the next carriage and automatically couple the two together. A second arrangement is also described.

461. PRODUCTION OF CARBURETTED AIR FOR LIGHTING, HEATING, &c., *H. H. Lake, London.—27th January*, 1883.—(*A communication from J. Blondel, jun., France.*) 6d.

The apparatus for bringing air into the carburetter consists of two air holders, one of which descends in order to force air into the carburetter, and when in its lowest position a cock is opened, and allows the other holder to descend, while the first rises again. The air is converted into gas by circulating round a woollen or other cloth arranged spirally, and to which the liquid hydro-carbon is supplied by the capillary attraction of the fabric.

462. MACHINERY OR APPARATUS FOR BINDING SHEAVES OR TRUSSES, *J. Howard and E. T. Bousfield, Bedford.—27th January*, 1883. 8d.

This relates to improvements in binding mechanism of the class described in specification dated 22nd September, 1881, No. 4092, and specification dated 26th August, 1882, No. 4093, and has for its object the simplification and increased efficiency of parts of such mechanism, and also the adaptation thereof in a modified form to the purpose of binding and tying straw into trusses as the same is delivered from a threshing machine.

463. AXLE BOXES, *F. Wirth, Germany.—27th January*, 1883.—(*A communication from Messrs. Dick and Kirschten, Germany.*) 6d.

This consists in fixing axle-boxes on axles by means of a ring serving as a nut, and having a flange and an octagon head to turn the ring by a spanner. Inside the head teeth are formed, and gear with teeth on a sleeve, which can be moved without being turned on a projection of the axle, and is secured by a pin or cotter.

464. Indices for Gas and Water Meters, &c., *S. Grey, Chelsea.—27th January*, 1883. 6*d*.

As applied to a dry gas meter index, this consists of a metal frame with a spindle and pinion connected at one end to the shaft receiving motion from the meter, and the other end carrying a pointer moving over a dial. The spindle carries a pinion with six leaves gearing with a wheel with thirty teeth carried by a second spindle carrying also a wheel with one long tooth and two spaces, the remainder of the periphery being plain. A third spindle carries two wheels, the front one having ten notches to receive the long teeth of the last wheel. Between each of the notches is a hollow to receive a part of the plain portion of the periphery of the wheel with one tooth, while the outer extremities of the hollow bear against the periphery, so as to lock the wheel on the third spindle except when the long tooth is in action. The other wheel on the third spindle has a plain periphery, and a long tooth and two spaces, and beneath are two other similar wheels. There is a fourth pair of wheels of similar construction, and another wheel with ten notches and hollows.

465. Separation of Lime from Crude Phosphates, &c., *H. H. Lake, London.—27th January*, 1883.—(*A communication from E. Winkelhofer, Austria.*)—(*Not proceeded with.*) 2*d*.

This relates to the elimination or separation of lime from raw or crude phosphates containing the same or carbonate of lime, and from solutions used in the treatment of the said phosphates.

466. Manufacture of Varnishes, *A. M. Clark, London.—27th January*, 1883.—(*A communication from La Compagnie Générale de Chromolithie, Paris.*)—(*Not proceeded with.*) 2*d*.

The base or primary ingredient is composed of paper treated with nitro-sulphuric acid, 102 parts (by weight); camphor dissolved in alcohol at 96 deg., 32 to 36 parts. These are worked together in a mixer heated to from 50 deg. to 60 deg. Centigrade, until brought to the desired consistence. The varnish is composed of—the primary ingredient, 1 kilo.; pure acetic ether, 2 kilos.; sulphuric ether at 65 deg., 250 grammes; castor oil, 50 to 100 grammes; Venetian turpentine, 150 to 250 grammes; methylated alcohol at 96 deg., 7½ litres; acetate of amyle, 10 grammes; pure crystallisable acetic acid, 200 grammes.

467. Reflectors, or Reflecting Lamp Shades or Globes, *H. H. Lake, London.*—(*A communication from J. Oertel and Co., Bohemia.*)—(*Not proceeded with.*) 2*d*.

This consists in coating the outside of glass shades with a solution of nitrate of silver, so as to convert the inside surface into mirrors to reflect the rays of light from the burner.

468. Velocipedes, *W. Jeans, Christchurch, Hants.—29th January*, 1883.—(*Not proceeded with.*) 2*d*.

The axle of one wheel of a tricycle is provided with a pinion, and is connected to the other wheel with a sleeve encircling the first axle and extending from the bearing of the second to the pinion where it terminates in an internal toothed wheel concentric with the pinion, with which it gears through an intermediate pinion on a stud projecting from a brake drum, which encloses the gearing, and is fixed to another sleeve encircling the first, and extending from the drum to the bearing at the opposite side, where it is provided with another brake drum. Rings are fitted to smaller drums fixed to the outer sleeve, and each ring has a lug to receive a pin forming the fulcrum of a lever, one arm of which is connected to one of the treadles. A chain or cord is attached to the other arm and passes round pulleys on an adjustable frame.

469. Drying Apparatus for Meat, &c., *E. A. Brydges, Berlin.—29th January*, 1883.—(*A communication from D. Grove, Berlin.*) 6*d*.

The object is to dry or aerify meat and other substances in a rapid, rational manner, by employing heated air.

470. Governors for Steam and other Fluid Pressure Engines, *C. J. Galloway and J. H. Beckwith, Manchester.—29th January*, 1883. 6*d*.

This relates to improvements on patent No. 2439, A.D. 1871, in which the balls of the governor are in the form of rollers borne down by a heavy transverse bar. On top of a vertical rotating spindle is fixed a crosshead, to each end of which a pair of pendant links is jointed carrying a roller at the lower end. A sleeve fits over the spindle and slides on a feather, such sleeve being formed with two heavy arms, each extending over the rollers between the suspending links. The underside of each arm which bears on the roller below it is concavely curved downwards towards its extremity. The sleeve has collars at its lower end to receive the fork of the regulating lever between them.

471. Revolving Flat Carding Engines, *J. M. Hetherington, Manchester.—29th January*, 1883. 6*d*.

This relates particularly to the elastic bends which carry the travelling chain of flats, and it consists in forming them truly concentric with the circumference of the carding cylinder by means of a cutter or grinding wheel fixed on the main cylinder and rotating with it, and being driven by suitable means, so as to act upon the bend which has been placed in position, until the whole of its periphery has been trued up.

472. Distillation, *J. F. Lackersteen, Greenwich.—29th January*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to distil alcohol and other products at a lower temperature than usual, and it consists in passing the vapour from the still into a vacuum space, where it is condensed, while at the same time the vapour so condensed is being drawn off by means of a hydrostatic balance tube and a vacuum maintained during the process.

473. Manufacture of Porcelain Fire-clay Baths, *J. Hall, Stourbridge.—29th January*, 1883. 4*d*.

This consists in making porcelain fire-clay baths with an outside enamel or glaze.

474. Tube Expanders with Self-expanding Roller Boxes, *G. Lohf, Berlin.—29th January*, 1883.—(*Not proceeded with.*) 2*d*.

This consists in providing every roller with a separate casing, which are so connected together as to form an expansible mechanism actuated by a conical mandril which is driven between the rollers.

475. Gas Cooking Stoves, *J. Russell, Reading.—29th January*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to improvements in gas cooking stoves, whereby the gas supply is automatically diminished by being partially turned off on the removal from the oven of the joints or other articles being cooked, and on a joint or other article being placed in the oven the supply of gas is automatically turned on.

476. Looms, *T. Lonsdale, Blackburn.—29th January*, 1883. 4*d*.

This relates to a combination of compound weighting levers and apparatus for controlling the letting off the warp from the warp beam. A regulator is suspended from the back bearer, one part resting on and against the warp, its lower end being connected by a rope passing through guides to a sliding weight mounted upon an inclined lever having its fulcrum in a slotted bracket pendant from back bottom rail. A second lever fulcrumed near the side frame extends to and is connected with the first lever by a pin near its loose end which passes through a slot in the first lever, the pin being adjustable to regulate its distance from the fulcrum of the compound levers. The weighting rope, after passing round the neck of the beam, is held by clip and screw adjustment.

477. Brakes for Wagons, Carts, or other Vehicles, *R. Heaton, Blackburn.—29th January*, 1883.—(*Not proceeded with.*) 2*d*.

This comprises a brake block or blocks of wood secured to an iron rim; the latter is by lugs, pins, and connecting links attached to an arm or projecting part of a hand lever, the fulcrum of the latter being a pin attached to an iron strap or supporting piece under the body of the vehicle.

478. Apparatus connected with Rope Driving and Haulage, *M. H. Smith, Halifax.—29th January*, 1883. 8*d*.

This relates to apparatus wherein a rope is the medium by which power is transmitted or applied in the first case to pulleys constructed in such manner that the portion of the rope encircling, for the time being, part of the circumference of the driving pulley is gripped, as distinguished from mere friction arising from contact of rope and pulley as heretofore.

479. Mills for Shelling and Grinding Oats, Wheat, &c., *G. Perrott, Cork.—29th January*, 1883. 6*d*.

This relates to that class of mill in which millstones are used, and in which the lower stone is fixed horizontally, and the upper stone is driven, and it consists in means for adjusting and driving the stones. To the centre of the runner a cylindrical casting forming an eye is adapted, and has on its periphery vertical ribs and sockets to receive the radial arms of the "stiff inque" or "driver" which is mounted on the end of the mill spindle. Through the ribs screw bolts are inserted and bear on the extremities of the arms, the bolts being fitted with nuts so as to adjust and retain the "runner" in position with respect to the bed stone.

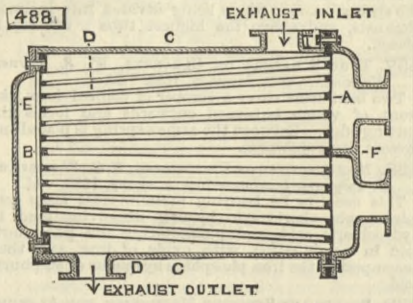
482. Construction of a Secondary Battery or Accumulator of Electricity, *A. L. N olf, Brussels.—29th January*, 1883. 2*d*.

One electrode is a sponge of metallic lead reduced galvanically, the other being formed of "a layer of pure minium." A solution of caustic soda is used for the exciting liquid.

488. Surface Condensers, *H. Guy, West Cowes.—29th January*, 1883. 6*d*.

The object is to facilitate the cleaning of the tubes of surface condensers, and consists in so constructing the condenser that the whole of the tubes may be removed together from the casing, together with the two tube plates in which they are fixed. The drawing shows one way of effecting this, the tubes being immovably

488



fixed in the tube plates A and B, the latter being small enough to pass into the casing C, and being secured by bolts to the end cover E, while the former is secured to a flange at the other end of the casing, and over it fits the cover F, the whole being fastened together by bolts.

556. Variable Expansion Gear for Steam Engines, &c., *T. English, near Dartford.—1st February*, 1883. 6*d*.

A is the engine shaft on which the excentric B which works the cut off or expansion slide is free to revolve, but is prevented moving along the shaft by the collar X and worm wheel C keyed on the shaft. In the body of the excentric a worm spindle D is mounted in bearings, and the worm gears with the wheel C. A pinion Y on spindle D gears with a wheel E attached to a

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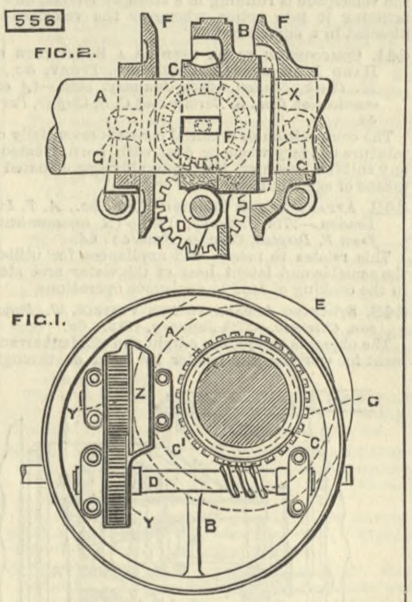

conical wheel Z without teeth, the axis of which revolves in bearings in excentric B. On each side of the excentric is a conical wheel F F[1] free to slide on shaft A, but being prevented from revolving with it by arms G G[1], gearing with studs formed at the sides of the wheels and fixed on rocking shafts, either of which can be partly turned by the action of a governor so as to press wheel F or F[1] against wheel E, and so shift the excentric round shaft A, and thus regulate the cut off.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

282,964. Removing Tin from Tin-scrap by Electricity, *James L. Delaplaine, Joseph G. Hendrickson, and Francis J. Clamer, Philadelphia, Pa.—Filed November 6th*, 1882.

Claim.—The herein-described method of removing tin and other metal from scrap tin, plate, &c., b

282964

placing the scrap metal in an insulated fire chamber in a suitable furnace, and heating it by a current of electricity, the metal being directly in the circuit, substantially as shown and described.

282,967. Expansion Joint, *Thomas W. Duffy, Boston, Mass.—Filed December 4th*, 1882.

Claim.—(1) A transversely-corrugated sheet metal tube, in combination with flanged metallic collars, similarly corrugated internally, surrounding and made fast to the ends of said tube, and adapted to be secured to similar flanges on other tubes, substantially as set forth. (2) A sheet metal tube corrugated spirally, in combination with flanged and spirally-grooved collars applied to the ends thereof by a screw action, said tube being expanded within said collars and faced upon their flanges, for the purpose set

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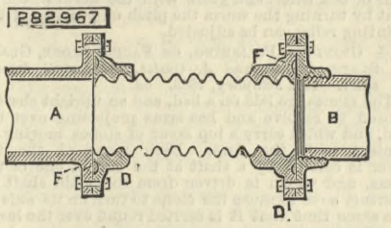

forth. (3) The rigid pipes A B, formed with radial flanges, in combination with the expansible means of connection, consisting in the corrugated tube C and collars D D[1], and the packing rings F, held within grooves in the flanges of the collars, substantially as and for the purpose set forth.

283,064. Steam Pump, *James H. Blessing, Albany, N.Y.—Filed March 11th*, 1882.

Brief.—To avoid or diminish the jar or concussion occasioned by the operation of steam pumps the movement of the water is gradually started and stopped at each end of the stroke. *Claim.*—(1) The combination of an exterior steam piston, open to the cylinder at its opposite ends and containing an interior piston, and an exterior water piston, also open at the ends and containing an interior piston, whereby the interior steam and water pistons are operated before the movement of the exterior steam and water

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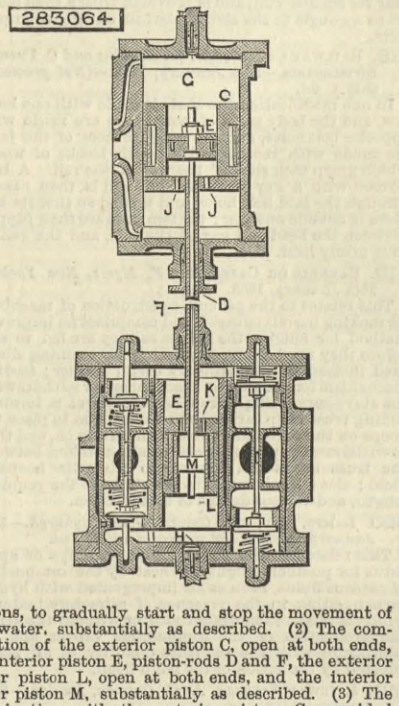

pistons, to gradually start and stop the movement of the water, substantially as described. (2) The combination of the exterior piston C, open at both ends, the interior piston E, piston-rods D and F, the exterior water piston L, open at both ends, and the interior water piston M, substantially as described. (3) The combination with the exterior piston C, provided with ports J, the interior piston E, piston-rods D and F, the exterior water piston L, provided with ports K, the interior water piston M, and the buffers G and H, substantially as shown and described.

283,068. Metallic Packing for Pistons, *James Brandon, New York, N.Y.—Filed December 20th*, 1882.

Claim.—(1) The combination, with the packing ring or rings of the piston in a pumping engine, of vent passages established from the under side of said packing ring or rings to the outer face of the piston, between the rings and piston, to relieve the former from the pressure of the fluid in the cylinder, and

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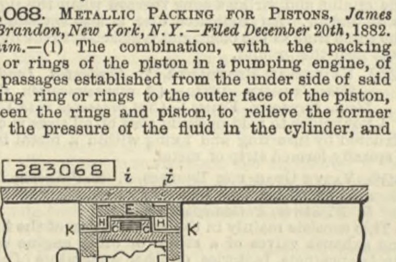

consequent friction, substantially in the manner as herein set forth. (2) The combination, with the expansible piston packing ring E, flanges C C, expanding rings H H, and connecting ports K K, of recesses *i i*, cut on the outer face of the outer edge of the packing ring E, substantially in the manner and for the purpose herein set forth.

283,261. Direct-acting Compound Engine, *Erasmus Darwin Leavitt, Jun., Cambridge, Mass.—Filed June 27th*, 1883.

Claim.—(1) The combination with two compound engines arranged to form the two sides of a duplex

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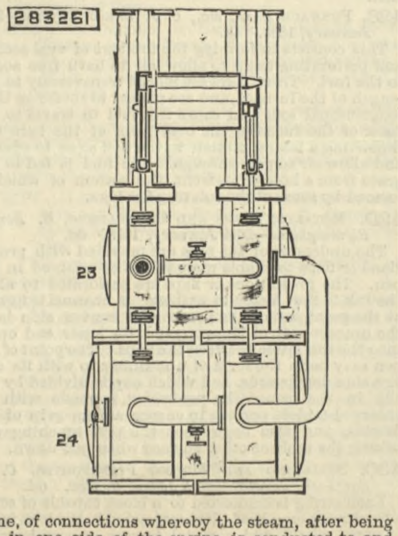

engine, of connections whereby the steam, after being used in one side of the engine, is conducted to and used in the second side of the engine, and then returned to and used in the first side of the engine, substantially as described. (2) The combination, with two compound engines arranged to form the two sides of a duplex engine, of tanks 23, 24, and connections whereby the steam, after being used in one side of the engine, is conducted to and used in the second side of the engine, and then returned to and used in the first side of the engine, substantially as described. (3) The combination, with two compound engines arranged to form the two sides of a duplex engine, of connections whereby the steam, after being used in one side of the engine, is conducted to and used in the second side of the engine, and then returned to and used in the first side of the engine, and means by which each engine actuates the inlet and outlet valves of the other, substantially as described.

283,343. Dynamo-electric Machine, *Edwin J. Houston, Philadelphia, Pa.—Filed December 30th*, 1882.

Claim.—(1) A field-magnet and frame composed of the two diametrically-opposite inwardly-projecting cores K K[1] for the field-magnet coils, having curved pole pieces, and the plain, continuously-curved connecting ribs R, suitably connected at their ends with said cores and free from internal projections, said ribs being curved from their point of connection, so as to bring their sides out of proximity with the field-magnets, as and for the purpose described. (2) The combination, with the cores K K[1], diametrically opposite one another, of a series of curved ribs whose ends are attached to the outer ends of the cores K K[1]. (3) A machine and magnet frame composed of the curved ribs, connected at their ends to the ends of the internally-projecting cores upon which the field-magnet coils are wound, and provided with the feet F. (4) A cylindrical or ovoidal field dynamo-machine frame, with internally projecting magnet cores

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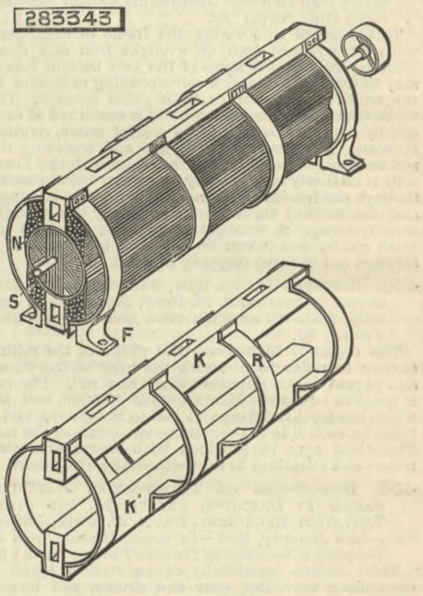


extending toward one another, in combination with separately-attachable pole pieces for said inwardly-projecting cores, as and for the purpose described. (5) The combination, with the magnet cores K K[1], of curved ribs R, provided with flanges W, substantially as described. (6) The combination, with the magnet core K, recessed at *a a*, of the curved rib R and head or flange W, resting in said recess. (7) The combination, with the cores K or K[1] for the field-magnet of a dynamo machine having a groove on its end, of the removable pole piece N and S, having a tongue which enters said groove. (8) The combination, with the core K or K[1] for the field-magnet of a dynamo machine having a groove in its end shaped as described, of a pole piece having a T-shaped tongue and set screws *m m*. (9) The combination, with the armature shaft, of the notched projections and the circumferentially-wound wire. (10) An armature or carrier for a dynamo-electric machine, constructed with radially-extending projections wound circumferentially, as described, and provided with the end plates or flanges. (11) The combination, with the radially-extending serrated projection forming the base of the armature carrier, of the transverse and radial openings in the teeth.

CONTENTS.

The Engineer, September 28th, 1883. PAGE

Borings have been commenced in the Ribble by Messrs. Timmins, of Runcorn, for the Preston Corporation, with the view of guiding the engineers as to the foundations for the new dock works. The new plans of the engineers fix the site of the dock nearer to the town of Preston than by the plan of Sir John Coode; but the exact site has not yet been decided. The works are to be proceeded with, it is expected, before the end of the present year.

464. Indices for Gas and Water Meters, &c., *S. Grey, Chelsea.—27th January, 1883. 6d.*

As applied to a dry gas meter index, this consists of a metal frame with a spindle and pinion connected at one end to the shaft receiving motion from the meter, and the other end carrying a pointer moving over a dial. The spindle carries a pinion with six leaves gearing with a wheel with thirty teeth carried by a second spindle carrying also a wheel with one long tooth and two spaces, the remainder of the periphery being plain. A third spindle carries two wheels, the front one having ten notches to receive the long teeth of the last wheel. Between each of the notches is a hollow to receive a part of the plain portion of the periphery of the wheel with one tooth, while the outer extremities of the hollow bear against the periphery, so as to lock the wheel on the third spindle except when the long tooth is in action. The other wheel on the third spindle has a plain periphery, and a long tooth and two spaces, and beneath are two other similar wheels. There is a fourth pair of wheels of similar construction, and another wheel with ten notches and hollows.

465. Separation of Lime from Crude Phosphates, &c., *H. H. Lake, London.—27th January, 1883.—(A communication from E. Winkelhofer, Austria.)—(Not proceeded with.) 2d.*

This relates to the elimination or separation of lime from raw or crude phosphates containing the same or carbonate of lime, and from solutions used in the treatment of the said phosphates.

466. Manufacture of Varnishes, *A. M. Clark, London.—27th January, 1883.—(A communication from La Compagnie Générale de Chromolithie, Paris.)—(Not proceeded with.) 2d.*

The base or primary ingredient is composed of paper treated with nitro-sulphuric acid, 102 parts (by weight); camphor dissolved in alcohol at 96 deg., 32 to 36 parts. These are worked together in a mixer heated to from 50 deg. to 60 deg. Centigrade, until brought to the desired consistence. The varnish is composed of—the primary ingredient, 1 kilo.; pure acetic ether, 2 kilos.; sulphuric ether at 65 deg., 250 grammes; castor oil, 50 to 100 grammes; Venetian turpentine, 150 to 250 grammes; methylated alcohol at 96 deg., 7½ litres; acetate of amyle, 10 grammes; pure crystallisable acetic acid, 200 grammes.

467. Reflectors, or Reflecting Lamp Shades or Globes, *H. H. Lake, London.—(A communication from J. Oertel and Co., Bohemia.)—(Not proceeded with.) 2d.*

This consists in coating the outside of glass shades with a solution of nitrate of silver, so as to convert the inside surface into mirrors to reflect the rays of light from the burner.

468. Velocipedes, *W. Jeans, Christchurch, Hants.—29th January, 1883.—(Not proceeded with.) 2d.*

The axle of one wheel of a tricycle is provided with a pinion, and is connected to the other wheel with a sleeve encircling the first axle and extending from the bearing of the second to the pinion where it terminates in an internal toothed wheel concentric with the pinion, with which it gears through an intermediate pinion on a stud projecting from a brake drum, which encloses the gearing, and is fixed to another sleeve encircling the first, and extending from the drum to the bearing at the opposite side, where it is provided with another brake drum. Rings are fitted to smaller drums fixed to the outer sleeve, and each ring has a lug to receive a pin forming the fulcrum of a lever, one arm of which is connected to one of the treadles. A chain or cord is attached to the other arm and passes round pulleys on an adjustable frame.

469. Drying Apparatus for Meat, &c., *E. A. Brydges, Berlin.—29th January, 1883.—(A communication from D. Grove, Berlin.) 6d.*

The object is to dry or aerify meat and other substances in a rapid, rational manner, by employing heated air.

470. Governors for Steam and other Fluid Pressure Engines, *C. J. Galloway and J. H. Beckwith, Manchester.—29th January, 1883. 6d.*

This relates to improvements on patent No. 2439, A.D. 1871, in which the balls of the governor are in the form of rollers borne down by a heavy transverse bar. On top of a vertical rotating spindle is fixed a crosshead, to each end of which a pair of pendant links is jointed carrying a roller at the lower end. A sleeve fits over the spindle and slides on a feather, such sleeve being formed with two heavy arms, each extending over the rollers between the suspending links. The underside of each arm which bears on the roller below it is concavely curved downwards towards its extremity. The sleeve has collars at its lower end to receive the fork of the regulating lever between them.

471. Revolving Flat Carding Engines, *J. M. Hetherington, Manchester.—29th January, 1883. 6d.*

This relates particularly to the elastic bends which carry the travelling chain of flats, and it consists in forming them truly concentric with the circumference of the carding cylinder by means of a cutter or grinding wheel fixed on the main cylinder and rotating with it, and being driven by suitable means, so as to act upon the bend which has been placed in position, until the whole of its periphery has been trued up.

472. Distillation, *J. F. Lackersteen, Greenwich.—29th January, 1883.—(Not proceeded with.) 2d.*

The object is to distil alcohol and other products at a lower temperature than usual, and it consists in passing the vapour from the still into a vacuum space, where it is condensed, while at the same time the vapour so condensed is being drawn off by means of a hydrostatic balance tube and a vacuum maintained during the process.

473. Manufacture of Porcelain Fire-clay Baths, *J. Hall, Stourbridge.—29th January, 1883. 4d.*

This consists in making porcelain fire-clay baths with an outside enamel or glaze.

474. Tube Expanders with Self-expanding Roller Boxes, *G. Lohf, Berlin.—29th January, 1883.—(Not proceeded with.) 2d.*

This consists in providing every roller with a separate casing, which are so connected together as to form an expansible mechanism actuated by a conical mandril which is driven between the rollers.

475. Gas Cooking Stoves, *J. Russell, Reading.—29th January, 1883.—(Not proceeded with.) 2d.*

This relates to improvements in gas cooking stoves, whereby the gas supply is automatically diminished by being partially turned off on the removal from the oven of the joints or other articles being cooked, and on a joint or other article being placed in the oven the supply of gas is automatically turned on.

476. Looms, *T. Lonsdale, Blackburn.—29th January, 1883. 4d.*

This relates to a combination of compound weighting levers and apparatus for controlling the letting off the warp from the warp beam. A regulator is suspended from the back bearer, one part resting on and against the warp, its lower end being connected by a rope passing through guides to a sliding weight mounted upon an inclined lever having its fulcrum in a slotted bracket pendant from back bottom rail. A second lever fulcrumed near the side frame extends to and is connected with the first lever by a pin near its loose end which passes through a slot in the first lever, the pin being adjustable to regulate its distance from the fulcrum of the compound levers. The weighting rope, after passing round the neck of the beam, is held by clip and screw adjustment.

477. Brakes for Wagons, Carts, or other Vehicles, *R. Heaton, Blackburn.—29th January, 1883.—(Not proceeded with.) 2d.*

This comprises a brake block or blocks of wood secured to an iron rim; the latter is by lugs, pins, and connecting links attached to an arm or projecting part of a hand lever, the fulcrum of the latter being a pin attached to an iron strap or supporting piece under the body of the vehicle.

478. Apparatus connected with Rope Driving and Haulage, *M. H. Smith, Halifax.—29th January, 1883. 8d.*

This relates to apparatus wherein a rope is the medium by which power is transmitted or applied in the first case to pulleys constructed in such manner that the portion of the rope encircling, for the time being, part of the circumference of the driving pulley is gripped, as distinguished from mere friction arising from contact of rope and pulley as heretofore.

479. Mills for Shelling and Grinding Oats, Wheat, &c., *G. Perrott, Cork.—29th January, 1883. 6d.*

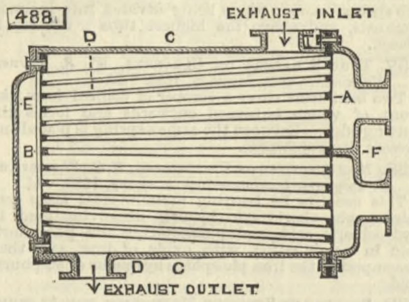
This relates to that class of mill in which millstones are used, and in which the lower stone is fixed horizontally, and the upper stone is driven, and it consists in means for adjusting and driving the stones. To the centre of the runner a cylindrical casting forming an eye is adapted, and has on its periphery vertical ribs and sockets to receive the radial arms of the "stiff inque" or "driver" which is mounted on the end of the mill spindle. Through the ribs screw bolts are inserted and bear on the extremities of the arms, the bolts being fitted with nuts so as to adjust and retain the "runner" in position with respect to the bed stone.

482. Construction of a Secondary Battery or Accumulator of Electricity, *A. L. N olf, Brussels.—29th January, 1883. 2d.*

One electrode is a sponge of metallic lead reduced galvanically, the other being formed of "a layer of pure minium." A solution of caustic soda is used for the exciting liquid.

488. Surface Condensers, *H. Guy, West Cowes.—29th January, 1883. 6d.*

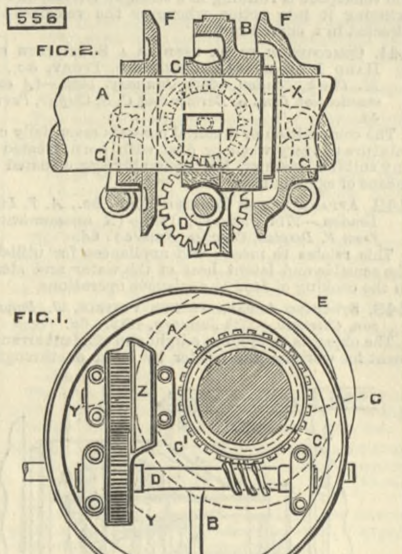
The object is to facilitate the cleaning of the tubes of surface condensers, and consists in so constructing the condenser that the whole of the tubes may be removed together from the casing, together with the two tube plates in which they are fixed. The drawing shows one way of effecting this, the tubes being immovably



fixed in the tube plates A and B, the latter being small enough to pass into the casing C, and being secured by bolts to the end cover E, while the former is secured to a flange at the other end of the casing, and over it fits the cover F, the whole being fastened together by bolts.

556. Variable Expansion Gear for Steam Engines, &c., *T. English, near Dartford.—1st February, 1883. 6d.*

A is the engine shaft on which the excentric B which works the cut off or expansion slide is free to revolve, but is prevented moving along the shaft by the collar X and worm wheel C keyed on the shaft. In the body of the excentric a worm spindle D is mounted in bearings, and the worm gears with the wheel C. A pinion Y on spindle D gears with a wheel E attached to a



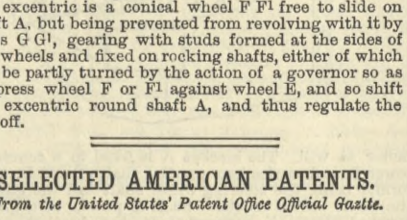
conical wheel Z without teeth, the axis of which revolves in bearings in excentric B. On each side of the excentric is a conical wheel F F¹ free to slide on shaft A. but being prevented from revolving with it by arms G G¹, gearing with studs formed at the sides of the wheels and fixed on rocking shafts, either of which can be partly turned by the action of a governor so as to press wheel F or F¹ against wheel E, and so shift the excentric round shaft A, and thus regulate the cut off.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

282,964. Removing Tin from Tin-scrap by Electricity, *James L. Delaplaine, Joseph G. Hendrickson, and Francis J. Clamer, Philadelphia, Pa.—Filed November 6th, 1882.*

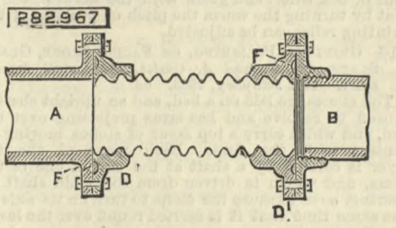
Claim.—The herein-described method of removing tin and other metal from scrap tin, plate, &c., b



placing the scrap metal in an insulated fire chamber in a suitable furnace, and heating it by a current of electricity, the metal being directly in the circuit, substantially as shown and described.

282,967. Expansion Joint, *Thomas W. Duffy, Boston, Mass.—Filed December 4th, 1882.*

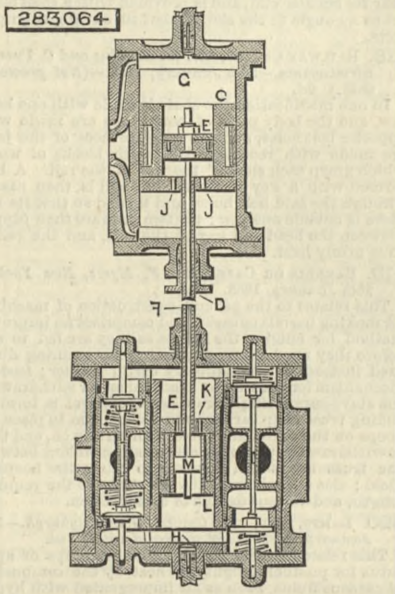
Claim.—(1) A transversely-corrugated sheet metal tube, in combination with flanged metallic collars, similarly corrugated internally, surrounding and made fast to the ends of said tube, and adapted to be secured to similar flanges on other tubes, substantially as set forth. (2) A sheet metal tube corrugated spirally, in combination with flanged and spirally-grooved collars applied to the ends thereof by a screw action, said tube being expanded within said collars and faced upon their flanges, for the purpose set



forth. (3) The rigid pipes A B, formed with radial flanges, in combination with the expansible means of connection, consisting in the corrugated tube C and collars D D¹, and the packing rings F, held within grooves in the flanges of the collars, substantially as and for the purpose set forth.

283,064. Steam Pump, *James H. Blessing, Albany, N.Y.—Filed March 11th, 1882.*

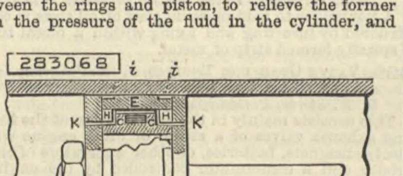
Brief.—To avoid or diminish the jar or concussion occasioned by the operation of steam pumps the movement of the water is gradually started and stopped at each end of the stroke. *Claim.*—(1) The combination of an exterior steam piston, open to the cylinder at its opposite ends and containing an interior piston, and an exterior water piston, also open at the ends and containing an interior piston, whereby the interior steam and water pistons are operated before the movement of the exterior steam and water



pistons, to gradually start and stop the movement of the water, substantially as described. (2) The combination of the exterior piston C, open at both ends, the interior piston E, piston-rods D and F, the exterior water piston L, open at both ends, and the interior water piston M, substantially as described. (3) The combination with the exterior piston C, provided with ports J, the interior piston E, piston-rods D and F, the exterior water piston L, provided with ports K, the interior water piston M, and the buffers G and H, substantially as shown and described.

283,068. Metallic Packing for Pistons, *James Brandon, New York, N.Y.—Filed December 20th, 1882.*

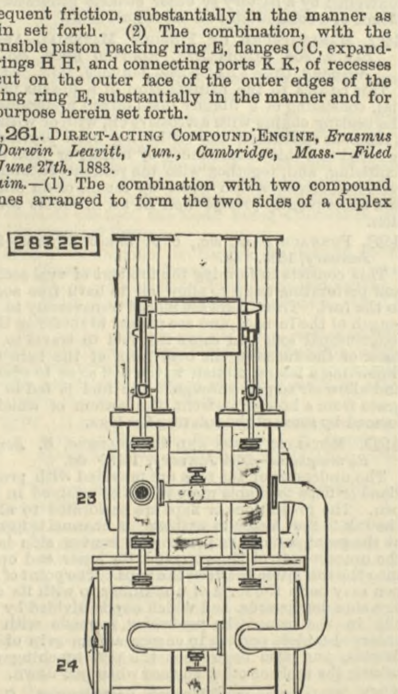
Claim.—(1) The combination, with the packing ring or rings of the piston in a pumping engine, of vent passages established from the under side of said packing ring or rings to the outer face of the piston, between the rings and piston, to relieve the former from the pressure of the fluid in the cylinder, and



consequent friction, substantially in the manner as herein set forth. (2) The combination, with the expansible piston packing ring E, flanges C C, expanding rings H H, and connecting ports K K, of recesses *i i*, cut on the outer face of the outer edges of the packing ring E, substantially in the manner and for the purpose herein set forth.

283,261. Direct-acting Compound Engine, *Erasmus Darwin Leavitt, Jun., Cambridge, Mass.—Filed June 27th, 1883.*

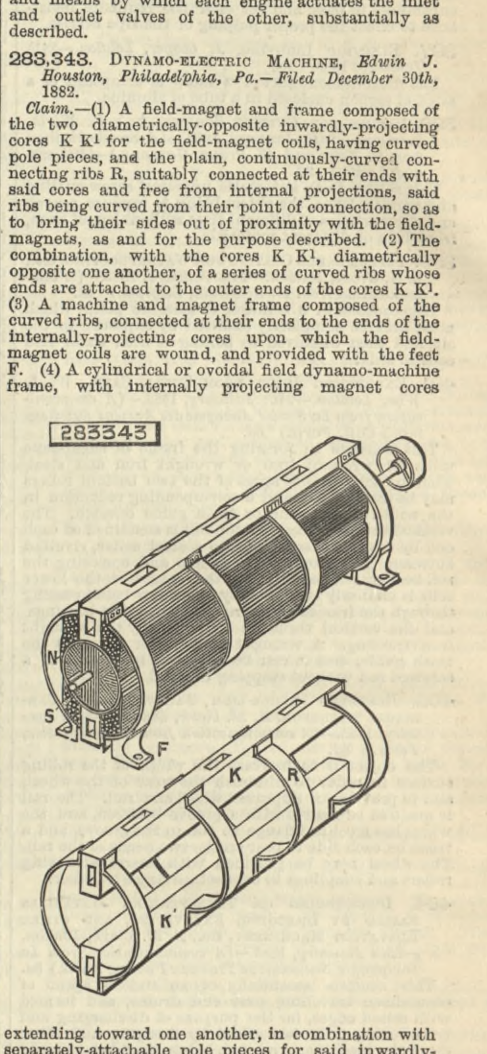
Claim.—(1) The combination with two compound engines arranged to form the two sides of a duplex



engine, of connections whereby the steam, after being used in one side of the engine, is conducted to and used in the second side of the engine, and then returned to and used in the first side of the engine, substantially as described. (2) The combination, with two compound engines arranged to form the two sides of a duplex engine, of tanks 23, 24, and connections whereby the steam, after being used in one side of the engine, is conducted to and used in the second side of the engine, and then returned to and used in the first side of the engine, substantially as described. (3) The combination, with two compound engines arranged to form the two sides of a duplex engine, of connections whereby the steam, after being used in one side of the engine, is conducted to and used in the second side of the engine, and then returned to and used in the first side of the engine, and means by which each engine actuates the inlet and outlet valves of the other, substantially as described.

283,343. Dynamo-electric Machine, *Edwin J. Houston, Philadelphia, Pa.—Filed December 30th, 1882.*

Claim.—(1) A field-magnet and frame composed of the two diametrically-opposite inwardly-projecting cores K K¹ for the field-magnet coils, having curved pole pieces, and the plain, continuously-curved connecting ribs R, suitably connected at their ends with said cores and free from internal projections, said ribs being curved from their point of connection, so as to bring their sides out of proximity with the field-magnets, as and for the purpose described. (2) The combination, with the cores K K¹, diametrically opposite one another, of a series of curved ribs whose ends are attached to the outer ends of the cores K K¹. (3) A machine and magnet frame composed of the curved ribs, connected at their ends to the ends of the internally-projecting cores upon which the field-magnet coils are wound, and provided with the feet F. (4) A cylindrical or ovoidal field dynamo-machine frame, with internally projecting magnet cores



extending toward one another, in combination with separately-attachable pole pieces for said inwardly-projecting cores, as and for the purpose described. (5) The combination, with the magnet cores K K¹, of curved ribs R, provided with flanges W, substantially as described. (6) The combination, with the magnet core K, recessed at *a a*, of the curved rib R and head or flange W, resting in said recess. (7) The combination, with the cores K or K¹ for the field-magnet of a dynamo machine having a groove on its end, of the removable pole piece N and S, having a tongue which enters said groove. (8) The combination, with the core K or K¹ for the field-magnet of a dynamo machine having a groove in its end shaped as described, of a pole piece having a T-shaped tongue and set screws *m m*. (9) The combination, with the armature shaft, of the notched projections and the circumferentially-wound wire. (10) An armature or carrier for a dynamo-electric machine, constructed with radially-extending projections wound circumferentially, as described, and provided with the end plates or flanges. (11) The combination, with the radially-extending serrated projection forming the base of the armature carrier, of the transverse and radial openings in the teeth.

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The Engineer, September 28th, 1883. PAGE

Borings have been commenced in the Ribble by Messrs. Timmins, of Runcorn, for the Preston Corporation, with the view of guiding the engineers as to the foundations for the new dock works. The new plans of the engineers fix the site of the dock nearer to the town of Preston than by the plan of Sir John Coode; but the exact site has not yet been decided. The works are to be proceeded with, it is expected, before the end of the present year.